Ex-Post Project Evaluation 2020
Package Ⅰ-4 (Mozambique, Malawi)

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ICONS Inc.

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The Republic of Mozambique

FY2020 Ex-Post Evaluation Report of Technical Cooperation Project

"Project for Improving Research and Technology Transfer Capacity for Nacala Corridor Agriculture Development, Mozambique"

External Evaluator: Haruo Ito, ICONS Inc.

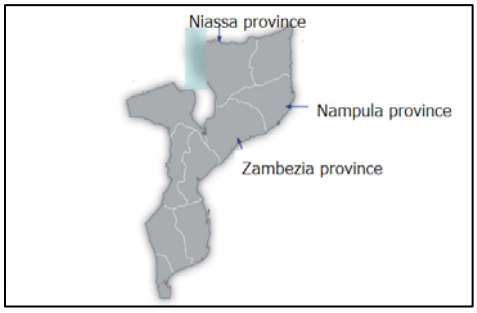
0. Summary

The tropical savannah region in the northern part of Mozambique, blessing with a sufficient amount of rainfall and a vast area of farmland, has high potential for expanding agricultural production. However, the extensive agriculture is practiced in much of the region and the productivity of both subsistence and commercial crops is not high. Under these circumstances, this project aimed to develop an appropriate agricultural development model for sustainable agriculture through improving the regional agricultural productivity mainly among small-scale farmers. Therefore, the project has improved the research capacity of the agricultural research institutes in the northeast and northwest regions under the Agricultural Research Institute of Mozambique (hereinafter referred to as "IIAM"), and transferred new agricultural technologies to pilot farmers through the triangular cooperation with Brazil which has a tropical savannah area with natural conditions similar to those of the project target area, and has expertise in agricultural development in that area. The evaluation found that the objective of the project is fully consistent with the development policy of Mozambique which aimed at improving agricultural productivity and competitiveness, and the development needs of the region. The project is also relevant with Japan's aid policy as well as the diplomatic strategy of the Brazilian government which include the promotion of the triangular cooperation, thus, the relevance of this project is high. As for the effectiveness and impact of the project, some outputs were not achieved because a part of the activities were discontinued in the middle of the project owing to the tight budget of the Brazilian aid agency, the partner in the triangular cooperation. However, considering that the project purpose and overall goal have been achieved and that other positive impacts were identified, such as increases in yields and farm incomes by using appropriate agricultural technologies, the effectiveness and impact of the project are high. On the other hand, actual project period and cost were exceeded the plan. Even though the increase in project period and cost due to the transfer of activities from the Brazilian side to the Japanese side are considered as an external factor, other factors such as a delay in the construction of the soil and crop analysis laboratory with increased expenses by the Japanese side also caused these increases. Therefore, the efficiency of the project is fair. The political and technical sustainability of the project is assured, allowing to continue research and extension activities of appropriate agricultural technologies transferred by the project. However, some issues have been identified in the institutional/organizational sustainability of the technical transfer from extension workers to farmers, and in the

financial sustainability, such as securing the maintenance costs of the procured equipment. Therefore, the sustainability of the project is fair.

Based on the above, the project is evaluated as satisfactory.

1. Project Description



Project locations (three northern regions)

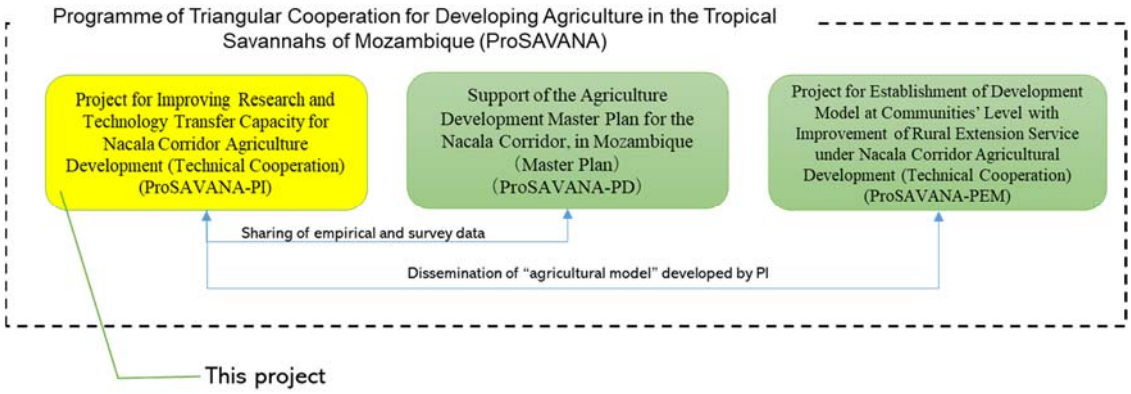
Training by IIAM staff

1.1 Background

The tropical savannah region in northern Mozambique is blessed with a sufficient amount of rainfall and a vast area of farmland and, therefore, has high potential for expanding agricultural production. However, the extensive agriculture is practiced in much of the region, resulting in low productivity for both subsistence and commercial crops. In addition, there are two agricultural research institutions under the umbrella of IIAM, the Institute of Agricultural Research of Mozambique Northeast Zonal Center (hereinafter referred to as the "IIAM CZnd") and the Institute of Agricultural Research of Mozambique Northwest Zonal Center (hereinafter referred to as the "IIAM CZno"), which are located in Nampula and Niassa provinces, respectively. However, owing to lack of a research capacity to the development of regionally appropriate agricultural technologies, these research institutes had difficulties in contributing to the improvement of agricultural productivity. In contrast, the Cerrados region in Brazil, which has similar conditions with large areas of uncultivated tropical savannah, has achieved an increase in grain production. The Cerrados agricultural development project, a joint initiative with Japan since the 1970s, has been implemented successfully and, as a result, many Brazilian engineers were trained and agricultural technologies developed. Consideration was given to the transfer of their knowledge and the technologies they developed to the savannah region of Mozambique. However, the socio-economic environment in Brazil and Mozambique is very different, confirming the need for a specific "agricultural development model" for farmers in the Nacala Corridor area that would help to select appropriate crops for the region. In order to achieve the goal, "accumulating the results of experimental research" and "implementing pilot projects" were identified as the most effective approaches. As a start, the project was requested for improving the research capacity of IIAM and demonstrating new agricultural technologies

on the pilot farms.

As shown in Figure 1, the project was implemented in cooperation with the *Support of the Agriculture Development Master Plan for the Nacala Corridor in Mozambique* (hereinafter referred to as "ProSAVANA-PD") and *Project for Establishment of Development Model at Communities' Level with Improvement of Rural Extension Service under Nacala Corridor Agricultural Development in Mozambique* (hereinafter referred to as "ProSAVANA-PEM") which are constituent projects of the *Programme of Triangular Cooperation for Developing Agriculture in the Tropical Savannahs of Mozambique* (hereinafter referred to as "ProSAVANA"). Specifically, this project planned to use the land map developed by ProSAVANA-PD and to disseminate the research results by using extension workers trained by ProSAVANA-PEM.



Source: drawn by the evaluator

Figure 1 Collaboration among ProSAVANA projects

1.2 Project Outline

Overall Goal		Appropriate agricultural technology is adopted in Nacala Corridor
Project Purpose		Appropriate agricultural technology is developed and transferred in Nacala Corridor
Outputs	Output 1	Capacity of IIAM research centers in Northeast and Northwest is strengthened
	Output 2	Natural resources and socio-economic conditions in Nacala Corridor are evaluated
	Output 3	Soil improvement technology for Nacala Corridor is developed
	Output 4	Appropriate cultivation technology for Nacala Corridor is developed
	Output 5	Technology transfer activities for extension workers are implemented on newly developed/validated agricultural technologies
Total cost (Japanese Side)		1,196 million JPY
Period of Cooperation		May 2011-November 2017 (Of which extension period: June 2016 - November 2017)
Target Area		21 districts in Niassa, Nampula, and Zambezia Provinces
Implementing Agencies		Ministry of Agriculture and Food Security (MASA[1])

[1] In February 2020, the Ministry of Agriculture and Food Security was renamed the Ministry of Agriculture and Rural Development (MADER).

	Institute of Agricultural Research of Mozambique (IIAM)
Other Relevant Agencies/ Organizations	Brazilian Cooperation Agency (ABC) Brazilian Agricultural Research Corporation (Embrapa)
Consultant/ Organization in Japan	NTC International Co., Ltd. Japan International Research Center for Agricultural Sciences (JIRCAS)
Related Projects	【Technical Cooperation】 – Support of the Agriculture Development Master Plan for the Nacala Corridor, in Mozambique (2012-2020) – Project for Establishment of Development Model at Communities' Level with Improvement of Rural Extension Service under Nacala Corridor Agricultural Development in Mozambique (2013-2020) – Project for Nacala Corridor Economic Development Strategies in the Republic of Mozambique (2012-2016)

1.3 Outline of the Terminal Monitoring

1.3.1 Achievement of Project Purpose at the Terminal Monitoring

The terminal monitoring[2] conducted in September 2017, determined that the project was on track to meet the sole indicator of the project purpose, namely, that "appropriate agricultural technologies are validated by IIAM and transferred to more than 100 extension workers." As a result, the project was considered to be highly likely to achieve the project purpose.

1.3.2 Achievement of Overall Goal at the Terminal Monitoring

At the time of the terminal monitoring of the project, the prospects for achieving the overall goal were not evaluated. To achieve the overall goal, it was identified that project activities such as continuation of the project activities of research, awareness-raising, dissemination activity, sharing of research results and knowledge, and human resource development were needed to be strengthened.

1.3.3 Recommendations from the Terminal Monitoring

The project was decided to be terminated in November 2017 as planned, as the project had achieved the prescribed outputs, and the project purpose was expected to be accomplished. The following items were recommended for the remaining period and for the post-project period.

<u>Recommendations for the remaining project period</u>

The soil and crop analysis training and Nacala Corridor Agricultural Research Meeting[3]

[2] The terminal evaluation was conducted for the project in December 2015, but because a one and half-year extension was agreed upon at that time, another terminal monitoring was conducted in September 2017.

[3] Agricultural Research Meeting in the Nacala Corridor (ARM-Nacala Corridor), a public research meeting for the Nacala Corridor region, was held to build the capacity of project stakeholders, share information, and strengthen collaboration with relevant organizations. The meeting was attended by representatives from IIAM, the Provincial Directorate of Agriculture and Food Security (DPASA), the International Institute of Tropical Agriculture (IITA), universities, agricultural colleges, and civil society organizations.

(hereinafter referred to as "ARM") should be continued by the project personnel. It was also necessary to conduct wrap-up meetings and presentations of the results of theme-based training and to compile the completion report. For IIAM, it was also recommended that someone be assigned to take charge of each activity, such as reviewing the fees for soil analysis, establishing the system to ensure maintenance costs are met, and approving various manuals.

Post-project recommendations

It was recommended that the IIAM continues its activities, such as dissemination of research results and human resource development, as well as securing the necessary budget for ongoing operations.

2. Outline of the Evaluation Study

2.1 External Evaluator

Haruo Ito, ICONS Inc.

2.2 Duration of Evaluation Study

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

Duration of the Study: October, 2020-February, 2022

Duration of the Field Study: April 19, 2021-May 19, 2021 (Remote)
September 22, 2021-October 15, 2021 (Remote)

2.3 Constraints During the Evaluation Study

Owing to the impact of the COVID-19 pandemic, the first and second field studies were conducted remotely using a research assistant. The evaluators were not able to visit the facilities and interview the beneficiaries as planned during the field studies so their evaluation was based on the reports of the assistant. As the evaluation had to be made based on the reports from research assistant, questionnaires and photographs were also used to the extent possible. However, the information on the operation and maintenance conditions of facilities and equipment that require visual inspection may not fully reflect the actual situation in the field.

3. Results of the Evaluation (Overall Rating: B[4])

3.1 Relevance (Rating: ③[5])

3.1.1 Consistency with the Development Plan of Mozambique

Before the planning of the project, at a cabinet meeting in 2006, the government of

[4] A: Highly satisfactory, B: Satisfactory, C: Partially satisfactory, D: Unsatisfactory
[5] ③: High, ②: Fair, ①: Low

Mozambique decided to prioritize food security and, based on this, the *Green Revolution Strategy* was formulated in 2007 to increase food production and employment. The aim of this strategy was to spur production, especially for basic crops, and to increase productivity. Based on this strategy, the cross-ministerial *Food Production Action Plan (PAPA: 2008-2011)* was formulated in 2008 in response to the international experience in food security. The plan envisioned addressing all the stages within the food production value chain: cultivation, harvesting, storage, processing, and marketing. Furthermore, the *Strategic Plan for Agricultural Development (PEDSA: 2010-2019)*, formulated in March 2010, included "improving agricultural productivity and competitiveness" as one of the five major goals. In addition, the *IIAM Strategic Plan (2011-2015)* set the goal of increasing agricultural productivity by 6%, which had declined during the previous 15-20 years, by developing and transferring appropriate agricultural technologies to farmers. Therefore, this project that aimed to increase agricultural productivity through the development and dissemination of agricultural technologies suitable for the target area was in line with the development policy of the government of Mozambique at the time of planning (in 2011).

In addition to the above-mentioned the *Strategic Plan for Agricultural Development (PEDSA: 2011-2020)*[6], at the time of project completion in 2017, the project was consistent with the *National Agricultural Investment Plan (PNISA: 2013-2017)*, the investment plan intended to support the implementation of the *PEDSA*, which aimed at developing appropriate agricultural technologies and disseminating them to farmers. The *IIAM Annual Plan,* at the time of project completion (in 2017), included the goal of developing and disseminating appropriate agricultural technologies needed by individual farmers and private contractors in the region, which is aligned with the objectives of this project; thus, the project is highly consistent with the development policy.

3.1.2 Consistency with the Development Needs of Mozambique

Although approximately 80% of the country's working population was engaged in the agricultural sector, only 16% of the country's land area was cultivated. The Nacala Corridor is a tropical savannah region with high agricultural potential, and 720,000 farmers, accounting for 24% of the total number of farmers in the country, were located in the corridor. Therefore, relevance of the region selection was also confirmed. The IIAM CZnd in Nampula Province and the IIAM CZno in Niassa Province are located in the target area, but their research facilities and equipment were limited, and it was pointed out at the time of planning that the analytical capacity of the researchers was insufficient, which hindered the development of agricultural technologies suitable for the region.

As for the completion of the project, the GNP of the agricultural sector in the country

[6] At the time of planning, "PEDSA: 2010–2019" was identified as a draft strategy, but later "PEDSA: 2011–2020" was published as the official strategic plan.

was 23% of the country's GNP, and it remained an important sector in which 80% of the working population was engaged[7]. The average land area owned by each household in the target area was 1.0 ha, which was lower than the national average (1.3 ha), and the poverty rate was also higher than the national average. Most farmers were growing their own food, mainly maize and cassava, and the importance of improving agricultural productivity through the development and dissemination of appropriate technologies in the target areas was confirmed.

3.1.3 Consistency with Japan's ODA Policy

The contribution of the project fell within "corridor development support" and "agricultural development," which are sub-items of the *Regional Economic Revitalization* program in the priority aid areas (Regional Economic Revitalization, Environment and Climate Change Countermeasures, and Administrative Capacity Building/Institutional Development) agreed upon at the 6th Japan-Mozambique Policy Conference in March 2011. Furthermore, the goals of the project were aligned with the promotion of triangular cooperation in "capacity building for increased food production and agricultural productivity" and "expansion of partnerships" in Africa, as stated in the *Yokohama Action Plan* at the Fourth Tokyo International Conference on African Development (TICAD IV) in 2008. The project, which was implemented as a triangular cooperation initiative with Brazil, was part of the Japan-Brazil Partnership Program (JBPP[8]), a framework signed in 2000 to effectively promote triangular cooperation between Japan and Brazil in Portuguese-speaking Africa and to strengthen Brazil's capacity as a development partner.

3.1.4 Consistency with Brazil's ODA Policy

As part of Brazil's foreign policy strategy, diplomatic relations with Africa have been strengthened since President Lula took office in 2003, with presidential visits to Africa and the opening of a number of embassies in the region. In 2010, international cooperation was promoted through the Brazil-Africa Policy Dialogue, inviting agriculture ministers or senior officials from approximately 50 African countries with a particular focus on food security.

3.1.5 Appropriateness of the Project Plan and Approach

As Brazil uses the same official language as Mozambique, Portuguese, and has developed agricultural research under similar natural conditions, the Mozambique side stated during the evaluation that the advantage of Brazilian participation in the triangular cooperation in terms of training and capacity building of researchers was clear. On the other hand, because Japan and Brazil, as equal partners, divided the responsibility between the two countries,

[7] Source: National Institute of Statistics (INE), *Basic Agriculture and Food Indicators 2015-2019* (2020)
[8] Source: https://www.br.emb-japan.go.jp/files/000441270.pdf (accessed on August 25, 2021)

unclear lines of command and unclear division of responsibilities made it difficult to coordinate training schedules and project expenses. Consequently, there was room for improvement in the implementation of the triangular cooperation. In addition, because of the sharp budget cuts from the Brazilian Cooperation Agency (ABC) in response to the stagnation of the Brazilian economy[9], many planned inputs from the Brazilian side were cancelled; therefore, some activities were removed and indicators had to be reset in the Project Design Matrix (hereinafter referred to as "PDM"). Appropriate changes to achieve the original project purpose, such as reallocating some of the Brazilian activities to the Japanese side were also made to the project plan over the approval by the Joint Coordinating Committee (JCC). Despite external factors, such as the withdrawal of Brazil due to their economic crisis, an appropriate approach was adopted in the project.

In summary, the project was highly relevant to Mozambique's development policies and development needs, as well as to the aid policies of Japan and Brazil. Furthermore, the restructuring of the project plan caused by Brazil's withdrawal has been properly implemented. Therefore, the relevance of this project is high.

3.2 Effectiveness and Impact[10] (Rating: ③)

3.2.1 Effectiveness

With regard to the project purpose indicator, the joint terminal evaluation between the Ministry of Agriculture and Food Security (MASA) and JICA conducted in December 2015 found that the indicator (number of trainees:100) was achieved quantitatively as there were 218 trainees at the time of the terminal evaluation, but qualitatively, the technical transfer of knowledge was not as effective, as it was pointed out that "the training provided was not so comprehensive that farmers were not able to acquire the developed agricultural technologies" and that "it is assumed that the level of understanding is limited in a one-time training." Therefore, in this ex-post evaluation, a beneficiary survey[11] of extension workers (responsible for the dissemination of agricultural technologies in the target areas) and farmers (as beneficiaries) was undertaken to assess their understanding and the degree of technology acquisition. This information was used as supplementary material in the evaluation of the achievements of the project purpose.

[9] The Brazilian economy experienced almost zero growth in 2014 and negative growth in 2015 and 2016 for the first time since the Great Depression, and these economic conditions forced ABC to withdraw from the project.

[10] Sub-rating for effectiveness is to be put with consideration of impact.

[11] For the survey sample, extension workers and farmers were selected from four districts in Nampula Province (Mohito, Murizae, Namigonha, and Naphome) and three districts in Niassa Province (Lione, Metamba, and Metande), based on the list of training participants. Two women out of 10 extension workers and 12 women out of 30 farmers were selected. (Selecting as many as half of the female participants was attempted, but the absolute number of women, especially among extension workers, was too small to achieve this ratio.)

3.2.1.1 Achievement of Project Purpose

As shown in Table 1, the indicator was achieved against the project purpose indicator of more than 100 extension workers trained, as a total of 393 extension workers received training during the project period. As mentioned in section 3.2.1.3, "Achievement of Outputs", it was also confirmed that the following documents, approved by the implementing agency, IIAM, were used for the training: *Land Use Plan*, *Guidelines of Research Center Management*, *Soil Improvement Manual,* and *Crop Manual*. Furthermore, as mentioned in section 3.2.1.2, the results of the beneficiary survey of extension workers and farmers revealed a sufficient degree of knowledge and understanding of the new technologies was acquired by the trainees, a target which was initially considered doubtful. Therefore, it can be concluded that the project purpose, "Appropriate agricultural technology is developed and transferred in Nacala Corridor" has been achieved.

Table 1 Achievement of project purpose

Indicator	Actual
Appropriate agricultural technologies will be certified by IIAM, and technology will be transferred to more than 100 extension workers	Manuals on agricultural technologies were approved by IIAM, and 393 extension workers were trained using these manuals

3.2.1.2 Results of Beneficiary Surveys Related to Training

According to the results of the beneficiary survey of the extension workers and farmers who received the training during the project period, all (100%) of the surveyed extension workers (10) and farmers (30) answered "Yes" to the question "Are you satisfied with the content of the training you received?" Specifically, 43% of the farmers answered that "the training was well organized and easy to understand," 27% stated that "they could learn new techniques," and 23% stated that "the training was practical and easy to implement." In addition, 14 out of 30 farmers (47%) surveyed actually used the appropriate technologies learned in the training on soil improvement, crop cultivation, and prevention of livestock diseases; the reasons given were that "the agricultural technologies have improved productivity" and "readily available materials can be applied." On the other hand, reasons due to economic conditions such as "difficulty in purchasing some materials and equipment, such as fertilizers, pesticides, and livestock vaccines," were given for not using these technologies. Considering the high level of satisfaction with the training content and the fact that only the cost of materials and equipment is a disincentive for the use of technology, it can be concluded that the level of knowledge and skill acquisition by farmers in the training of this project is acceptable.

Table 2 Number and percentage of farmers using appropriate agricultural technologies

(Unit: person)

	Using	Not using
IIAM CZnd areas	9	6
IIAM CZno areas	5	10
Total	14 (47%)	16 (53%)

Source: Beneficiary survey

3.2.1.3 Project Outputs

(1) Output 1: *The capacity of IIAM CZnd and IIAM CZno is strengthened.*

For output 1, almost all of the indicators related to the research structure of the IIAM regional centers were achieved. Owing to Brazil's withdrawal, the activity and indicator for the multipurpose laboratory in the IIAM CZno, originally planned to be constructed by Brazil, were changed from "construction" to "development of a construction plan." With the developed construction plan, the IIAM CZno reached out to other development partners, but construction has not yet been realized. The impact of this is a possible decline in the effectiveness of the development of agricultural technologies due to the lack of the anticipated laboratory. On the other hand, the terminal evaluation in 2015 suggested that there were some problems in improving the technical transfer capacity of the IIAM staff (project counterparts), but the results of the beneficiary survey in the ex-post evaluation showed the high satisfaction of extension workers and farmers with the training provided by IIAM during the project, which means that their capacity for technical transfer had been improved to a certain extent by the end of the project.

BOX Technical transfer in the research-based technical cooperation project

Among the counterparts in the project, many researchers showed interest in the research using the latest experimental equipment. However, there were differences in the ability to acquire the basic knowledge and techniques required to conduct the research using the latest technology. Therefore, we focused on raising the research capacity by providing guidance on the basic content and spending time on understanding the importance of these basics. Ownership of researchers toward the project was strengthened by engaging them as authors, providing opportunities to present their research overseas and holding contests to solicit research themes and distribute the budget to the winners (Japanese expert).

(2) Output 2: *Natural resources and socio-economic conditions of the Nacala Corridor are evaluated.*

Most of the indicators for output 2 were achieved. Soil, vegetation, and meteorological data in the "*Report and Database on Natural Resources*" were presented and approved at the *10th African Crop Science Conference* held in September 2011. On the other hand, the collection and analysis of water resource data and landscape data were not carried out by the Brazilian side due to their withdrawal from the project. The data collected by the

Japanese side were stored in the shared computers in the soil and crop analysis laboratory for researchers to review and use. For the *Report on Socio-economic*, some pilot areas in Zambezia Province were selected where soybean is widely cultivated, and the profitability of soybean was surveyed and analyzed. The results were presented and approved at the Internal Annual Meeting on Research Achievements and Planning (hereinafter referred to as "IAMRAP") and the ARM. These results were finally compiled into a database for the Decision Support System[12] (hereinafter referred to as "DSS").

(3) Output 3: *Soil improvement technology for the Nacala Corridor is developed*

The indicators for the development of the soil improvement technology of Output 3 were achieved. The results of the fertilizer application, soil improvement, and soil conservation tests conducted for the activities related to the output were presented as a research paper, and a draft of the *Soil Improvement Manual* was prepared, based on the results. The Manual was reviewed by counterparts and peer-reviewed by the committee formed by three senior researchers of IIAM and approved by IIAM in October 2017. The results of the beneficiary survey in this ex-post evaluation also indicated that extension workers and farmers were highly satisfied with the training using the *Soil Improvement Manual*.

(4) Output 4: *Appropriate cultivation technology for Nacala Corridor is developed.*

Output 4 indicators were achieved with the development of appropriate cultivation techniques for crops. Based on the results of the crop cultivation experiments, a draft cultivation manual for soybean, peanut, sorghum, and potato was prepared and authored by IIAM researchers; this was approved by IIAM in October 2017 after counterpart review and committee peer review. Initially, a seed bank and demonstrations of seeds were planned with the support of the Brazilian side in order to develop an appropriate seed multiplication system, but these were not implemented. The establishment of the seed bank, especially the development of quality seeds, was expected to further increase agricultural productivity. However, as some of the activities, such as the seed demonstrations, were implemented with the USAID-funded component of the project budget, and appropriate cultivation techniques were developed through experiments on crop cultivation in the project, it was confirmed that the cancellation of those Brazilian activities was not an obstacle to the achievement of this output.

[12] The DSS is the combination of the crop yield prediction model (AquaCrop) and the linear programming model (BFMmz). By using the computer program, outputs (type of crop, planted area, cropping style) that can maximize agricultural income are calculated from the inputs (farmer's location, management area, labor force, crops to be cultivated), and the results are presented to farmers.

(5) Output 5: *Technology transfer activities for extension workers are implemented on newly developed/validated agricultural technologies.*

Indicators of output 5 for the technology transfer of agricultural technologies to extension workers were achieved. IAMRAP, ARM, field days, and various training programs were conducted as opportunities for technical transfer to extension workers. Moreover, DSS (Ver.1) was developed, based on the results of farmer field trials, and was explained to a wide range of stakeholders at the ARM in October 2017 and approved. Nevertheless, the necessity for further capacity building for IIAM researchers and extension workers on the DSS was stated by IIAM. However, as various training sessions were conducted as planned and the participants were highly satisfied with them, output 5 is evaluated as almost achieved.

As mentioned above, the indicator of the project purposes was achieved, and the beneficiary survey showed that the extension workers and farmers were highly satisfied with the training and understood the agricultural technology they acquired. In addition, the cessation of activities on the Brazilian side due to external factors did not hinder the achievement of the project purpose, and thus, the effectiveness of the project is considered high.

3.2.2 Impacts

In order to evaluate the impact, the continuity of the project purpose of "Appropriate agricultural technology is developed and transferred in Nacala Corridor" and the degree of achievement of the resulting overall goal of "Appropriate agricultural technology is adopted in Nacala Corridor" were assessed. In regard to the degree of achievement of the overall goal, its promoting and inhibiting factors were also analyzed through evaluating the synergy effect with ProSAVANA-PEM, another component of ProSAVANA, which was implemented to enhance the extension mechanism at the community level to disseminate the agricultural technologies developed by this project.

3.2.2.1 Continuity of Project Purpose

In evaluating the continuity of the project purpose "Appropriate agricultural technologies are developed and transferred to the Nacala Corridor region", three points were confirmed: (1) continuity of strengthening the research system in IIAM; (2) preparation of tools for technical transfer; and (3) continuity of technical transfer to extension workers and farmers.

In 2020, 93 agricultural trials were conducted at the IIAM CZnd using the soil and crop analysis laboratory established under the project, and 88 agricultural trials were conducted at the IIAM CZno. In addition, three socioeconomic surveys were conducted at the IIAM

CZnd[13]. The ex-post evaluation also identified that a number of new manuals, brochures, posters, and newsletters were developed by both centers, using the results of the project[14]. In terms of technical transfer by IIAM to extension workers and farmers, 2,674 and 78 extension workers and farmers[15] were trained in IIAM CZnd and CZno, respectively, using the *Soil Improvement Manual* prepared by the project. On the other hand, with regard to training of farmers by extension workers, based on the results of the beneficiary survey in the ex-post evaluation, only 10 farmers (33%) out of 30 responded that they had received training and support from extension workers, owing to the lack of access to farmers by extension workers (such as due to vehicles and fuel costs) and the negative effect of COVID-19. IIAM is not in charge of the transfer of technology from extension workers to farmers, but is in charge of the Provincial Directorate of Agriculture and Fisheries (hereinafter referred to as "DPAP") and its subordinate organization, the District Services of Economic Activities (hereinafter referred to as SDAE) to which the extension workers belong[16]. However, as mentioned above, there are some issues, such as the fact that the training and support provided by the DPAP and SDAE reached only a few farmers. On the other hand, the IIAM officials pointed out that the challenge of continuity of technical transfer to extension workers and farmers are now being solved through the SUSTENTA program implemented by MADER.

As mentioned above, considering (1) the continuity of strengthening the research system in IIAM, (2) the preparation of tools for technical transfer, and (3) the challenge of continuity of technical transfer to extension workers and farmers is being reserved, it was evaluated that the continuity of project purpose is acceptable.

3.2.2.2 Achievement of Overall Goal

As shown in "continuity of project purpose", IIAM has continued to provide training to extension workers and farmers using the guidelines and manuals developed by the project, and as a result, as shown in Table 3, the indicator for the overall goal has been achieved, accomplishing the overall goal "Appropriate agricultural technology is adopted in Nacala Corridor."

At the time of project planning, the number of farmers in the target area was estimated to

[13] In the first quarter (January-March) of 2021 at the IIAM CZno, the number of agricultural trials has decreased by 30% and seed production by 73% compared to those of the previous year owing to budget cuts and infection control measures resulting from the financial emergency caused by the COVID-19. In addition, training for agricultural extension workers and farmers, field activities, and fairs have been postponed as a precautionary measure to prevent infection and have therefore not been implemented.

[14] Manuals for extension workers and farmers are in great demand and are currently being used as the basis for training of extension workers under the SUSTENTA implemented by MADER.

[15] Owing to the delay in budget allocation for 2020, the number of trained extension workers and farmers was only 78 compared to the planned 704.

[16] As a result of the decentralization policy, extension workers belonging to the extension offices of the Ministry of Agriculture were vested in provinces. The provincial government has set up agricultural extension sections in the SDAE of agricultural departments in each district and assigned extension workers there.

be 720,000[17], and the indicator for overall goal was that 72,000 farmers, accounting for 10% of the total, would adopt the appropriate agricultural technologies. The beneficiary survey in the ex-post evaluation identified that, on average, 150 farmers were covered by one extension worker, 33% of farmers had received support from extension workers, and 47% of farmers had used the training content. In addition, by the time of the ex-post evaluation (in 2020), three years after the completion of the project, 3,559 extension workers had received training (393 during the project and 3,166 after the completion of the project[18]). By calculating these figures, about 83,000 farmers[19] have used agricultural technology, accounting for 11.5% (83,000/720,000) of the farmers in the target area. Thus, it is estimated that the target value of 10% has been reached.

Table 3 Achievement of overall goal

Indicator	Actual
At least 10% of farmers in the target area apply IIAM-approved appropriate agricultural technologies.	At the time of the ex-post evaluation, it was estimated that about 11.5% of the farmers have applied the training contents, and thus, the indicator is likely to have been achieved.

3.2.2.3 Synergy with Other ProSAVANA Projects

In the project, in collaboration with ProSAVANA-PEM, one of the ProSAVANA projects, intercropping of superior varieties of cassava and peanut and comparative display of superior legume varieties were undertaken, and technical transfer to the farmers supported by ProSAVANA-PEM was implemented. After the completion of the project, DPAP, the counterpart of ProSAVANA-PEM, also provided training from IIAM researchers to extension workers and extension workers to farmers, using the manuals prepared during the project. On the other hand, the IIAM staff stated that collaboration has been limited, as SDAE could not participate in the annual joint liaison meeting for planning the dissemination activities owing to the lack of budget for SDAE and extension workers from DPAP after the completion of ProSAVANA-PEM.

3.2.2.4 Other Positive and Negative Impacts

(1) Increase yields and farmer incomes by using agricultural technologies

In the project, as a result of adopting appropriate technology from the project in the fields of IIAM CZnd and CZno, relatively high yields of 1,800-1,900 kg/ha for maize, 200-500 kg/ha for cowpea, and 1,400-1,500 kg/ha for Zambonae varieties of soybean were recorded

[17] Source: ProSAVANA-PEM project ex-ante evaluation table. The number of farmers in the target area at the time of ex-post evaluation has not been calculated; therefore, the evaluation judgment is based on the number calculated at the time of planning.

[18] Includes participants in training conducted in collaboration with ProSAVANA-PEM.

[19] 150 (number of farmers covered by one extension worker) x 3,559 (number of extension workers who received training) x 0.33 (dissemination rate from extension workers to farmers) x 0.47 (implementation rate of training content by farmers) = 83,000 farmers.

in the completion report. Furthermore, using the DSS allowed farmers to accurately predict yields of soybean, maize, and cowpea; 81% of the farmers in the group that voluntarily referred to the DSS for crop planning (only 31% in the group that did not refer to the crop plan) had increased their income from farming.

Similarly, the beneficiary survey in the ex-post evaluation indicated that all 14 farmers who adopted the appropriate agricultural technology of the project reported an increase in yield, thereby increasing farm income. As shown in the table below, the increase in yield per hectare (ha) was approximately 2 to 3.5 times, and the increase in income per crop season was 2.5 to 5.5 times[20] more in each area. In particular, the income of farmers in the IIAM CZno areas who received training in infectious disease control for the protection of livestock which greatly contributes to generating income and have been practicing it has increased significantly.

Table 4 Yield and income of farmers utilizing appropriate agricultural technologies

	Yield per hectare (kg/ha)			Revenue per crop season (MZN*/season)		
	Before utilization**	After utilization	Increase rate	Before utilization	After utilization	Increase rate
IIAM CZnd area (Average of 9 farmers)	730	1,433	196%	4,713	12,067	256%
IIAM CZno area (Average of 4 farmers)	16	55	344%	648	3,560	550%

Source: Beneficiary survey
*Note: Metical, the currency of Mozambique, (calculated at 1 MZN = 1.78 JPY as of October 22, 2021)
**Note: The exact years before and after utilization of appropriate agricultural technology cannot be specified because the timing of training by IIAM varies from farmer to farmer.

(2) Impact on the natural environment[21]

One of the outcomes of the project was the assessment of the natural resources, and based on this assessment, soil improvement and selection of crops and varieties were implemented. Specifically, although there were no facilities in Mozambique that could properly dispose of reagent effluents before the project, the IIAM CZnd used a soil analysis method with hazardous reagent effluents, and these were disposed without treatment. Therefore, the project adopted a method of soil and crop analysis without the use of these harmful reagents and compiled into soil improvement and crop variety selection manuals. It was concluded that the project had not caused any negative impacts and generated a positive impact on the natural environment.

[20] According to the *Yearbook 2020*, the per capita GDP of Nampula, one of the target provinces of the project, has increased by 109% between 2016 and 2019, while the income of farmers using appropriate technology has shown a higher increase.
[21] The summary of ex-ante evaluation for the project was prepared in January 2011; however, the environmental category based on the *JICA Environmental and Social Consideration Guidelines* was not determined.

(3) Resettlement and land acquisition

The soil and crop analysis laboratory established in the IIAM CZnd was built within the existing facility and did not cause any issues in terms of relocation of residents or land acquisition.

(4) Poverty reduction

This project aimed at sustainable agricultural development through improving agricultural productivity in the region, mainly among small-scale farmers, and thus the main target was the poverty group. During the workshop at the beginning of the project, it was also revealed that small-scale farmers are unable to purchase improved seeds owing to poverty and thus are using seeds with low productivity in target areas. Therefore, the socio-economic survey was setting up as a project activity to detail the household and technology levels or farmers, and to propose technologies that small-scale farmers could adopt so that the project outputs can be fairly distributed. It can be inferred that this provides an important means of alleviating poverty and increasing food security in rural areas where poverty is widespread.

(5) Gender equality

Agriculture is a major industry in the Mozambican economy, with more than 80% of the population working in the agricultural sector, 90% of which are women. Many of the participants in the farmer training program were also women. Furthermore, the number of staff in the IIAM CZnd was 173 (in 2020), of which 47 (27%) were women. Of the 172 undergraduate (bachelor) and graduate (master) students accepted by the IIAM CZno for internships, 53 (31%, in 2020) were female students, indicating that the project contributed to gender equality.

From the above, regarding the effectiveness and impact of the project, although the Brazilian activities were discontinued in the middle of the project, it did not hinder the achievement of the outputs, and the project purpose was achieved at the end of the project; therefore, the effectiveness of the project is high. As for the impact, the indicator for the overall goal – the utilization of appropriate technology by farmers – was achieved. As a result, positive impacts such as increased yield and income for some farmers were also confirmed. Therefore, the effectiveness and impact of the project are high.

3.3 Efficiency (Rating: ②)

3.3.1 Inputs

Because of the triangular cooperation among Japan, Brazil, and Mozambique, the project provided each input using the respective budgets from each country. Thus, when the

Brazilian input was withdrawn in 2015, the activity plan in the PDM was revised, the project period was extended, and additional budget from the Japanese side was added to compensate for the reduction in funding. As a result, it has contributed to the continuation of activities after project completion, and had an ongoing impact on the field level.

Table 5 Inputs from the Japanese and Mozambican sides

Inputs	Plan	Actual (As of the project completion)
(1) Experts	2 Long-term (120 Man Month (MM)) 7 Short-term (140 MM) Soil analysis, fertilization technology, soil conservation, cultivation, land use planning, soil microorganisms, and water resources.	1 Long-term 25 Short-term* (Total: 218.42 MM)
(2) Trainees received	Training in Japan	Training in Japan: 4 participants (2013:1, 2014:1, 2016:2) International academic conferences: 3 participants (Uganda (2013):1, Burkina Faso (2016):2)
(3) Equipment	Four-wheel drive vehicles, construction of experimental buildings, improvement of irrigation facilities at the agricultural experiment stations, and research equipment.	Facilities: soil and crop analysis laboratory, well, and generator shed Major equipment: soil analysis experimental equipment, equipment for cultivation tests, meteorological observation-related equipment
(4) Local expenses	Seminar and workshop expenses, etc.	Local business enhancement expenses: 125 million JPY[22] Consultant activity expenses: 22 million JPY[23]
(5) Japanese Side Total Project Cost**	600 million JPY	1,196 million JPY
(6) Mozambique Side Total Project Cost	Local cost, counterpart salaries	IIAM CZnd[24]: 87 million JPY[25] IIAM CZno: 45 million JPY[26] (Counterpart salaries, electricity, communication, transportation, fuel, etc.)

Source: Documents provided by JICA
*Note: Including one interpreter
**Note: Total expenses of (1) to (4)

[22] 1,094,852 USD (calculated at the rate as of October 22, 2021, 1 USD = 113.95 JPY)
[23] 192,601 USD (calculated at the rate as of October 22, 2021, 1 USD = 113.95 JPY)
[24] As for the operation and management fees paid by the IIAM CZnd to the project, the amounts up to the time of the 2015 joint end-of-term evaluation assessment are shown because the actual results for 2016 and 2017 were not available.
[25] 48,968,085 MZN (as of October 22, 2021, calculated at 1 MZN = 1.78 JPY)
[26] 25,476,479 MZN (as of October 22, 2021, calculated at 1 MZN = 1.78 JPY)

Table 6 Inputs on the Brazilian side

Inputs	Plan	Actual (As of the project completion)
(1) Experts	Short-term (50 MM) Research and extension technology, infrastructure technology, seed multiplication system technology, livestock production technology, natural environment analysis, technical transfer, etc.	Total of 46 short-term experts (89.6 MM)
(2) Trainees received	Training in Brazil	6 participants in Brazil (twice in 2012, once in 2013, 3 times in total)
(3) Equipment	Construction of laboratory buildings, research equipment, nursery and seed-related machinery for smallholders	PCs, printers, and vehicles Total of 6 items of equipment
(4) Local expenses*	-	Activities funded by the Brazilian Cooperation Agency (ABC): 141 million JPY[27] Cost of dispatching experts by Brazilian Agricultural Research Corporation (Embrapa): 25 million JPY[28]

Source: Documents provided by JICA
*Note: Total expenses of (1) to (3)

3.3.1.1 Elements of Inputs

As for the project input from the Japanese side, one long-term coordinator and 25 short-term experts were dispatched. The change in the dispatch of short-term experts compared to the original plan was the increase in the number of experts to replace the Brazilian activities due to the withdrawal of their participation in 2015 and the increase in the number of experts for the construction and management of the new soil and crop analysis laboratory in the IIAM CZnd (the original plan was to renovate the existing facility). Inputs related to attendance at academic conferences that were not initially planned were also generated. The increase in inputs due to the withdrawal of the Brazilian side is evaluated to have been appropriate in response to external factors and in order to achieve the project purpose. Moreover, the allocation of additional personnel for the establishment of the new soil and crop analysis laboratory was also an essential input to improve the quality of the project's research and to secure income for the center through the provision of analysis services.

Regarding inputs from Brazilian side, a total of 46 experts, including coordinators, were dispatched for a longer period than planned until their withdrawal in 2015. The initially planned multipurpose laboratory in IIAM CZno, with financial support from Brazil was not realized and its blueprints having only been completed owing to their withdrawal.

As for the input from the Mozambican side, personnel costs of the researchers and the

[27] 1,239,833 USD (calculated at the rate as of October 22, 2021, 1 USD = 113.95 JPY)
[28] 2,150,400 USD (calculated at the rate as of October 22, 2021, 1 USD = 113.95 JPY)

utility costs in IIAM CZnd and CZno were covered by the budget from each center as originally planned.

3.3.1.2 Project Cost

The project cost was 1,196 million JPY, significantly exceeding the planned amount of 600 million JPY (199% of the planned amount). The reason, as mentioned earlier, was the withdrawal of Brazil from the project, resulting in Japanese experts being added to help ensure implementation. The increase in project costs due to Brazil's withdrawal because of the severe economic crisis can be categorized as an external factor, as it was not initially expected. Thus, taking this increase in the project cost into account is not appropriate for determining efficiency. Initially, the existing soil and crop analysis laboratory was planned to be renovated, then, however, in order for the IIAM CZnd to fulfill its role as the core agricultural experiment station in the region, the soil and crop analysis laboratory was newly built, and the equipment and materials were set to specifications appropriate for that role. As a result, the costs for equipment and materials and for the dispatch of specialists in construction supervision increased. This was exacerbated by significant delays in the construction of the laboratory due to unseasonable weather (torrential rain), which resulted in having to extend the employment period of construction supervisors as well as increase the dispatch period of experts involved in cultivation tests. These increases in project costs[29] for reasons other than Brazil's withdrawal were taken into account in the evaluation of the project efficiency.

3.3.1.3 Project Period

As a result of the terminal evaluation in 2015, the project was extended by 1.5 years from the planned 5 years to 6 years and 6 months (130% of the planned period); therefore, the project period exceeded the plan. The main reason for the extension of the project, same as the project cost, was the substitution of Brazilian activities by the Japanese side on Brazil's withdrawal, which can be classed as an external factor. The extension of the project period to compensate for the delay in the accumulation of soil and plant data, as well as the development and dissemination of the DSS model caused by the delay in the construction of the soil and crop analysis laboratory, and delays in upgrading specification equipment on the part of the Japanese were considered as factors of increase in the project period rather than external factors in the evaluation of the project's efficiency.

As above, the project cost was significantly higher than planned and the project period was exceeded the plan, but this did not reduce the efficiency of the project because the main

[29] Since the extension of the period for dispatching experts was related to both the reasons for withdrawal from Brazil and the delay in the construction of the soil test laboratory, it was difficult to calculate the labor cost and other costs separately, so they were evaluated together.

reason can be summarized as the external factor of the Brazil's withdrawal due to the historical deterioration of their economy. However, the project cost and period were increased not only by the external factor but also by the delay of the construction of the soil and crop analysis laboratory and upgrading in specifications equipment, which were the activities of Japanese side. Therefore, the efficiency of the project is fair.

3.4 Sustainability (Rating: ②)

3.4.1 Policy and Political Commitment for the Sustainability of Project Effects

At the time of the ex-post evaluation, the final draft of *Strategic Plan for Agricultural Sector Development II (2021-2030) (PEDSA II)*, the successor to the *Strategic Plan for Agricultural Sector Development (2011-2020) (PEDSA)*, was formulated. The *National Agricultural Sector Investment Plan (PNISA II)* has been formulated which showed the budget estimation for the actual implementation of the *PEDSA II*. The political sustainability of the project is considered to be high, as PEDSA II states that IIAM will implement the areas related to agricultural commodity prioritization, cash crop production, sustainable livestock management, establishment and operation of agricultural information systems, promotion of agricultural value chain research, and sustainable soil management in collaboration with other relevant institutions among priority programs aimed at increasing agricultural productivity.

3.4.2 Institutional/Organizational Aspect for the Sustainability of Project Effects

As a result of the project, the *Guidelines of Research Center Management* were prepared to help guide the continued operation and management of the IIAM CZnd and CZno. Operation and maintenance personnel were also appointed to the soil and crop analysis laboratory in the IIAM CZnd, and the facilities and equipment are being operated and managed in accordance with the *Guidelines of Research Center Management*. In addition, the project provided several training sessions, including on-the-job training, were conducted for the counterparts such as researchers and technicians of the IIAM CZnd and CZno. Of the 30 counterparts, 26 (87%) continued to work at IIAM and provided agricultural technical services in response to the needs in the field. The revision of the service fee in accordance with the recommendations of the *Guidelines for the Operation and Management of Agricultural Experiment Stations* has brought stable income to both regional centers.

With regard to the dissemination system for farmers, the IIAM regional center officials reported difficulties in collaboration between different organizations such as research and extension agencies although communication with SDAE was smooth, owing to lack of budget from DPAP, SDAE staff could not participate in the liaison meeting to discuss the annual joint extension plan between IIAM and SDAE. One extension worker was assigned to each community, and each one is supposed to be responsible for an average of 250

farmers[30]. However, according to the beneficiary survey in the ex-post evaluation, the average number of farmers actually supported by each extension worker is 150, which is only about 60% of the stipulated number; this is because of the lack of DPAP support for access to farmers and fuel costs, and the recent impact of COVID-19.

As mentioned above, although there are no issues with the implementation system of the activities in the IIAM CZnd and CZno that were strengthened by the project, there are some challenges in the implementation of the extension workers' activities, indicating that there are some challenges to sustainability in the institutional/organizational aspect of the project.

3.4.3 Technical Aspect for the Sustainability of Project Effects

It was confirmed that continuous capacity building of the staff was implemented in both IIAM regional centers through IAMRAP and internal training. In the ex-post evaluation beneficiary survey, all the extension workers surveyed expressed high satisfaction with the training provided by the staff of the IIAM CZnd and CZno, indicating that their research and extension staff had a sufficient level of skills. Furthermore, various manuals for extension workers and farmers, developed under the project, are also confirmed to be still used in extension activities and in developing new extension manuals and guidelines as references. Although the data for DSS should be accumulated by increasing the number of crop types and correcting the model, researchers and extension workers should become familiar with the method through field practice. However, due to insufficient technical transfer during the project, the filed practice has not been carried out since the completion of the project owing to the lack of personnel who can teach DSS. The IIAM therefore suggested the necessity for further technical transfer in order to achieve widespread dissemination at the field level.

Training and capacity building in IIAM have still been implemented and the manuals and guidelines developed in this project have been used. Although the dissemination of DSS requires further capacity building for researchers and extension workers, the high level of satisfaction of extension workers attending IIAM training sessions indicates that the technical sustainability of IIAM researchers and staff is high.

3.4.4 Financial Aspect for the Sustainability of Project Effects

The main income of the IIAM CZnd and CZno is derived from the budget of the IIAM headquarters, state government, and development partners and self-generated revenue from their various services. As shown in the table below[31], the budget of the IIAM CZnd has been

[30] The number of farmers is stipulated in the *Master Plan for Agricultural Extension (2007-2016*) issued by the National Agricultural Extension Service (DNEA), MADER; the figure remained unchanged at the time of the ex-post evaluation.

[31] We were unable to obtain the income and expenditure information for each center; thus, only the budget is shown in Table 7.

decreasing owing to the termination of support from development partners and the difficulty in providing some services because of the breakdown of laboratory equipment. On the other hand, the budget of the IIAM CZno had increased by 2020 owing to an increase in personnel costs associated with the hiring of new researchers and the promotion of existing researchers; however, a difficult financial situation was reported as the budget for 2021 was reduced by about 30% compared to that of the previous year owing to the impact of COVID-19.

The necessary budget of the soil and crop analysis laboratory in the IIAM CZnd for the project activities was funded by the Japanese side, including the cost of operation and maintenance during the project period, and then the IIAM CZnd was to secure the operation and maintenance cost after the completion of the project. The IIAM had planned to pool the income from the various services provided by the regional centers and allocate it to the maintenance and management costs, but due to the breakdown of many of the analytical equipment, including the soil analysis experimental equipment[32] procured by the project, due to unstable power supply and other force majeures, the IIAM pointed out that they were unable to generate the expected incomes and fell into the budget shortfall, resulting in the negative cycle.

Table 7 Budget trends of the IIAM CZnd and CZno

(Unit: MZN)

	2016	2017	2018	2019	2020
IIAM CZnd	62,528,230	52,714,790	48,549,830	39,706,271	28,579,725
IIAM CZno	27,629,911	31,895,830	43,334,639	43,033,430	56,191,321

Source: Questionnaire

As described above, policy/political commitment and technical sustainability have been ensured for the continuation of the research and extension activities that assist in transferring appropriate agricultural technologies to the farmers through the project. On the other hand, there are some minor problems within the institutional/organizational component concerning the technical transfer by extension workers, and within the financial component, regarding the operation and maintenance costs of the equipment. Therefore, the sustainability of the project effects is evaluated as fair.

4. Conclusion, Lessons Learned, and Recommendations

4.1 Conclusion

The tropical savannah region in the northern part of Mozambique, blessing with a

[32] At the time of the Ex-post evaluation, the JICA Mozambique office followed up on the selection of a contractor for the repair and maintenance training of the soil analysis experimental equipment, and those will be implemented within the fiscal year of 2021.

sufficient amount of rainfall and a vast area of farmland, has high potential for expanding agricultural production. However, the extensive agriculture is practiced in much of the region and the productivity of both subsistence and commercial crops is not high. Under these circumstances, this project aimed to develop an appropriate agricultural development model for sustainable agriculture through improving the regional agricultural productivity mainly among small-scale farmers. Therefore, the project has improved the research capacity of the agricultural research institutes in the northeast and northwest regions under the IIAM and transferred new agricultural technologies to pilot farmers through the triangular cooperation with Brazil which has a tropical savannah area with natural conditions similar to those of the project target area, and has expertise in agricultural development in that area. The evaluation found that the objective of the project is fully consistent with the development policy of Mozambique which aimed at improving agricultural productivity and competitiveness, and the development needs of the region. The project is also relevant with Japan's aid policy as well as the diplomatic strategy of the Brazilian government which include the promotion of the triangular cooperation, thus, the relevance of this project is high. As for the effectiveness and impact of the project, some outputs were not achieved because a part of the activities were discontinued in the middle of the project owing to the tight budget of the Brazilian aid agency, the partner in the triangular cooperation. However, considering that the project purpose and overall goal have been achieved and that other positive impacts were identified, such as increases in yields and farm incomes by using appropriate agricultural technologies, the effectiveness and impact of the project are high. On the other hand, actual project period and cost were exceeded the plan. Even though the increase in project period and cost due to the transfer of activities from the Brazilian side to the Japanese side are considered as an external factor, other factors such as a delay in the construction of the soil and crop analysis laboratory with increased expenses by the Japanese side also caused these increases. Therefore, the efficiency of the project is fair. The political and technical sustainability of the project is assured, allowing to continue research and extension activities of appropriate agricultural technologies transferred by the project. However, some issues have been identified in the institutional/organizational sustainability of the technical transfer from extension workers to farmers, and in the financial sustainability, such as securing the maintenance costs of the procured equipment. Therefore, the sustainability of the project is fair.

Based on the above, the project is evaluated as satisfactory.

4.2 Recommendations

4.2.1 Recommendations to the Implementing Agency

Budgeting for renewal of laboratory equipment and purchase of consumables and reagents

It was observed that much of the equipment procured to the IIAM CZnd and CZno was

out of order, and the inability to purchase consumables and reagents due to insufficient budgetary allocations has hindered research and service provision at the IIAM CZnd and CZno. Therefore, it is recommended that the IIAM and the provincial government provide budgetary support to the IIAM CZnd and CZno for upgrading of laboratory equipment and purchasing of consumables and reagents. It is also recommended that both regional centers develop a budget plan for the allocation of their own income generated from technical services towards the maintenance of laboratory equipment and purchase of consumables and reagents. They should ensure that these budgets are secured.

Establishment of a multipurpose laboratory in the IIAM CZno

The construction of the multipurpose laboratory in the IIAM CZno, which was originally planned to be built and funded by Brazil, was discontinued within the project, and the activities and indicators were revised to the drawing up of a construction plan only. Based on this developed plan, the IIAM CZno approached other development partners but it has not yet been realized. The researchers from the center claim that the laboratory is expected to play an important role in the development of agricultural technologies in the region, and that it is indispensable for acquiring data to refine the agricultural technologies and DSS model developed in the project. Thus, continued advocacy is required to secure government funding or support from development partners.

Support for the activities of extension workers and expansion of training for farmers

It was observed that some of the activities of extension workers who are responsible for dissemination training of agricultural technologies developed under the project have not been carried out, mainly owing to unreliable salary and difficulty in accessing some farmers. Therefore, it is recommended that the IIAM CZnd and CZno continue to consult with DPAP to support extension workers in disseminating the technologies to farmers. At the same time, IIAM training programs should expand their targets as much as possible by involving farmers as direct beneficiaries.

4.2.2 Recommendations to JICA

Conduct supplemental training on DSS

The IIAM suggested that the IIAM researchers and engineers need to acquire more knowledge and practice so that the accuracy of the DSS model introduced by the project can be improved through continuous data collection and analysis. As for technical transfer to extension workers and farmers, IIAM extension staff need to deepen their understanding and experience of DSS through practice. However, due to the insufficient level of technical transfer during the project, this has not been carried out since the completion of the project owing to the lack of personnel who can teach DSS. Therefore, it is recommended that

supplementary training for IIAM researchers and engineers be provided, such as training in Japan or the dispatch of short-term DSS experts to the region.

4.3 Lessons Learned

Lessons from triangular cooperation with equal partners

Triangular cooperation usually focuses on the use of third-country resources for some parts of a project, such as training in third countries and the dispatch of third-country experts. The project applied a new approach where the ProSAVANA, including the project, was implemented as an equal partnership between Japan and Brazil. The withdrawal of the Brazilian side from the project was due to external factors such as the unprecedented economic crisis in Brazil, but it also brought to the surface the risk of a financially unstable third country bearing the cost of the project and implementing the project as an equal partner through triangular cooperation, a risk even without an economic crisis. In addition, the equal intervention from both Japanese and Brazilian expert teams may make project management more difficult owing to technical disagreements and fragmentation of each activity. Triangular cooperation with equal partners has the merit of increasing efficiency through budget sharing and securing the ownership of the partner country; however, when using this approach, it is necessary to consider how to respond to the financial risks of the partner country or its donor agency and to clarify the chain of command and sharing of roles within the project.

Republic of Mozambique

FY2020 Ex-Post Evaluation of Japanese Grant Aid Project

"The Project for Construction of Bridges on the Road between Ile and Cuamba"

External Evaluator: Makoto Tanaka, ICONS Inc.

0. Summary

This project was implemented with the aim of ensuring safe and stable traffic in the northern part of Mozambique, thereby activating human exchanges and logistics in the area, and contributing to socio-economic activities, by constructing bridges in the section between Ile/Nampevo, Zambezia Province, and Cuamba, Niassa Province. At the commencement and the ex-post evaluation, the project was consistent with Mozambique's policies, such as *The Action Plan for the Reduction of Poverty* and *Road Sector Strategy*, and with the development needs, as represented by handling of agricultural products. Therefore, its relevance is high. The grant limit was increased and the project period was extended as large-scale floods occurred during the project period. Although the project cost was within the revised plan, the project period exceeded the plan. Therefore, its efficiency is fair. Most of the indicators for the expected quantitative and qualitative effects have been achieved without negative impacts. However, certain indicators have not been achieved, as corresponding important assumptions have not been satisfied. Therefore, both its effectiveness and impacts are fair. No major problems are observed in the institutional/organizational, technical, and financial aspects, and the current status of the operation and maintenance system at the time of the ex-post evaluation. Therefore, its sustainability is high.

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

1. Project Description

Project Location

Namutimbua Bridge, one of the 13 bridges constructed in the Project

1.1 Background

The Republic of Mozambique (hereinafter referred to as "Mozambique") established its national rebuilding program in 1992 to reconstruct the basic infrastructures devastated by the conflict. The national road network was reconstructed with the aid of many partner countries and international organizations, placing the development of infrastructures as an important field in *The Action Plan for the Reduction of Absolute Poverty I* (PARPA I: 2001–2005), *The Action Plan for the Reduction of Absolute Poverty II* (PARPA II: 2006–2009), and *The Action Plan for the Reduction of Poverty* (PARP: 2011–2014) at the time of the project planning. However, Mozambique's road density[1] was ranked 12th (38 km/km^2) among 14 countries in Southern Africa, and there were more than 300 bridges requiring reconstruction owing to aging and overhead flooding in the rainy seasons. These conditions hindered Mozambique's economic development.

The main industry in the target area of the project is agriculture: the area has a high potential for agriculture, owing to its rich soils and rainfall. However, the access to markets was difficult due to the lack of satisfactory roads and bridges in the target section, affecting the handling of agricultural products. Some routes ensured the tentative access of transportation between the sections by constructing temporary bridges, which have poor sustainability; for example, there were sections that became impassable in the rainy seasons and experienced frequent traffic accidents caused by the narrow approaches to bridges. Thus, there was an urgent need for improvement.

1.2 Project Outline

The project aimed at ensuring safe and stable traffic in the northern part of Mozambique, thereby activating human exchanges and logistics in the area and contributing to socio-economic activities, by constructing bridges in the section between Ile/Nampevo, Zambezia Province, and Cuamba, Niassa Province.

Grant Limit / Actual Grant Amount	3,937 million yen (initial grant limit) 5,173 million yen (revised grant limit) 5,033 million yen (actual)[2]
Exchange of Notes Date /Grant Agreement Date	December 10, 2012 (detailed design) E/N and G/A June 14, 2013 (initial) E/N and G/A November 11, 2015 (revision of the project period)[3] G/A July 20, 2016 (revision of grant limit)[4] E/N and G/A

[1] Total road length per unit area of the national land

[2] The grant limit includes 132 million yen for the Detailed Design. The actual amount is the sum of the actual payment JPY 130,225,000 (Japanese yen) for the Detailed Design, consulting fee JPY 280,231,000 finally agreed (August 18, 2017) and construction fee JPY 4,623,429,000 finally agreed (August 18, 2017) (Source of the actual amount: documents provided by JICA).

[3] The deadline of the project period was extended from May 2016 to August 2017 (Source: documents provided by JICA).

[4] The grant limit of the main part was increased from 3,805 million yen to 5,041 million yen (Source: the Ministry of Foreign Affairs of Japan and documents provided by JICA).

Executing Agency	National Road Administration (ANE)
Project Completion	November 2017
Target Area	Zambezia and Niassa Provinces
Main Contractors	Konoike Construction Co., Ltd. and Daiho Corporation (JV)
Main Consultants	Chodai Co., Ltd. and Eight-Japan Engineering Consultants Inc. (JV)
Procurement Agency	NA
Preparatory Survey	March 2010 – December 2011
Related Projects	JICA Technical Cooperation Project: The Project for the Capacity Development of road maintenance in the Republic of Mozambique (August 2011 – August 2014) Other donors: Islamic Development Bank (IDB): Improvement of the Section between Nampevo and Gurue (Loan, 2003) IDB: Improvement of the Section between Gurue and Magige (Loan, 2011) Government of Portugal: Improvement of the Section between Magige and Cuamba (Loan, 2011 – 2014)

2. Outline of the Evaluation Study

2.1 External Evaluator

Makoto Tanaka, ICONS Inc.

2.2 Duration of Evaluation Study

This ex-post evaluation study was conducted according to the following schedule.

Duration of the Study: October 2020 – February 2022

Duration of the Field Study: April 25 – May 8 and August 22 – August 28, 2021

2.3 Constraints during the Evaluation Study

The field study was implemented using only local assistants, as the Japanese Evaluator could not visit the country owing to the worldwide spread of COVID-19. Information on the governance and financial status of the National Road Administration (hereinafter referred to as "ANE") could not be acquired because no answers to the questionnaire survey were given, and no interview could be implemented with the Ministry of Public Works, Housing, and Water Resources (hereinafter referred to as "MOPHRH"), the supervising ministry of the ANE, that is, the implementing organization of the project.

3. Results of the Evaluation (Overall Rating: B[5])

3.1 Relevance (Rating: ③[6])

3.1.1 Consistency with the Development Plan of Mozambique

At the time of planning, the most important national policy of Mozambique aimed at poverty reduction: *The Action Plan for the Reduction of Poverty* (PARP: 2011–2014) positioned construction of local infrastructures as an important sector, including the Road Sector Strategy (2007–2011, hereinafter referred to as "RSS") for the road traffic sector. The RSS positioned the target section as an important corridor running through the mid-northern part of the country. This section was designated to be constructed with the highest priority, as it forms a road network combined with the Nacala Corridor, connecting Nacala Port and Malawi and Zambia, and National Route No. 1, the main north-south route of Mozambique. These have contributed to the development of poverty areas with high agricultural potential in the country.

At the time of the ex-post evaluation, the basic development policy of Mozambique was shown in the *2020–2024 Five-Year Plan of the Government* (hereinafter referred to as "PQG 2020–2024"). PQG 2020–2024 aims to provide a "diversified and competitive economy" by providing many opportunities for income and employment for the young, including (1) agricultural production, (2) social and economic infrastructure, (3) fishery and aquaculture, (4) tourism, and (5) mining as important items. Infrastructure is designated as the second of the five important items in the development policy in PQG 2020–2024, and remains one of the most important topics in the development policy of Mozambique, even at the time of the ex-post evaluation.

3.1.2 Consistency with the Development Needs of Mozambique

At the time of planning, agriculture was the main industry in the target area. The area had a high potential for agriculture, owing to plenty of rainfall and rich soil. However, access to markets was difficult due to the lack of roads and bridges in the target section: this substantially affected the handling of agricultural products. The project aimed to construct bridges urgently from the viewpoint of the following human security aspects.

- Many poor people lived in the target area (Zambezia and Niassa Provinces), most of whom were engaged in agriculture. To effectively develop the agriculture sector, the construction of the road network was required.
- The daily life of residents around the target section was affected in terms of commutes, hospital visits, and emergency transport, owing to the lack of appropriate bridges. Thus, the construction of bridges was required to improve their lives.

[5] A: Highly satisfactory, B: Satisfactory, C: Partially satisfactory, D: Unsatisfactory

[6] ③: High, ②: Fair, ①: Low

- Many accidents occurred on the bridges, and the most of them could be avoided by broadening the bridges from one lane to two.
- Certain bridges faced risks of falling, in which case they required replacement.

As described above, the Niassa Corridor connecting Ile/Nampevo and Cuamba plays an important role for domestic, arterial, and industrial roads. However, the traffic has previously been suspended on the bridges in this section, owing to river floods during the rainy seasons. Some of the sections ensured traffic mobility using temporary bridges, but these were not durable. In addition, there were subsections suspended in the rainy seasons and with many traffic accidents owing to the narrowing at bridges. It was urgently necessary to improve these issues. In particular, it was judged that the necessity of the project was high, as ensuring a passable state was necessary to improve issues of disrupted commutation, traffic accidents, the risk of falling bridges, and agricultural development.

At the time of the ex-post evaluation, the section between Ile/Nampevo and Cuamba was an important artery for Niassa Province to send agricultural products and other materials to Zambezia Province and the coastal area. For example, in Cuamba District of Niassa Province, at the end of the target section on the side of Niassa, 72,874 households (84% of the population) were engaged in agriculture, producing 563,505 tons of food crops and 521,766 tons of cash crops, and gaining MZN[7] 22,000 of income in 2019. In Ile District of Zambezia Province, at the end of the target section on the side of Zambezia, 43,869 people (of the total population of 186,446) were engaged in agriculture, sending 88,368 tons of agricultural products (including 6,392 tons of cash crops) in the period from September 2020 to September 2021 via roads, including the bridges targeted in the project. In Gurue District of Zambezia Province (population: 430,085), 320,993 tons of agricultural products (including 31,471 tons of cash crops) were handled and 43,952 tons (including 26,298 tons of cash crops) were transported to the outside of the district via roads, including the bridges targeted in the project[8]. In 2020, the National Institute of Statistics (INE) released the population and agricultural production statistics for the three districts along the target section (Ile and Gurue Districts of Zambezia Province and Cuamba District of Niassa Province); these are listed in Table 1.

[7] MZN stands for meticais (singular: metical), the Mozambican currency: MZN 1 was equivalent to approximately JPY 1.42 as of the end of 2020.

[8] Source of the above: results of an interview with the Ministry of Agriculture and Rural Development (MADER)

Table 1. Population and Agricultural Production in the Three Provinces along the Section (2020)

Province	Population	Agricultural population	Agricultural production (ton)				
			Maize	Rice	Pigeon pea	Soybean	Total
Ile	318,880	184,950	5,124	1,915	2,750	1	9,790
Gurue	500,531	400,425	24,919	1,621	8,144	9,473	44,157
Cuamba	264,225	166,462	19,421	365	1,692	358	21,836
Total	1,083,636	751,837	49,464	3,901	12,586	9,832	75,783
Nationwide	29,300,000	NA	1,451,686	179,836	168,714	NA	NA

As described above, the target section plays an important role in agriculture in the northern part of Mozambique: accordingly, the project meets the development needs.

3.1.3 Consistency with Japan's ODA Policy

At the time of the planning, Japan's “Country Assistance Policy for the Republic of Mozambique” (March 2013) indicated that it was the most effective approach to promoting the development of the Nacala Corridor, and it was the most effective approach in Japan's development assistance for Mozambique. A variety of projects were implemented, such as the project, “Upgrading of Cuamba-Nampula Road,” and “Agricultural Development of the African Tropical Savanna” as part of “Programme of Development and Rehabilitation of the Nacala Corridor.” As is clear from the overall program, the target of the project was positioned as an important artery for the transport and traffic sector. The project aimed to contribute to reducing poverty in Mozambique by constructing a triangular road network including the Niassa Corridor, and was also consistent with Japan's assistance policy for Mozambique. The project agreed with the most important sector of assistance, i.e., the “Activation of Local Economy” and the cooperation program of the highest priority, i.e., the “Programme of Development and Rehabilitation of the Nacala Corridor” in the analysis paper of JICA at the time of the planning. It was also positioned in the “Programme of Development of Economic Infrastructure.” The project also contributed to the achievement of the “Construction and Amplification of Domestic and Wide-area Economy” goal listed in the Fourth Tokyo International Conference on African Development (TICAD IV, 2008).

From the above, it can be seen that the project has been highly relevant to Mozambique's development plan and development needs, as well as Japan's ODA policy. Therefore, its relevance is high.

3.2 Efficiency (Rating: ②)

3.2.1 Project Outputs

The planned outputs of the project were new construction of 13 bridges (length: 15 – 105

m) and culverts[9] and the replacement, widening, rehabilitation, and reinforcement of existing bridges in the target section as civil works, along with providing detailed design and construction management as consulting services. The planned outputs of the civil works (at the preparatory survey) are listed in Table 2, and the differences between the planned and actual outputs are listed in Table 3.

Table 2. Planned Outputs of Civil Works of the Project (at the Preparatory Survey)

	Bridges	Handling	Width (m)	Length (m)	Approach road (m)
1	Mutabasse	Replacement	9.6	105	335
2	Muliquela	Widening, rehabilitation and reinforcement of the existing bridge	5.2	70	335
3	Matacasse	Replacement	9.6	15	345
4	Lua	Widening, rehabilitation and reinforcement of the existing bridge	5.2	50	530
5	Ualasse	Replacement	9.6	15	205
6	Licungo	Replacement	9.6	35	440
7	Nivaco	Replacement	9.6	30	330
8	Matsitse	Replacement	9.6	15	325
9	Namisagua	Replacement	9.6	15	285
10	Nuhusse	Replacement	9.6	35	415
11	Lurio	New construction	9.6	70	430
12	Muassi	Replacement	9.6	15	265
13	Namutimbua	Replacement	9.6	30	430

Source: documents provided by JICA, etc.

Table 3. Differences of Outputs of Planned Civil Works (at the Preparatory Survey) and Actual Works of the Project

	Bridges	Approach road (m)			Revision other than approach roads	
		Plan-ned	Actual	Diffe-rence	At the completion of the Detailed Design	During the Project
1	Mutabasse	335	545.7	+210.7	Abutment height 8.5 → 10 m	Revetment added
2	Muliquela	335	370.2	+35.2	Width 5.2 → 5.35 m Abutment height 8→10 m	Revetment added Railing of the existing bridge restored
3	Matacasse	345	308.0	-37.0		
4	Lua	530	541.9	+11.9	Width 5.2 → 5.35 m	Revetment added
5	Ualasse	205	205.0	±0.0		
6	Licungo	440	398.0	-42.0		
7	Nivaco	330	350.0	+20.0	Pipe culvert deleted	Revetment added
8	Matsitse	325	305.0	-20.0		
9	Namisagua	285	285.0	±0.0		
10	Nuhusse	415	415.0	±0.0	Abutment height 13.5 → 8 m	Revetment added
11	Lurio	430	448.1	+18.1		
12	Muassi	265	311.5	+46.5		
13	Namutimbua	430	464.9	+34.9		
Total		4,670	4,948.3	+278.3		

Source: documents provided by JICA

[9] A culvert is an underground drain. In the Project, it is expected to use rectangular (box) or tube (pipe) culverts to pass river water and to serve their top as roads.

All outputs expected by the ANE were achieved. As listed in Tables 2 and 3, there are slight differences between the planned and actual outputs. Some of the designs for the approach roads were changed at the completion of the detailed design, and some changed during the project. The reasons for the changes at the completion of the detailed design were as follows: revisions in the replacement concrete (Mutabasse and Muliquela: changes in the abutment heights), confirmation of rock outcrops (Nuhusse: change in the abutment height), revisions of the technical standard (Muliquela and Lua: changes in the width), and a lack of need owing to road rehabilitation by the Islamic Development Bank (hereinafter referred to as "IDB") (Nivaco: pipe culvert deleted).

In January 2015, during the project period, a large-scale flood occurred in central Mozambique, affecting the construction materials, temporary bridges, and abutments under construction. The roads to the target sites were occluded, causing a long period of construction suspension, resulting in the additional costs for rehabilitation from the disaster and construction management during the suspension. Thus, an extension of the project period and increment of the grant limit were agreed to in November 2015 and July 2016, respectively. Accordingly, the alignments of the approach roads were changed, and construction works such as revetment works were added as listed in the right column "During the Project" in Table 3. In addition, an additional grant compensated for the re-restoration (all of them were earthworks for rehabilitation) of the re-affected river-crossings of the bypasses for the dry seasons of three bridges not targeted in the project (in the domain of the ANE), as they were necessary for resuming the construction works of the project.

As a consulting service, detailed design and construction management tasks were performed as planned, along with handling of the flood as described above.

3.2.2 Project Inputs

3.2.2.1 Project Cost

In the original plan, the grant limit on the Japanese side was JPY 3,937 million (including JPY 132 million for the detailed design), whereas the revised limit was JPY 5,173 million (ibid.). The actual disbursement from the Japanese side was JPY 5,033 million[10], 128% of the original plan and 97% of the revised plan.

As a consequence of the above-mentioned flood in January 2015, the contractor notified the ANE that construction should be suspended, because it was impossible to continue the construction works under the situation. After this notification, the ANE, JICA, Japanese consultant, and contractor discussed together and signed the Grant Agreement (G/A) to extend the project period in November 2015, and the Exchange of Notes (E/N) and G/A for increasing the grant limit in July 2016, respectively. The original design of the 13 target bridges and their access roads conformed to the standards of the ANE and the Southern

[10] See "1.2 Project Outline" for the basis of the calculation.

Africa Transport and Communications Commission (SATCC)[11], depending on the peak flow rates and planned water levels corresponding to the dimensions of the rivers (source: documents provided by JICA). As the flood disaster in January 2015 exceeded expectations, this is considered as an "external factor" as described in the *Ex-post Evaluation Reference*. Therefore, the grant limit and project period in the E/N and G/A as revised owing to the flood are assumed as the planned values for evaluation, and should be compared with the actual values to evaluate the efficiency. Under this consideration, the project cost is 97% of the planned cost, and is within the plan.

The costs burdened by the Mozambican side were approximately JPY 260 million, and all of the general and specific items for the Mozambican side were implemented as planned[12].

3.2.2.2 Project Period

In the original plan, the project period was 3 years and 0 months (36 months) from June 2013 to May 2015[13]. The plan revised after the flood in January 2015 extended the project deadline to August 2017, making the project period 4 years and 3 months (51 months). The actual period was 54 months, from June 2013 to November 2017. According to the ANE Headquarters, the reasons of the extension were not only because the suspension of the constructions of the 13 target bridges and their design changes, but also because the roads used for the construction were unable to be passed through, and the corresponding restoration works took time. The ANE therefore recognized that there were legitimate reasons for the extension. In reference to documents provided by JICA and the results of interviews with the Japanese consultant, the factors causing the extension were as follows.

- As a consequence of the flood in January 2015, the contractor notified the ANE in February 2015 that the construction should be suspended, because it was impossible to continue the construction works under that situation. After this notification, the ANE, JICA, Japanese consultant, and contractor discussed options together.
- The flood affected existing roads and bridges out of the project scope that were nevertheless used for transporting materials for the project. The restoration of these existing out-of-scope roads and bridges was necessary to restart the construction immediately.
- The costs for the above should have been disbursed: they were released by tentatively omitting items planned in the later part of the original scope, because the E/N for

[11] The SATCC is one of the sector committees of the South African Development Community (SADC) established in April 1980, to which 9 countries in the Southern Africa (Source: article on the SATCC by the Union of International Association (UIA), https://uia.org/s/or/en/1100061374, browsed on June 28, 2021).
[12] However, no reference was located to confirm the amount disbursed by the Mozambican side.
[13] The ex-ante evaluation paper does not state the period from the end of the Detailed Design to the signing on the G/A of the main part. This evaluation study adopts 36 months as the period, counting the planned period of the main part except the Detailed Design, including the start and end of the period as one month each.

increasing the grant limit required additional time.

- After the G/A for extending the period in November 2015, the E/N and G/A were serially updated to increase the grant limit in July 2016, one and a half years after the flood. The tentatively omitted portions of the original scope were linearly revived afterward.
- As mentioned above, the original design for the 13 target bridges and their access roads conformed to the standards of the ANE and SATCC, depending on the peak flow rates and planned water levels corresponding to the dimensions of the rivers. The flood disaster in January 2015 exceeded the expectations of these standards.

The actual period was 106% of the planned period even when the period of 51 months in the revised plan was adopted, thereby exceeding the plan. According to the results of an interview with the Japanese consultant, the reasons were as follows.

- The main reason was a change in the alignment of the access roads. They were changed because of ANE requirements in February 2017 during the construction, and corresponded to a strong request from the Mozambican Government in March 2017 to prevent overturning and the pushing-off of badly serviced trailers often happened in the target section. As some of the construction tasks were premised on the alignment before the changes, some critical path works[14] needed to be revised owing to the changes in the alignment, resulting in a 3.3-month extension of the period.
- The work for changing the alignment was planned to start in April 2017, but started in May instead, so as to wait for the end of the rainy season.
- The changes in the alignment required extensions of the approach roads, resulting in an increasing quantity of work on the road structures.
- The changes required removal of the existing road structures in sections already constructed.

From the above, although the project cost was within the plan, the project period exceeded the plan. Therefore, the efficiency of the project is fair.

3.3 Effectiveness and Impacts[15] (Rating: ②)

3.3.1 Effectiveness

3.3.1.1 Quantitative Effects (Operation and Effect Indicators)

The "Summary of Ex-Ante Evaluation Results" lists the travel time between Nampevo and Cuamba (ordinary car, hour), traffic quantity (ordinary and large vehicles) and annual

[14] A critical path is a work path, or a process that is critical, or the most important for minimizing the period of a whole project. The delay in the work on the critical path results in the delay in the whole project period.
[15] Sub-rating for Effectiveness is considered in combination with Impacts.

occlusion period (months) as the quantitative effects. They are classified as into operation and effect indicators, and assumed Operation Indicator (1) Traffic quantity (ordinary and large vehicles), Effect Indicator (1) Travel time between Nampevo and Cuamba (ordinary car), and Effect Indicator (2) Annual occlusion period. The results for the quantitative indicators are listed in Table 4.

Table 4. Achievement of the Quantitative Indicators

	Baseline 2011	Target 2019 (3 years after comple-tion)	Actual*1			
			2017	2018	2019 (2 years after comple-tion)	2021 (4 years after comple-tion)
Operation Indicator (1) Traffic quantity (vehicles/day)*2	278	438	429	339	284	NA
Effect Indicator (1) Travel time between Nampevo and Cuamba (ordinary car)	7 h	5 h	NA	NA	NA	6 h 11 min*3
Effect Indicator (2) Annual occlusion period	Average approxima tely 1 – 2 months per year*4	0	0	0	0	0

*1: The target values are assumed to be those in 2019 because the planned completion of the period was in May 2016; they should be the values in 2020, three years after the actual completion in November 2017. However, the indicators in this ex-post evaluation, such as traffic quantity, were thought to be severely affected by the hindrance of the economy caused by the spread of COVID-19 that started in February 2020. Therefore, the values in 2019 are adopted for Operation Indicator (1) and Effect Indicator (2) as the actual values. Regarding Effect Indicator (1), the actual value is assumed to be the one obtained by the method of *3 because no actual values were available from the existing data. At the time of the ex-post evaluation, the data for 2020 have not yet been added.
*2: Regarding the calculation method, see Table 5.
*3: The local assistant measured by driving through a 4WD car in August 2021 (in the dry season).
*4: It was estimated that there was an average of two to four overflows on bridges or culverts per year in the rainy season. Considering the local conditions, restoration and resumption require approximately two weeks. Hence, the target section was thought to be occluded on average for one or two months per year.

Source: documents provided by the ANE, etc.

Operation Indicator (1): Traffic quantity

The ANE provides the number of passing vehicles in the target section. The results are summarized in Table 5.

Table 5. Number of Passing Vehicles in the Target Section

		Average number of daily passing vehicles*1*2			
		Nampevo – Gurue (110 km)	Gurue – Magige (49 km)	Magige – Cuamba (84 km)	Nampevo – Cuamba (243 km)
Baseline (2011)		–	–	–	278
Target (2019)		–	–	–	438
Actual	2013	517	NA	122	NA
	2014	487	NA	361	NA
	2015	158	32	259	173
	2016	554	131	412	433
	2017	509	126	471	429
	2018	483	173	211	339
	2019	382	129	221	284

*1: The provided data are the number of passing vehicles through each of the five subsections between Nampevo and Gurue, three subsections between Gurue and Magige, and three subsections between Magige and Cuamba, which are calculated by multiplying these by the length of each subsection divided by the total length. Such calculation methods are generally utilized to evaluate traffic quantities. Both the baseline and target values were obtained using the same method.
*2: There are five bridges of Mutabasse, Muliquela, Matacasse, Lua, and Ualasse in the section between Nampevo and Gurue, two of Licungo and Nivaco between Gurue and Magige, and six of Matsitse, Namisagua, Nuhusse, Lurio, Muassi, and Namutimbua between Magige and Cuamba. Lurio Bridge is located just between Zambezia and Niassa Provinces.

Source: prepared by the Evaluator, based on data from the ANE

Table 5 shows that the number of passing vehicles tends to decrease after 2016. The section between Nampevo and Gurue was rehabilitated in 2003, and again between Gurue and Magige in 2011, both by loan from IDB. These sections have at least one lane for one-way travel and are fully paved. The section between Magige and Cuamba was planned to be rehabilitated by the loan from the Government of Portugal, but even at the time of the ex-post evaluation after the planned completion in 2014, the rehabilitation was not completed in that year and is not even now, and it was difficult for large vehicles to pass through this section (impassable in the rainy seasons), as shown in Photo 1. Large vehicles generally bypass this section by utilizing another route in the east. Accordingly, logistics companies want the route expected for the project to be passable (source: results of interviews with the ANE Zambezia and Niassa Delegations, and logistics companies). Increases in the number of passing vehicles through this section seem to be hindered by the fact that many passengers and logistics companies utilize another bypass route.

According to the ANE, which provides the data, the data includes the number of construction vehicles in the project. All 13 target bridges were made with concrete[16]; accordingly, several or tens of vehicles ran in the section transporting fresh concrete and other materials during the construction. It is estimated that the number of passing vehicles decreased after the project completion, because there was no car passing through the road

[16] As for the bridges constructed in the Project, Mutabasse, Muliquela, Lua, Licungo, Nuhusse, and Lurio Bridges are post tension T-girder bridges, and Matacasse, Ualasse, Nivaco, Matsitse, Namisagua, Muassi, and Namutimbua Bridges are reinforced concrete (RC) hollow slab bridges (Source: documents provided by JICA).

to deliver the materials to the construction site.

From the above, Operation Indicator (1) has not been achieved.

Photo 1. Example of road condition between Magige and Cuamba

Effect Indicator (1): Travel time between Nampevo and Cuamba (ordinary car)

In the ex-ante evaluation of the project, it was expected that the construction of the 13 target bridges would shorten the travel time between Nampevo, Gurue, and Cuamba from 7 hours (baseline value) in 2011 to 5 hours (target value) in 2019, 3 years after the completion of the project.

In the ex-post evaluation, the local assistant drove through the target section with a 4WD car and recorded the travel time, as listed in Table 6.

Table 6. Travel Time of the Target Section by 4WD Car

	Nampevo – Gurue (110 km)	Gurue – Magige (49 km)	Magige – Cuamba (84 km)	Nampevo – Cuamba (243 km)
Travel time*1	2 h 0 min	31 min	3 h 40 min	6 h 11 min
Schedule speed*2	55 km/h	95 km/h	23 km/h	39 km/h

*1: The local assistant drove from Cuamba to Magige, from Magige to Gurue, and from Gurue to Nampevo in the daytime in August 2021, during the dry season. The listed times are the differences between departure and arrival times.

*2: The schedule speed is the travel distance divided by the total travel time.

Source: record of actual driving by the local assistant

As shown in Table 6, it took 6 hours and 11 minutes to travel through the target section with a 4WD car in the dry season. It was estimated that it would take 8 or 9 hours to travel through the section in the rainy season, because the travel time between Magige and Cuamba would become much longer. From the above, the project has not achieved the Effect

Indicator (1).

Four important assumptions were assumed for the achievement of the Project Purpose: “Mozambique's political situation and public security do not worsen”; “No natural disaster occurs that cause significant changes in the design conditions”; “Mozambique's national development plan and policy on roads and bridges are not changed”; and “Road rehabilitation projects in the target section by IDB and the Government of Portugal are implemented and completed as planned.” According to the ANE, two of the four important assumptions were satisfied: “Mozambique's political situation and public security do not worsen” and “Mozambique's national development plan and policy on roads and bridges are not changed.” The assumption that “No natural disaster occurs that cause significant changes in the design conditions” was satisfied because the traffic quantity (as an effect indicator) depended on the revised plan, although the flood in January 2015 was a natural disaster causing changes in the design conditions. In contrast, “Road rehabilitation projects in the target section by IDB and the Government of Portugal are implemented and completed as planned” has not been satisfied, because the road rehabilitation between Magige and Cuamba, a portion being performed by the Government of Portugal, has not been completed yet (thereby affecting the unachieved indicator of the traffic quantity).

Effect Indicator (2): Annual occlusion period

In 2011, before the project, it was estimated that there were an average of two to four overflows on bridges or culverts per year in the rainy seasons between Nampevo, Gurue, and Cuamba, the target section. Considering the local conditions, restoration and resumption require approximately two weeks. Hence, the target section was thought to be occluded on average for 1 or 2 months per year (baseline value). It was expected that the section would become passable throughout the year with no occlusion, because the plan considered sufficient freeboard under the target bridges, that is, the annual occlusion period was expected to be zero (target value) in 2019, 3 years after the completion.

According to the ANE Zambezia and Niassa Delegations, no traffic occlusion has occurred since the completion of the project. From the above, it is judged that Effect Indicator (2) has been achieved.

3.3.1.2 Qualitative Effects (Other Effects)

The Summary of Ex-Ante Evaluation Results lists the following qualitative effects: (1) “the risks of overhead flooding and falling are resolved, which contributes to ensuring safe and stable transport for pedestrians and drivers”; (2) “access of inhabitants to markets and public services, etc., is improved by ensuring stable transport”; and (3) “improvement of road condition is expected to contribute economic development in the area by enabling

stable and efficient transport of people and materials." These statements seem redundant, and it is difficult to judge the achievements objectively, as the short-term outcomes (related to the effectiveness) and mid- and long-term outcomes (related to the impacts) can be easily confused. Therefore, only (1) (of (1), (2) and (3) above) is considered as a short-term outcome to be used to evaluate and judge the effectiveness, and (2) and (3) are assumed as qualitative indicators of the impacts.

According to the ANE Zambezia and Niassa Delegations, no traffic occlusion caused by natural disasters has occurred since the completion of the project. Inhabitants living in the vicinities of the Lurio, Muassi, and Namutimbua bridges[17] said that they feared that the old bridges used before the project would collapse, but such concerns have been resolved.

There were large-scale rainfalls on February 10 and March 25, 2017, just before the completion of the project. Roads to the target bridges were occluded and transport of materials became impossible owing to these rainfall events, but the bridges were not affected at all (source: documents provided by JICA). As drawn from this rainfall event, it is evident that the possibility of overhead flooding has significantly decreased. For reference, the estimated rainfall in 2021 in the three provinces along the target section (Ile and Gurue Districts of Zambezia Province, and Cuamba District of Niassa Province) are shown in Table 7. The table shows that the maximum monthly rainfall is approximately 200 mm in January. The target bridges are thought not to be affected severely by these estimated rainfall events, as they were not affected by the above-mentioned heavy rainfalls, in which there were almost monthly quantities of rain in one day each.

Table 7. Estimated Rainfalls in 2021 in the Three Districts along the Target Section

Month		1	2	3	4	5	6	7	8	9	10	11	12
Rainfall (mm)	Ile	196	172	105	29	4	3	5	3	2	27	58	158
	Gurue	196	172	105	29	4	3	5	3	2	27	58	158
	Cuamba	196	163	113	25	6	1	1	0	1	16	62	163
Rainy Days	Ile	23	23	21	13	5	5	6	3	3	8	13	21
	Gurue	23	23	21	13	5	5	6	3	3	8	13	21
	Cuamba	29	26	25	15	6	2	3	1	2	7	14	27
Sunny Days	Ile	8	5	10	17	26	25	25	28	27	23	17	10
	Gurue	8	5	10	17	26	25	25	28	27	23	17	10
	Cuamba	2	2	6	15	25	28	28	30	28	24	16	4

Source: Estimation by Meteoblue, a private meteorology company

From the above, it is judged that the qualitative effect (1) of the effectiveness has been achieved.

[17] In this ex-post evaluation, each 10 households were selected and interviewed in Zambezia and Niassa Provinces.

3.3.2 Impacts

3.3.2.1 Intended Impacts

At the planning of the project, the following were listed as quantitative effects: a decrease in transport costs, and an economic effect on the agricultural sector. The following were listed as qualitative effects: the strengthening of the road networks, an improvement of basic living conditions, a decrease in traffic accidents, the resolution of disaster risks, and benefits to poor people.

(1) Quantitative effects

The Preparatory Survey (2nd) Report assumed the following for the quantitative effects (decrease in transport costs and economic effect on the agricultural sector):

- Gross national income (GNI) in the agricultural sector in the target area: USD 146 million (calculated from GNI per capita USD 440, and contribution rate to the agricultural sector of 43%)
- Economic effect for 20 years after the project period: USD 389 million (calculated from estimated annual increase rate 5% in Economic and Social Plan 2011 (PES 2011))

However, no information was obtained on the GNI of the target region in the agricultural sector or on its economic effects. In addition, evidence for the calculation of these indicators is not available. Transporters along the target section (each one in Ile, Magige, and Cuamba) state that they do not feel the project lowers their transport costs because, in most cases, they utilize another route in the east to avoid the section between Magige and Cuamba, as it is in a bad condition, when they move between Ile and Cuamba. In contrast, the ANE Zambezia and Niassa Delegations think that the completion of the project made access to Niassa Province and Cuamba from outside easier, and that it activated distribution of agricultural products produced in the province.

(2) Qualitative effects

In this ex-post evaluation, two indicators of the effectiveness described in the Summary of Ex-Ante Evaluation Results are summarized into indicators of the impacts. In particular, the effectiveness indicators “access of inhabitants to markets and public services, etc., is improved by ensuring stable transport” and “improvement of road conditions is expected to contribute to economic development in the area by enabling stable and efficient transport of people and material” are summarized into the impact indicators of “strengthening of road network” and “activation of economic and social activities”, respectively. There are other indicators of the impacts: “improvement of basic living conditions,” “decrease in traffic accidents” “resolution of disaster risks,” and “benefits to poor people.” Those indicators are

discussed further below.

The completion of the project made access to Niassa Province and Cuamba from outside easier, and activated distribution of agricultural products produced in the province. However, the large-scale transport of agricultural products remains an issue to be addressed, because it is difficult for large-scale vehicles to pass through the section from Cuamba to Gurue, where unpaved subsections remain (source: results of interviews with the ANE Zambezia and Niassa Delegations).

The achievements regarding the six indicators are described as follows. Some have been achieved, and others have been partly achieved[18].

- Strengthening of road network: The improvement of road network by the project was pointed out by the following interviewees: the ANE Headquarters and Zambezia and Niassa Delegations, a transporter in Cuamba and one in Gurue, an agricultural product exporter in Cuamba, and inhabitants of Cuamba and Gurue (source: result of each interview). However, large vehicles utilize another route that is longer than the target section between Gurue and Cuamba where unpaved subsections remain; this is because the latter becomes unpassable for large vehicles in the rainy season (source: results of interviews with two transporters in Cuamba). From the above, it is judged that this indicator has been partly achieved.
- Improvement of basic living conditions: Inhabitants near Lurio, Muassi, and Namutimbua Bridges in Niassa Province reported that the project contributed to the improvement of access from their residents to the market and the activation of socio-economic activities, but the bad conditions of the road between Gurue and Cuamba hindered the increases in their income (source: results of interviews with inhabitants in Niassa Province). In contrast, inhabitants in Gurue pointed out similar positive effects, but they did not report any hindering factors, which depended on the bad road conditions between Gurue and Cuamba (source: results of interviews with inhabitants in Gurue). From the above, it is judged that this indicator has been partly achieved.
- Decrease in traffic accidents: The project removed a sharp curve previously existing in the approach road of Ualasse Bridge, providing better driving safety (source: results of an interview with transporters in Gurue). Ualasse and Mutabasse Bridges were difficult to see from their approach roads; this had caused many head-on collisions by cars, as drivers could not recognize that there had been only one lane on each bridge. The project removed this cause of similar accidents by making these two bridges two-laned. From the above, it is judged that this indicator has been achieved.
- Resolution of disaster risks: There were large-scale rainfalls on the 10th of February

[18] The ANE, as the managing body of road infrastructures, recognizes that the expected impacts have not yet been achieved, as the section of road between Magige and Cuamba is still to be completed. Indeed, the ANE continues making efforts to seek funds to complete the construction works of the referred road section.

and the 25th of March 2017, just before the completion of the project, but the bridges were not affected at all (source: documents provided by JICA). It is thought that there will be less possibility of the road network being cut at bridges by heavy rainfall relative to the period before the project, provided that the bridges are appropriately maintained hereafter. From the above, it is judged that this indicator has been achieved.

- Benefits to poor people, and the activation of economic and social activities: The project improved the transport of maize, soybean, and other beans, thereby benefiting the poorer local farmers. The agricultural economy in Niassa Province is expected to improve substantially if the road conditions between Gurue and Cuamba are improved (source: result of an interview with an agricultural product exporter in Cuamba). Although the effect of the project has not been maximized owing to the bad conditions in some access roads, the construction of the bridges has substantially enhanced local economic activities (source: result of interviews with transporters in Gurue). The project made previously unpassable bridges passable for large vehicles, enabling the development of agricultural product markets and increases in exports (source: result of an interview with an agricultural product exporter in Gurue). From the above, it is judged that these two indicators have been partly achieved.

3.3.2.2 Other Positive and Negative Impacts

In addition to the quantitative and qualitative effects described in Section 3.3.2.1, the evaluation study also examined (1) impacts on the natural environment, (2) resettlement and land acquisitions, and (3) other impacts.

(1) Impacts on the Natural Environment

According to "*JICA guidelines for environmental and social considerations*" (established in April 2010), it was judged that adverse impacts from the project on the environment were minimal, considering the characteristics of the sector, project, and project site; the project is not categorized in large-scale projects in the sector of bridges, and was classified as a Category B project.

In addition, an environmental impact assessment of the project was approved in June 2012 by the Ministry for the Coordination of Environmental Affairs (MICOA) of Mozambique. The Summary of Ex-Ante Evaluation Results predicted that the target area would not be in sensitive areas such as national parks and their surroundings, and that the adverse impacts on the natural environment would be minimal. All projects by the ANE are preceded by environmental studies. The ANE studied the impacts on the environment in the designated way, and implemented the environmental countermeasures requested there (source: results of interviews with the ANE Headquarters and Zambezia Delegation). The ANE Headquarters indicated that all environmental measures have been taken in such a way

that there have been no environmental problems. None of the interviewed inhabitants insisted on any concerns regarding the environment.

From the above, it is expected that the project will have no negative impacts on the natural environment.

(2) Resettlement and Land Acquisition

The ex-ante evaluation indicated that the project required a very small-scale acquisition of lands that were previously farmlands, and that the land acquisition should be executed following the domestic procedure. At the time of planning, it was expected that the land acquisition necessary for the project would cause resettlement[19] and require compensation for the farmlands along the target section. Therefore, the ANE commenced the designated procedure of land acquisition and resettlement, but there were no cases of acquisition of houses and farmlands (source: results of interviews with the ANE Headquarters and Zambezia and Niassa Delegations). Consequently, the ANE did not compensate or provide disbursements for any land acquisition in fact (source: answers to the questionnaire to the ANE Headquarters). The ANE Headquarters explained that this was because there were no inhabitants near the 13 target bridges.

From the above, it is expected that the project has caused no cases of land acquisition and resettlement.

(3) Other Impacts

There were no gender-related issues reported in the related references and the interviews with the ANE, transporters, and inhabitants. It is judged that there were no positive or negative impacts related to gender.

The indicators and whether they have been achieved are summarized in Table 8.

Table 8. Achievement of the Indicators for the Effectiveness and Impacts

Indicators	Type of indicator	Achievement	Remarks
Traffic quantity (ordinary and large vehicles)	Quantitative effect of the effectiveness, operation indicator	not achieved	The portion by the Government of Portugal has not been achieved in the important assumption "Road rehabilitation projects in the target section by IDB and the Government of Portugal are implemented and completed as planned."
Travel time between Nampevo and Cuamba (ordinary vehicles)	Quantitative effect of the effectiveness, effect indicator	not achieved	Same as the above

[19] There was a possibility of resettlement for three households in the vicinity of Lua Bridge (Source: Preparatory Survey Report).

Annual occlusion period	Quantitative effect of the effectiveness, effect indicator	achieved	
Risk of overhead flooding and bridge collapse	Qualitative effect of the effectiveness	achieved	
Decrease in transport costs	Quantitative effect of the impacts	unknown	Positive effect
Economic effect on the agricultural sector	Quantitative effect of the impacts	unknown	Although the indicator is not available, positive effect is reported.
Strengthening of road network	Qualitative effect of the impacts	partially achieved	This indicator includes “Access of inhabitants to markets and public services, etc., is improved by ensuring stable transport.”, which was an indicator for qualitative effect of the Project Purpose.
Improvement of basic living conditions	Qualitative effect of the impacts	partially achieved	
Decrease in traffic accidents	Qualitative effect of the impacts	achieved	
Resolution of disaster risks	Qualitative effect of the impacts	achieved	
Benefits to poor people	Qualitative effect of the impacts	partially achieved	
Activation of economic and social activities	Qualitative effect of the impacts	partially achieved	This indicator includes “Improvement of road condition is expected to contribute economic development in the area by enabling stable and efficient transport of people and materials.”, which was an indicator for qualitative effect of the Project Purpose.

From the above, it can be considered that the project has achieved its objectives to some extent. Therefore, the effectiveness and impacts of the project are fair. The reason some of the indicators for the quantitative effects of the effectiveness have not been achieved depends mainly on unsatisfied yet important assumptions.

3.4 Sustainability (Rating: ③)

3.4.1 Institutional/Organizational Aspects of Operation and Maintenance

The target section consists of national roads, the maintenance of which is implemented by the ANE Zambezia and Niassa Delegations. Of these, 29 staff members (25 technical and 4 administrative members) belong to the former, and 23 (17 technical and 6 administrative members) belong to the latter. These numbers did not change from the completion of the project until the ex-post evaluation. When any disorder occurs, the local community reports it, and the ANE engineers confirm the situation. The actual road maintenance works are contracted out to companies selected through designated procedures under the supervision

of members. The current number of staff is sufficient (source: answers to the questionnaire from the ANE Headquarters, results of interviews with ANE Zambezia and Niassa Delegations, documents provided by JICA, etc.).

From the above, no major problems have been observed in the institutional/organizational aspects.

3.4.2 Technical Aspect of Operation and Maintenance

The staff members at the ANE Zambezia and Niassa Delegations were in charge of construction management during the project period, and could confirm the situation of the target. They have sufficient knowledge on structures, including the bridges targeted in the project, and were expected to correspond to problems rapidly. The target section was maintained using the road inspection and maintenance system introduced in Zambezia and Niassa Provinces, which was introduced in Maputo and Gaza Provinces through the JICA technical cooperation project "The Project for the Capacity Development of road maintenance in the Republic of Mozambique" implemented from August 2011 to August 2014 prior to the project. In addition, the technology to use this system was transferred through internal training in the ANE, and consequently, the system was effectively used in Zambezia and Niassa Provinces.

The actual maintenance works are contracted out to companies based on inspection results. There are companies with sufficient technical skills to implement such maintenance works. Therefore, no problems exist in operation and maintenance. The ANE has prepared a manual of daily management, inspection, maintenance, and correspondences to abnormalities, etc., following its internal regulations. A training system for the staff of each delegation has also been established after the completion of "The Project for the Capacity Development of road maintenance in the Republic of Mozambique." Thus, no problems are seen to exist regarding technical transfer (source of the above: results from an interview with the ANE Headquarters, etc.).

From the above, no major problems have been observed in the technical aspect.

3.4.3 Financial Aspect of Operation and Maintenance

The main maintenance works on the bridges themselves and their access roads as constructed in the project comprise inspection, cleaning, and repair. The ANE bears the costs for maintenance, using subsidies from the Road Fund (hereinafter referred to as "FE") established by the MOPHRH for financing national roads. The ANE and FE posted the amounts listed in Table 9 as the budgets for daily maintenance of the section, including the 13 target bridges. According to the ANE, the FE will allocate sufficient budget for future maintenance (source: answers to the questionnaire to the ANE). However, no data were obtained on the costs of each bridge or the actual disbursements.

Table 9. Budget for Daily Maintenance of the Target Section

Year	Budget for maintenance (MZN)	Budget for maintenance (USD)*	Remarks
2012	5,473,410.00	185,539	
2013	11,302,210.00	380,290	project period
2014	13,916,888.85	440,966	project period
2015	9,217,919.58	211,130	project period
2016	10,216,418.45	136,492	project period
2017	10,963,954.12	182,672	project period
2018	9,264,786.77	152,156	
2019	9,231,253.23	145,580	

*Converted by the exchange rate for business implementation contracts and business consignment contracts with JICA in December of each year

Source: Answers to the questionnaires to the ANE and FE

The ANE revenues and disbursements from 2017 to 2019 are listed in Table 10. According to this, the revenue and expenditure are almost balanced.

Table 10. ANE Revenue and Expenditure from 2017 to 2019

Year	Revenue (top: MZN, bottom: USD*)	Expenditure (top: MZN, bottom: USD*)	Expenditure / Revenue
2017	836,616,001.60 13,938,954	836,616,001.60 13,938,954	100.00 %
2018	1,588,762,199.96 26,092,334	1,588,762,199.95 26,092,334	100.00 %
2019	923,125,978.49 14,558,040	948,746,890.69 14,962,102	102.78 %

*Converted from Meticais to USD by the exchange rate for business implementation contracts and business consignment contracts with JICA in December of each year

Source: Answers to the questionnaire to the ANE

However, the ANE has not formulated a large-scale repair plan for the 13 target bridges (source: answer to the questionnaire to the ANE). Thus, the ANE must find evidence for posting the budget for the costs of the future large-scale maintenance for each bridge.

From all of the above, no major problems have been observed in the financial aspect.

3.4.4 Status of Operation and Maintenance

Before the project, the target bridges did not ensure stable traffic, because they were temporary bridges with one lane and weight restrictions. The project made them permanent and upgraded the pavements on them and ensured stable traffic, thereby activating markets beside the arterial roads (source: documents provided by JICA). The inhabitants in Gurue and Niassa Provinces who were interviewed answered similarly.

The target section will be maintained in the same scheme as for other national roads, that is, contractors selected by the ANE will implement maintenance works, and the ANE will supervise their work (source: answer to the questionnaire to the ANE). The target section is slotted in the ANE's maintenance program for all roads in the domain of the ANE, and the

13 target bridges will be maintained along that program (source: result of an interview with the ANE Headquarters). The ANE Zambezia Delegation has formed annual maintenance plans in which the 13 target bridges are slotted (source: result of an interview with the ANE Zambezia Delegation).

In addition, the ANE holds regular meetings with related local authorities so that the local inhabitants respect and preserve road facilities (source: answers to the questionnaire to the ANE).

From the above, the status of the operation and maintenance is good.

From the above, no major problems have been observed in the institutional/organizational, technical, financial aspects and current status of the operation and maintenance system. Therefore, the sustainability of the project effects is high.

4. Conclusion, Lessons Learned and Recommendations

4.1 Conclusion

This project was implemented with the aim of ensuring safe and stable traffic in the northern part of Mozambique, thereby activating human exchanges and logistics in the area, and contributing to socio-economic activities, by constructing bridges in the section between Ile/Nampevo, Zambezia Province, and Cuamba, Niassa Province. At the commencement and the ex-post evaluation, the project was consistent with Mozambique's policies, such as *The Action Plan for the Reduction of Poverty* and *Road Sector Strategy*, and with the development needs, as represented by handling of agricultural products. Therefore, its relevance is high. The grant limit was increased and the project period was extended as large-scale floods occurred during the project period. Although the project cost was within the revised plan, the project period exceeded the plan. Therefore, its efficiency is fair. Most of the indicators for the expected quantitative and qualitative effects have been achieved without negative impacts. However, certain indicators have not been achieved, as corresponding important assumptions have not been satisfied. Therefore, both its effectiveness and impacts are fair. No major problems are observed in the institutional/organizational, technical, and financial aspects, and the current status of the operation and maintenance system at the time of the ex-post evaluation. Therefore, its sustainability is high.

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

4.2 Recommendations

4.2.1 Recommendations to the Executing Agencies

(1) Clarification of maintenance plans (to the ANE)

The target section is slotted in the ANE's maintenance program for all roads in the ANE

domain. Bridges are part of roads, but as structures, bridges are different from the main bodies of roads, both structures need specific maintenance plans. After a passage of a certain rainy season or occurrence of an exceptional event, to be sure, the ANE proceeds with a detailed inspection, to identify and quantify the damages on the structure and to propose the subsequent repair works, including estimated costs. To maximize the effects of such efforts, staff should deploy the general road inventory, integrate the maintenance plans for each structure, and clarify the plans for specific structures when forming the maintenance program for all roads in the domain of the ANE. This will help consider what percentage of the limited total budget can be diverted to certain structures, e.g., those for which unexpected maintenance costs exceeding expectations (from the costs for other structures) in the maintenance program should be borne for some reasons. In addition, this will also clarify which structures need regular large-scale maintenance when forming a long-term maintenance program.

(2) Delivery of meteorological data to the ANE (To the MOPHRH)

The risks of overhead flooding and the falling of bridges can be evaluated from the estimated water levels and flow rates of the rivers under these bridges. This behavior of rivers can be estimated from meteorological data. As a large-scale flood occurred in January 2015 during the project period, recent heavy intensive rainfalls and severe disasters are not exceptional in the target area. Therefore, it seems important that estimations of the behaviors of rivers from meteorological data at the time of their designs should be continuously revised for the future maintenance of bridges. For this purpose, it is recommended to build an organizational structure for assisting the ANE in establishing maintenance programs and large-scale repair plans of specific structures by providing meteorological data to the ANE. Specifically, the MOPHRH should refer to meteorological data to estimate the occurrence of meteorological phenomena that may affect road structures, in alliance with the National Directorate of Water Resources Management (DNGRH) inside the Ministry, and the National Institute of Meteorology (INAM), etc., and then provide such data to the ANE. The MOPHRH, from a technical perspective, should also assist the ANE in utilizing meteorological data for predicting future rainfalls, and in revising the data necessary for future management of the 13 target bridges[20].

4.2.2 Recommendations to JICA

Confirmation of progress of related projects by other donors for the realization of project effects, etc.

The purpose of the Project was to secure safe and stable transportation in the area between

[20] For example, an upward revision of the design high-water level a river may cause changes in the abutment height or access road alignment to ensure the clearance below the girder of the bridge over the river in case of large-scale upgrade.

Ile and Nampevo, while the direct output was the development of 13 bridges in the same section. Of the section, the roles were divided between IDB for road development between Ile / Nampevo and Magige, the Portuguese government for road development between Magige and Cuamba, and JICA for the development of bridges in the same section. However, according to interviews with related parties, the roads between Magige and Cuamba have not been constructed as planned, and even if the bridges are constructed in the Project, the connecting roads are unpaved. Large vehicles use other detour routes because the section is difficult to pass, and it is strongly suggested that this is the cause of the failure to achieve some of the operation and effect indicators of the Project and it hindered the project effects. The plan was scheduled to be completed in 2014 (before the flood in January 2015, which had a major impact on the Project), and road construction for the section was completed in the first half of the project period according to the initial plan of the Project. It is desirable to confirm the prospect of completion with the implementing agency regarding the status of road construction between Magige and Cuamba so that the originally planned Project effect will be fully realized.

4.3 Lessons Learned

Response to unexpected matters

In January 2015, during the project period, heavy rainfall occurred in the target area, causing large-scale flooding. In response to this situation, the concerned entities first confirmed the damage status not only of the target bridges but also of the surrounding roads necessary for the construction of bridges and bridges other than the target, and identified the factors making it impossible to continue the construction. Next, the management considered what should be done to resume the construction, then calculating the personnel, equipment, and funds required for it, and temporarily cutting part of the scope of the original plan. At the same time, steps were taken to extend the construction period and change the grant limit, and measures were taken to restore the temporarily-cut scope with the signature of the revised G/A and E/N. Notably, when a natural disaster made it impossible to continue construction, it was calmly decided what to do, rather than just waiting. As it was necessary to complete the restoration work before the next rainy season with almost no time to spare, the Japanese consultant and contractor gathered information on the damage situation, confirmed the necessary items for the restoration work, and promptly reduced the cost. In close cooperation with this, JICA promptly approved the related design changes.

Although the completion was 18 months behind schedule and the project cost increased by JPY 1,096 million, all of the originally planned outputs were achieved. In addition, the heavy rainfall occurring just before the completion of the extended construction period did not cause great damage to the target bridges which were about to be completed, i.e., there was no need to re-extend the project period.

It is thought that the case reasons for such favorable results are (1) calmly identifying the influence on the Project when an unexpected situation occurred, (2) listing, based on the survey results what should be done and what can be done to restart the Project under the constraints of existing human resources, goods, and money, (3) boldly rearranging the initial plan to devote existing resources as necessary, and (4) the related entities cooperating closely through (1) to (3) and playing their respective roles based on mutual trust.

Developing countries are not only vulnerable to natural disasters but also other factors such as harsh natural environments, inadequate meteorological data, and inadequate records of past natural phenomena; they are also often restricted in responding to the influences of natural disasters. The above measures in the Project will set a good precedent for responding to unexpected situations potentially occurring in similar projects in the future.

Republic of Malawi

FY2020 Ex-post Evaluation Report of Japanese Grant Aid Project

"The Project for the Reconstruction and Expansion of Selected Community Day Secondary Schools (Phase 1), The Project for the Reconstruction and Expansion of Selected Community Day Secondary Schools (Phase 2), and The Project for the Reconstruction and Expansion of Selected Community Day Secondary Schools and Conventional Secondary Schools (Phase 3)"

External Evaluator: Haruo Ito, ICONS Inc.

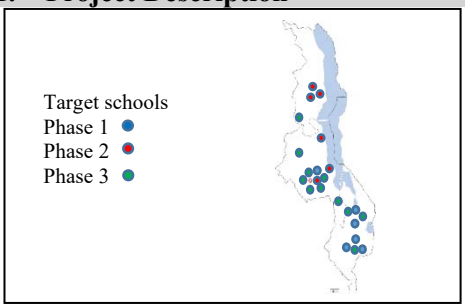
0. Summary

These projects (hereinafter referred to as "the Projects") were implemented to solve the shortage of classrooms and improve the learning environment in the target schools by expanding and upgrading existing secondary educational facilities and providing education–related equipment, including science laboratory equipment, thereby, contributing to the improvement of the quality and accessibility of secondary education in the target areas.

On the one hand, the purpose of the Projects is well in line with the development policy and development needs of Malawi, as well as the aid policy of Japan; thus, the relevance of the Projects is high. On the other hand, although the cost was in line with the original plan, the project period exceeded the plan due to the rebidding, insufficient distribution of imported materials, natural disasters caused by heavy rains during the rainy season, and financial and administrative problems of some contractors, resulting in the efficiency of the Projects as "fair." As for effectiveness, the quantitative and qualitative effectiveness indicators set at the planning stage were mostly achieved. In addition, as it has been confirmed that the Projects have had an impact on promoting girls' school enrollment, preventing the spread of COVID-19 in schools, and improving student performance through the synergistic effect of technical cooperation for the capacity building of science and mathematics teachers, their effectiveness is evaluated to be high. In terms of sustainability, there are no major issues in the system of project operation and maintenance, but some financial issues, such as the inability to secure sufficient operation and maintenance costs for experimental equipment, were identified. Therefore, project sustainability is also fair.

Considering the above, the Projects are evaluated to be "satisfactory."

1. Project Description



Project locations

Classrooms developed under the Projects

1.1 Background

The Projects included in "The Projects for the Reconstruction and Expansion of Selected Community Day Secondary Schools (hereinafter referred to as "Phase 1")," "The Projects for the Reconstruction and Expansion of Selected Community Day Secondary Schools (Phase 2) (hereinafter referred to as "Phase 2")," and "The Projects for the Reconstruction and Expansion of Selected Community Day Secondary Schools and Conventional Secondary Schools (Phase 3) (hereinafter referred to as "Phase 3")" supported the expansion of facilities such as general classrooms, multipurpose halls, science laboratories, libraries, and hostels for girl students in 23 secondary schools throughout Malawi. As mentioned above, the Projects consist of separate projects in each phase; however, each phase was evaluated as a whole in this ex-post evaluation.

1.2 Project Outline

The Projects aim to solve the shortage of classrooms and improve the learning environment in the target schools by expanding and upgrading existing secondary education facilities and providing education-related equipment, including science laboratory equipment, thereby, contributing to the improvement of the quality and accessibility of secondary education in the target areas.

Grant Limit / Actual Grant Amount	1,198 million yen (Phase 1), 1,085 million yen (Phase 2), 1,756 million yen (Phase 3) / Actual amount is same as Grant Limit
Exchange of Notes Date /Grant Agreement Date	August 2010 (Phase 1), March 2012 (Phase 2), March 2014 (Phase 3)
Executing Agency	Ministry of Education, Science and Technology (MoEST)[1]
Project Completion	August 2013 (Phase 1), September 2014 (Phase 2), May 2017 (Phase 3)
Target Area	Phase 1: Southeast, Southwest, Midwest, and Shire Highlands (Total of 6 schools) Phase 2: Midwest and Middle East (Total of 6 schools) Phase 3: Midwest, North, Middle East, Southeast, and Shire Highlands (Total of 11 schools)
Main Consultant(s)	Mazda Consultants International Co., Led
Procurement Agency	Japan International Cooperation System
Outline Design	Phase 1: August 2009–September 2010 Phase 2: December 2010–February 2012 Phase 3: June 2013–June 2014
Related Projects	【Technical Cooperation】 "Strengthening Mathematics and Science at Secondary Education (SMASSE) INSET Malawi" (2004–2007) "Strengthening Mathematics and Science at Secondary Education (SMASSE) INSET Malawi Phase 2" (2008–2012) "Project for Strengthening of Mathematics and Science in Secondary Education in Malawi" (2013–2017)

[1] After the new government came to power in June 2020, MoEST was renamed as the Ministry of Education (MoE).

	【Grant Aid】 "The Projects for Improvement of Domasi College of Education" (E/N: 2004) "The Projects for Construction of a Teacher Training College for Secondary School Teachers in Lilongwe" (G/A: 2013) "The Projects for Expanding and Upgrading the Domasi College of Education" (G/A: 2017)

2. Outline of the Evaluation Study

2.1 External Evaluator

Haruo Ito, ICONS Inc.

2.2 Duration of Evaluation Study

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

Duration of the Study: October 2020 – February 2022

Duration of the Field Study: April 30 – May 22, 2021 (Onsite)

August 25 – September 7, 2021 (Remote)

2.4 Constraints during the Evaluation Study

The Projects of Phase 1 and Phase 2 were completed in 2013 and 2014, respectively. Thus, by the time of the ex-post evaluation, periods of seven years and six years, respectively, have already passed since the Projects' completion, and the target year data for the indicators to evaluate the effectiveness of the Projects have been lost from the target schools and were difficult to obtain. Therefore, the degree of achievement was identified and evaluated based on the available data, so there may be some bias in the degree of achievement due to variability over time.

Due to the impact of the COVID-19 pandemic, the second field study was conducted remotely by hiring a local assistant. Although this did not have a significant bias in the evaluation, the evaluator did not observe lessons at the target schools, which was initially planned for the second field study, and, therefore, made an evaluation based on the reports from the local assistant.

3. Results of the Evaluation (Overall Rating: B[2])

3.1 Relevance (Rating: ③[3])

3.1.1 Consistency with the Development Plan of Malawi

At the time of planning, the "National Development Strategy (Vision 2020)" issued in 1998, the "Malawi Growth and Development Strategy (2006–2010)," and the "Second Malawi Growth and Development Strategy (2011–2016) (MGDS II)" issued in 2006 positioned the education sector as a priority area, indicating the need to improve access, quality, and equity in secondary

[2] A: Highly satisfactory, B: Satisfactory, C: Partially satisfactory, D: Unsatisfactory

[3] ③: High, ②: Fair, ①: Low

education, which is consistent with the purpose of the Projects. The "National Education Sector Plan (2008–2017) (NESP)" was formulated as an education policy, and its goals for secondary education were to increase enrollment, ensure equity, and improve facilities as priorities. In addition, the "Education Sector Implementation Plan (2009–2013) (ESIP)" and the "Education Sector Implementation Plan (2013–2017) (ESIP II)" were developed in response to the NESP. These plans set targets for secondary education, including upgrading of facilities of Community Day Secondary School (CDSS) and construction of girls' hostels. From the above, the Project Purpose was consistent with the development policy at the planning stage of the Projects.

At the time of the ex-post evaluation, the "Malawi Growth and Development Strategy III (MGDS III)" was developed as a successor to the "Malawi Growth and Development Strategy II" In MGDS III, "Strategy 1: Improve access and equity in secondary education for all children, with a particular focus on hard–to–reach girls, vulnerable groups, and others, including students who travel long distances in rural areas" and "Strategy 2: Improve the quality of secondary education and the relevance of teaching contents" are stated as concrete strategies for secondary education.

Furthermore, the Projects, which include the construction of girls' hostels and toilets, as well as the installation of toilets and slops for disabled students, are consistent with the "National Inclusive Education Strategy (2018–2021) (NIES)," which specifies the need to adopt school designs that are conducive to gender equality and people with disabilities. In addition, the "National Girls' Education Strategy (NGES)" provides guidelines for promoting girls' education, which is also consistent with improving the learning environment for girls in the Projects.

BOX 1: Contributions to the Sustainable Development Goals (SDGs)

The purpose of the Projects is to contribute to the achievement of Goal 4 "Quality Education" in SDGs. In particular, the Projects will support specific SDGs such as "Ensure that all girls and boys complete free, equitable and quality primary and secondary education leading to relevant and effective learning outcomes," "eliminate gender disparities in education and ensure equal access to all levels of education and vocational training for the vulnerable, including persons with disabilities, indigenous peoples and children in vulnerable situations," and "Build and upgrade education facilities that are child, disability and gender sensitive and provide safe, non-violent, inclusive and effective learning environments for all."

In addition, the Projects promote girls' education, which will contribute to Goal 5 "Gender Equality," and the improvement of water supply and toilets in schools will contribute to access to sanitation through Goal 6 "Clean Water and Sanitation." Furthermore, the development of quality school infrastructure that is resistant to disasters will help to mitigate the impact of climate change; therefore, the Projects will also contribute to Goal 13 "Climate Action."

3.1.2 Consistency with the Development Needs of Malawi

In the planning stage of the Projects, the total enrollment rate in secondary education stagnated from 20.3% in 2008 to 21.4% in 2011, with the lack of classrooms as one of the factors denying

students to advance from primary to secondary education. The ratio of qualified teachers by region in secondary education in 2010 was about 56% in urban areas and 37% in rural areas, with low teacher retention rates in rural areas, particularly due to long commuting time because of the lack of teacher housing and some amenities.[4]

Even at the time of the ex-post evaluation, the shortage of secondary schools and classrooms is becoming more pronounced due to the growing need for secondary education, with the total number of students in 2020 at 415,013, an increase of about 10%, from 377,731 in 2019. These factors have resulted in a net enrollment rate of 15.5% in 2020, virtually unchanged over the past 5 years, and schools remained overcrowded with an average of 63 students per classroom in the same year. Thus, the need to construct secondary schools is still high, especially in rural areas where the demand for secondary education has been increasing. Subsequently, the consistency of the Project Purpose, promoting the construction of secondary schools in rural areas (13 out of 23 target schools are located in rural areas), and the development needs of Malawi were confirmed. In addition, although indicators for quality education, such as gender equality,[5] the pass rate of the Malawi School Certificate Examination (hereinafter referred to as "MSCE"),[6] and the dropout rate,[7] had been partially improved, they are deteriorating due to the impact of the COVID-19 pandemic from 2020. Consequently, the Projects, aiming to improve the quality of education through improving the educational environment in schools, are more aligned with the country's development needs than ever before. The procurement of sanitary water, flush toilets, and social distancing by reducing the number of students per classroom through constructing additional classrooms are necessary learning environments in schools during the COVID-19 pandemic, and the need for the Projects has increased in the same context.

3.1.3 Consistency with Japan's ODA Policy

The "Basic Education for Growth Initiative (BEGIN)" in 2002, in which the Japanese government announced its support for the spread of basic education. At the "Fourth Tokyo International Conference on African Development (TICAD IV)," the government announced the construction of 1,000 primary and secondary schools as a specific goal for African basic education cooperation. Furthermore, at the "5th Tokyo International Conference on African Development (TICAD V)" in 2013, it announced its support to "provide quality education to 20 million children." Under the "Basic Education Expansion Program" specified in the "Country Assistance

4 From documents provided by JICA.

5 In 2020, the Gender Parity Index (GPI) for primary education has become 1.0 (half boys and half girls), while the GPI for secondary education is 0.94 (0.96 in urban areas and 0.92 in rural areas), leaving a gender gap.

6 The MSCE pass rate improved from 44% in 2006/2017 to 50% in 2018/2019, but declined to 41.4% (47.3% for boys and 34.6% for girls) in 2019/2020 as schools were closed for eight months due to COVID-19.

7 The dropout rate for 2019/2020 is 10% (8% for boys and 12% for girls), with girl students accounting for 60% of the total number of dropouts. For both boys and girls, the most common reason for dropping out is the inability to pay school fees, while for girls, the most common reasons are pregnancy and early marriage.

Policy for the Republic of Malawi (2012)," several grant aid and technical cooperation projects have been implemented in the field of education. Therefore, the objective of the Projects is consistent with Japan's ODA policy.

3.1.4 Appropriateness of the Projects' Plan and Approach

(1) Appropriateness of adapting the scheme, "Grant Aid for Community Empowerment"

One of the advantages of adopting the scheme, "Grant Aid for Community Empowerment," is that it allows the flexible use of funds to realize the requests from the recipient country to the maximum extent possible. In fact, the Projects made it possible to reflect the needs of the basic education sector in Malawi, where quantitative expansion is a high priority, by significantly reducing costs with the use of local contractors. Japanese consultants, however, pointed out that one of the challenges of using "Grant Aid for Community Empowerment" is that the construction period is often delayed, which makes it difficult to deliver the Projects on time due to the insufficient capacity of local contractors and unfavorable procurement conditions.

(2) Selection and process of target schools and decision process of support contents

In planning the Projects, the selection of target schools was carried out in consideration of the location where effective construction supervision could be carried out. The selection of target schools was evaluated as appropriate because it was carried out according to the site selection criteria agreed upon by both parties in line with the request from the Ministry of Education (hereinafter referred to as "MoE"). The Education Infrastructure Management Unit (hereinafter referred to as "EIMU") under the MOE was not sufficiently involved in the planning of specifications such as facility size and layout, and improvements are required in the future.

(3) Reflecting lessons learned from the prior phases.

As mentioned above, by reflecting the defects in the preceding phases, the Projects were smoothly implemented from Phase 1 to Phase 3 to maintain the quality of construction supervision. Specifically, the capacity of the Malawian side to fulfill their responsibilities (e.g., water and electricity supply, perimeter fence, etc.) was assessed, and the responsibilities that might cause hindering factors in the Projects were complemented by the Japanese side. To ensure the quality of the Projects, the appropriate size of the bidding lots was set in the bidding process to promote the participation of major companies with high technical skills, and the appropriate construction schedule and the firm procurement supervision mechanism were also set considering the unstable local procurement situation of construction materials and equipment.

Above all, the Projects have been highly relevant to the country's development plan and needs, as well as Japan's ODA policy. Therefore, their relevance is high.

3.4 Efficiency (Rating: ②)

3.2.1 Project Outputs

The outputs of the Projects were not significantly different from the plan set in the Detailed Design (hereinafter referred to as "D/D"). The procurement of facilities, equipment, and furniture was carried through competitive bidding by local contractors, resulting in total cost reduction and generating residual funds in Phases 2 and 3. The Projects adapted the scheme "Grant Aid for Community Empowerment," which can use resources in an effective manner; thus, the number of facilities and furniture for those additional facilities was increased in Phases 2 and 3 by using the remaining funds. The Japanese consultant selected the target schools and necessary components based on the priorities and the needs of the recipient country identified in the D/D and the modification of the Drafted Design was approved by JICA and the government of Malawi. As for the science laboratory equipment, although the specification of some items was changed in Phase 1 due to the availability of local procurement, it was confirmed that there was no difference in the quantity between the planned and actual items.

Table 1 Outputs of the Projects (planned and actual)

		Phase 1	Phase 2	Phase 3
Classroom	Plan	26	28	78
	Actual	26	28	78
Laboratory	Plan	12	5	11
	Actual	12	5	11
Library and Administration building	Plan	6	6	11 (Library 9)
	Actual	6	6	11 (Library 9)
Student hostel (Girl's hostel)	Plan	8	10	–
	Actual	8	10	–
Kitchen	Plan	4	5	4
	Actual	3	5	4
Multi–purpose hall	Plan	4	5	4
	Actual	4	6	6
Teachers' house	Plan	32	18	36
	Actual	32	30	40
Toilet	Plan	33	26	30
	Actual	33	26	30
Guardroom	Plan	6	2	–
	Actual	6	4	–
Water supply	Plan	–	–	6
	Actual	–	–	6
Solar panel	Plan	–	–	1
	Actual	–	–	1
Furniture	Plan	3,893	6,114	12,993
	Actual	5,658[8]	6,594	13,893
Laboratory equipment	Plan	511	891	891
	Actual	511	891	891

Source: Documents provided by JICA

Note 1 : Increase : Decrease

8 Although the volume has increased, there is no difference between the plan and actual results because the calculation method is different; for example, the plan includes desks and chairs as a set.

3.2.1.1 Added Support Components

In the Projects, the components that have been added in the planning stage (D/D) due to the generation of residual funds were the multipurpose hall in the Mkwichi CDSS, which was the target school of Phase 2, the teachers' house (one building and two dwellings), and the furniture to be installed in these additional facilities for all target schools for Phase 2. In addition, the components of Phase 3 included multipurpose halls for Mzoma CDSS and Kabekele CDSS and teachers' housing (two buildings and four dwellings) for Zomba Urban CDSS with furniture for these additional facilities.

3.2.1.2 Deleted Support Components

One of the support components that was removed from the planning stage was the installation of a kitchen for Chikwaza CDSS in Phase 1, as the existing kitchen was usable. The installation of a new kitchen was canceled to avoid duplication.

3.2.1.3 Other Changes in the Design

Other changes in the original design were 1) the specifications of the science laboratory equipment, locations of the wall and the well, and concrete blocks in Phase 1, 2) location of the wall, flush toilets in the teachers' houses, the addition of drainage facilities in Phase 2, and 3) ground improvement and locations of toilets and drainage facilities in Phase 3.

3.2.1.4 Consulting Services

In the Projects, Japanese consultants contracted with a procurement agency (Japan International Cooperation System) to provide technical services for construction supervision according to the plan.

3.2.2 Project Inputs

3.2.2.1 Project Cost

There was no difference between the planned amount (Grant Agreement) and the actual amount for Phases 1, 2, and 3, and the project cost was within the plan. The actual cost was 100% of the planned amount, even though additional procurement was carried out using the remaining funds generated by competitive bidding to select the construction contractor. The project cost was as planned. However, the amount to be borne by the government of Malawi could not be confirmed.

Table 2 Project cost

(Unit: million yen)

	Phase 1	Phase 2	Phase 3
Plan	1,198	1,085	1,761
Actual	1,198	1,085	1,761
Actual/Plan	100%	100%	100%

Source: Documents provided by JICA

3.2.2.2 Project Period

As shown in the table below, the project period exceeded the plan in Phases 1 and 3. Phase 1 was delayed for about four months due to the rebidding caused by the withdrawal of a successful bidder, the disruption in the distribution of imported materials (especially, fuel and cement shortage) caused by foreign currency shortage, and the delay in material procurement and construction progress caused by heavy rainfall during the rainy season. In Phase 3, the construction period was delayed for about six months due to delays in procuring materials and labor shortages caused by financial problems and the contractor's lack of management capacity.

Table 3 Project period

(Unit: months)

	Phase 1	Phase 2	Phase 3
Plan	27	27	30
Actual[9]	35	27	36
Actual/Plan	130%	100%	120%

Source: Documents provided by JICA

3.2.2.3 Obligation Items of Recipient Country

The obligation items that were reported to be completed during the Defect Inspection were confirmed to have almost been carried out in the ex-post evaluation. However, one of the Phase 1 target schools, Nankumba CDSS, has no electricity connection and city water supply (currently using well water). According to school officials, they have never used electricity or city water since the completion of the Projects. To use the science laboratory and equipment effectively, and to ensure the hygienic condition of the toilets, it is important to install city water. In particular, school officials pointed out that securing water in the school is an important factor for preventing COVID-19; therefore, immediate measures are required. In addition, on the one hand, the installation of school walls, which was an item borne by the Malawian side, has not been made compulsory, as it should be implemented as needed. On the other hand, the installation of school walls plays an important role not only in ensuring the safety of the school premises but also in maintaining the facility against theft of equipment, misuse of the facility, and graffiti. Some of

[9] The actual results for the project period were calculated by excluding the period of additional procurement by using residual funds (Phase 3: three months, Phase 3: one month) as unavoidable.

the target schools without walls face challenges in the operation and maintenance of the facilities.

Consequently, although the project cost was within the plan, the project period exceeded the plan, and some incomplete items were borne by the Malawian side. Therefore, the efficiency of the Projects is fair.

3.5 Effectiveness and Impacts[10] (Rating: ③)

3.5.1 Effectiveness

3.3.1.1 Quantitative Effects (Operation and Effect Indicators)

The number of enrolled students at the target school, which is an indicator of quantitative effectiveness, was 14,291, far exceeding the target of 9,793. Moreover, the capacity of first-year students reached 3,865 compared to the target of 2,570 students. The average number of students per class, an indicator set only for Phase 3, was 56 students per class, slightly higher than the ideal target of 50 students set by the MoE due to the increase in the students' number. Although some of the target schools were overcrowded with a maximum of 70 students per class, almost all the target schools were below the national average of 63 students per class, which was also a significant improvement from the baseline of 85 students per class.

From the above, it is evaluated that the quantitative effects of the Projects have been "almost achieved."

Table 4 Baseline, target and actual for quantitative effects of the Projects

(Unit: person)

	Baseline	Target	Actual
	Phase 1: 2009 Phase 2: 2011 Phase 3: 2013	Phase 1: 2017 Phase 2: 2017 Phase 3: 2019	2021 Ex-post evaluation
Number of students enrolled	6,548	9,793	14,291
Capacity of new students	1,511	2,570	3,865
Average number of students per class	85	50	56

Source: Documents provided by JICA, and ex-post evaluation questionnaire

Note 1: The target year for achieving the indicators is 2017 for Phase 1 (5 years after the completion), 2017 for Phase 2 (3 years after the completion), and 2019 for Phase 3 (3 years after the completion), but since past data was not available on the site, the data at the time of ex-post evaluation (2021) was used as the actual figure.
Note 2: "Number of enrolled students" and "Capacity of new students" in the target schools means the total of 23 target schools of Phase 1, Phase 2 and Phase 3.
Note 3: "Average Number of Students per Class" was not set as an indicator in the Phase 1 and Phase 2 because most of the target schools were located in rural areas, where the number of students was limited, and the problem of overcrowded classrooms did not arise.

3.3.1.2 Qualitative Effects (Other Effects)

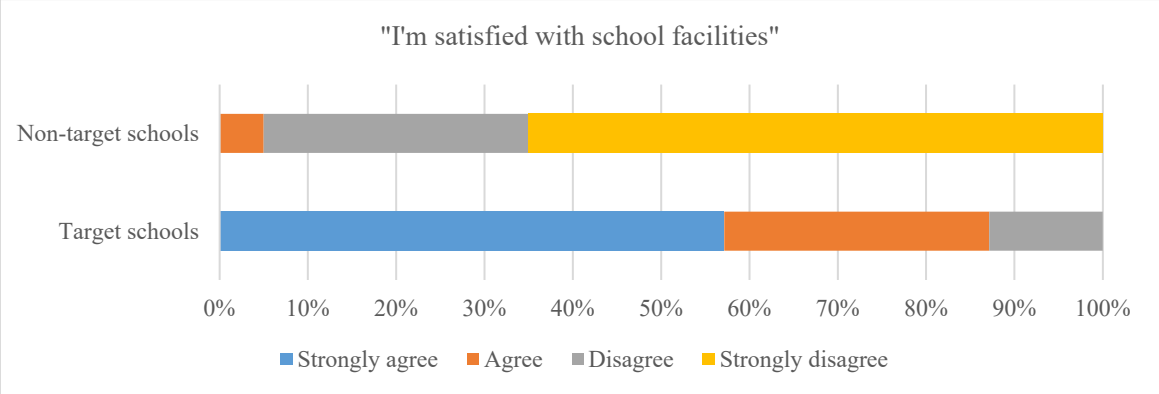
In order to measure the qualitative effect, "improvement of the learning environment," resulting

[10] Sub-rating for Effectiveness is to be put with consideration of Impacts.

from new classrooms, student hostels, restrooms, science laboratories, and laboratory equipment, and to evaluate effectiveness, the opinions regarding students' satisfaction with the learning environment and teachers' satisfaction with the school management and classroom operating environment are summarized as follows.

(1) Students' satisfaction with the learning environment

From the results of the questionnaire for the students[11] (70 students in the target schools and 20 students in the non–target schools), 86% of the students (37% in the non–target school) answered "Strongly agree" or "Agree" in response to "I am satisfied with the school facilities (classrooms, library, toilets, laboratories, etc.)." Consequently, the students showed a high level of satisfaction with the facilities of the target schools.



Source: Ex-post evaluation questionnaire

Figure 1 Students' satisfaction with facilities

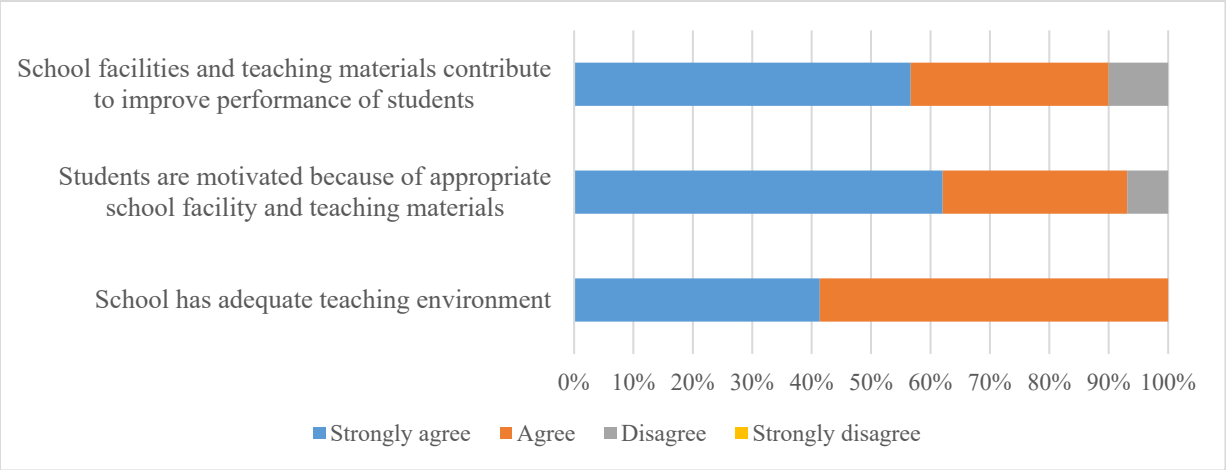
From the results of the student interviews at the target schools, the following comments were made about the learning environment at the schools.

- *There were science labs and experimental equipment, and through experiments, I was able to better understand the content. (Boy student)*
- *The school had electricity so I could study at night [in the school], which helped me improve my grades. (Boy student)*
- *I am glad that there are clean and flushable women's toilets. (Girl student)*
- *The distance between the hostel and the restrooms is a challenge. (Girl student)*
- *The parents are happy to be able to attend a well–maintained school and are actively involved in PTA activities. (Girl student)*

[11] Of the 10 schools that were visited by the Japanese evaluator, questionnaires were distributed to 10 students (5 boys and 5 girls each) in each of the 7 target schools (Phase 1: 1 school, Phase 2: 2 schools, Phase 3: 4 schools) and 2 non-target schools (CDSS). The students from final year (4th grade) were selected on sites during the evaluator's visit to the school, because this cohort of students has benefited the most from the upgraded facilities.

(2) Teachers' satisfaction with school management and the classroom operating environment

As shown in the figure below, the results of the questionnaire for teachers[12] (30 teachers) in target schools show that all the teachers answered that the "School has adequate teaching environment," and more than 90% of teachers felt that "Students are motivated because school facilities and teaching materials are well maintained" and "school facilities and teaching materials contribute to improving students' performance."



Source: Ex-post evaluation questionnaire

Figure 2 Teachers' satisfaction with the facility, students' motivation, and impact on academic performance

The results of the interviews with the school heads and teachers in the target schools indicated that the learning environment was improved by the Projects, and the teachers' motivation was increased, as shown below.

- *In the past, there were only a few teachers and many of them left the school, but the improvement in the facilities has improved the community's interest in education for their children, which in turn has affected the motivation of the teachers. (School head)*
- *The head of the school conducts contests for teachers and awards outstanding teachers to improve their performance. (Female teacher)*
- *The school facilities are of high quality and are well designed. It has now become a symbol of the community. Residents also use facilities for weddings and events. (Male teacher)*
- *There is no electricity in the village, and only classrooms with lights are open at night to ensure that students have time to learn. (School head)*

[12] Questionnaires were distributed to 30 teachers (21 boys and 9 girls), 5 teachers from each of the 6 schools (Phase 1: 1 school, Phase 2: 2 schools, and Phase 3: 3 schools), who were present at the time of the visit.

- *In science labs, students can learn through experiments. In addition, there is sufficient space for group work and individual instruction. (Male teacher)*
- *Now that the teachers' hostel is in place, they no longer have to commute as long as they did before and can use more time to prepare classes and tuitions for students. (Female teacher)*

Other requests from the school heads and teachers included expansion of the library and development of additional hostels and the perimeter walls.

- *The library is small and not large enough for learners to read inside. (School head)*
- *There are no hostels, and many students are forced to commute long distances to school, averaging 14 km. This affects the safety of students and their academic performance. (Male teacher)*
- *Due to the lack of school walls, outsiders broke in and stole. The community has installed barred doors in the facility, but it is important to install walls to secure the safety of students and maintain the facility. (School head)*

3.3.2 Impacts

3.3.2.1 Intended Impacts

The indicators for measuring the impact of the Projects were mostly achieved. In particular, on the one hand, the implementation of the Projects contributed significantly to improving the dropout and retention rates, the pass rate of MSCS, girls' enrollment rate, and the rate of qualified teachers in the target schools. On the other hand, in 2020/2021, when the ex-post evaluation was conducted, all national secondary schools, including the target schools, were closed for eight months due to the COVID-19 pandemic. This closure had a significantly negative impact on these indicators, but it was assessed that the target schools were impacted less when compared to nationwide deterioration. The achievements of each set indicator for measuring the impacts are shown as follows.

(1) Dropout rate

The dropout rate in the target schools was 4%[13] in 2019/2020, which is lower than the national average of 10% in the same year (8% for boys and 12% for girls). Major reasons for dropping out are early marriages and pregnancies of girl students, while some cases are due to migrating to neighboring countries (Mozambique and South Africa) for boys. The reasons for the lower dropout rate in the target schools compared to the national average are the construction of girls' hostels and flush toilets by the Projects, as well as the high percentage of female teachers (51% compared to the national average of 24%) who are role models for girl students. They provide support to girl students, and their parents as members of the

[13] Although the dropout rate segregated by gender was not available in the target schools, it was confirmed from the interviews that girl students account for about 60-80% of the dropouts.

Mother Groups, and impact the female teacher retention rate.

In 2020/2021, schools were closed for eight months due to COVID-19, and the increase in poverty was reported to have resulted in early marriage and increased pregnancies among girl students, and the national average dropout rate increased to 15.7%.[14]

(2) Retention rate

The retention rate for 2019/2020 at the target school was 0.59%, which is much lower than the national average of 2.5% for the same year (2.4% for boys and 2.6% for girls). The retention rate tends to be higher in the final year of the school, especially for students who cannot pass the MSCE in the final year and prepare to retake the exam in the following year. However, in the target school, the MSCE pass rate is higher than that of other schools, as described below, which contributes to the lower retention rate.

(3) Girls' enrollment rate

In 2020/2021, the percentage of girl students in the target schools is 50%, with a Gender Parity Index (GPI) of 1.0, higher than the national average of 0.94 (0.96 in urban areas and 0.92 in rural areas). In particular, it was observed that girls' enrollment in rural areas increased as a result of establishing girls' hostels and hygienic toilets and an increase in the number of female teachers. The percentage of girl students in the target schools with girls' hostels was 55%, much higher than the 47% in the target schools without girls' hostels. It was pointed out that there is a high demand from parents for girls' hostels to ensure the safety of students commuting from far away, and this is an important factor in promoting girls' enrollment. In some target schools, toilets for boys and girls are located too close to each other, and the incinerator for sanitary products is located near the toilet for boys, which does not ensure privacy and is difficult for girl students to use.

(4) Pass rate of the Malawi School Certificate Examination (MSCE)

The MSCE pass rate for 2019/2020 at the target school was 47.2% (57.7% for boys and 36.7% for girls), and girl students, who are forced to spend a lot of time on household chores, tend to have a lower success rate[15]. Although it was affected by the COVID-19 pandemic in that school year, it is higher than the national average of 41.4% (47.3% for boys and 34.6% for girls). As shown in the table below, the pass rate of the target schools has been higher than the national average for the past three years. Given that the national average includes private schools and Day Secondary Schools (DSS), the pass rate of target schools is at the top among the CDSS. The reasons for the higher MSCE pass rate compared to the national average are the retention of qualified teachers[16] by improving the school environment, the provision of

[14] MoE "Education Sector Performance Report (2019/2020)."

[15] THE TIMES https://times.mw/msce-pass-rate-reflects-poor-government-policies/

[16] At the time of the ex-post evaluation, the rate of qualified teachers in the target schools was 89%, which is a significant improvement from that of 49% before the implementation of the Projects. The rate in the target schools was also very high compared to the national average of 43% (2019/2020).

opportunities for night study with lighted classrooms, the improvement of student performance owing to the procurement of science laboratories (used for a wide range of subjects such as physics, chemistry, biology, and agriculture), the availability of teaching materials, the availability of textbooks to each student as a result of upgrading the library, and securing learning opportunity by procurement of girls' hostels.

Table 5 Comparison of MSCE pass rates

(Unit: %)

	National Average	Average of Target Schools
2017/2018	63.2	66.6
2018/2019	50.3	67.2
2019/2020	41.4	47.2

Source: MoE and ex-post evaluation questionnaire

In addition, it was pointed out that almost all target schools had no students going on to university before the implementation of the Projects[17]; however, since the implementation of the Projects, students have been proceeding to national universities such as the University of Malawi and Malawi University of Science and Technology.

BOX 2: Synergies with technical cooperation and other Grant Aid projects

The technical cooperation project that supported science and mathematics teachers, "Strengthening of Mathematics and Science in Secondary Education, (hereafter referred to as "SMASSE")," was ended in 2017. However, since then, the annual (one-week) in-service training (called SMASSE training named after the project) has continued using the budget allocated by the MoE. In addition, SMASSE central training for regional trainers has been conducted at the two teacher training schools developed under the following Grant Aid projects, "The Projects for Improvement of Domasi College of Education" and "The Projects for Construction of a Teacher Training College for Secondary school Teachers in Lilongwe."

In the target schools of the Projects, 4 to 10 science and mathematics teachers attend SMASSE training every year,[18] and SMASSE training is also provided to school heads, so they understand the importance of teachers' participation in the training. The teachers who participated in the training were able to practice the SMASSE concepts of activity-based, student-centered, and experiment-based teaching because the science laboratory was equipped through the Projects.[19] In addition, there are several target schools where master trainers of SMASSE training are assigned, the science laboratories are used for cluster training with neighboring schools, and other schools are benefiting from the science laboratories of the target schools through SMASSE training. From the results of the questionnaire survey of teachers,[20] all science teachers

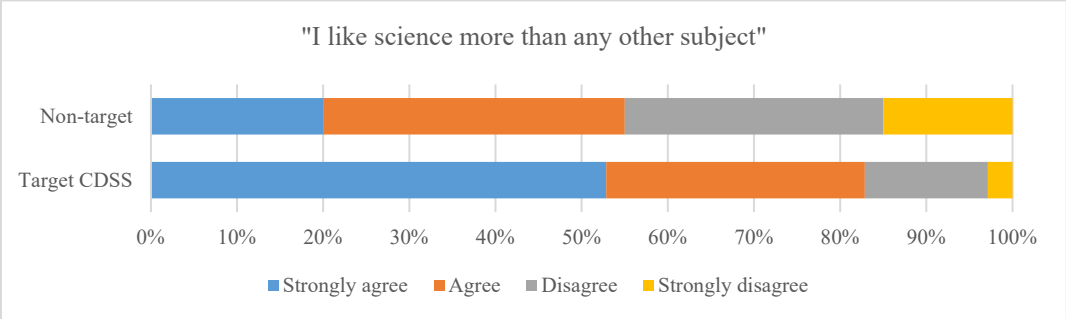
17 Despite the fact that CDSS are more numerous than the DSS and other schools, only about 18% (2019) of the CDSS graduates attend public universities.

18 It was reported that 3,436 science and mathematics teachers (biology, chemistry, physics, ecology/home economics, and mathematics teachers) from almost all over the country attended the training in FY2021, despite the COVID-19 pandemic.

19 As of 2020, only 45% of national secondary schools are equipped with laboratories. Most of them are DSS, and many CDSS do not have laboratories, which makes it difficult to conduct experiments in science class.

20 Questionnaire were distributed to 30 teachers (21 boys and 9 girls), 5 from each of the 6 schools (Phase 1: 1 school, Phase 2: 2 schools, and Phase 3: 3 schools) whose teachers were present at the time of the visit.

answered “Strongly agree” or “Agree” to “I am able to use the laboratory and laboratory equipment effectively,” which suggests that the SMASSE in-service training at the target school has been generating a synergistic effect. The results of the student questionnaire survey[21] also showed that 84% of the students in the target schools answered “Strongly agree” or “Agree” to “I like science more than other subjects,” while only 38% of the students in the non–target schools answered “Strongly agree” or “Agree.” This shows that the maintenance of science laboratory and equipment and the continuation of SMASSE training in the target schools have contributed to the improvement of students’ interest in science.



Source: Ex-post evaluation questionnaire

Figure 3 Results of questions to students regarding science subject

3.3.2.2 Other Positive and Negative Impacts

(1) Impact on the natural environment

The Projects are an expansion of an existing educational facility, and the site area does not exceed 30 hectares; thus, it was confirmed that the Projects are not subject to the procedures for the Environmental Impact Assessment (EIA) under the Environmental Management Act 1996. No other negative impacts on the natural environment were identified.

(2) Resettlement and land acquisition

As all the target schools have existing school sites, their land-use rights are already known, and no issue has arisen. During the Preparatory Study, some sites were found to be illegally inhabited, but these sites were not a hindrance to the Projects due to their large sizes.

(3) Unintended positive/negative impacts.

Contributing to Gender Equality

It was confirmed that the high ratio of female teachers and their retention as a result of constructing girls’ hostels, hygienic toilets, and teachers’ hostels through the Projects contributed to the reduction of girl students’ dropout rate, mainly due to early marriage and pregnancy.

[21] Of the 10 schools that were visited by the Japanese evaluator, 10 students (5 boys and 5 girls each) in the final year (4th grade) who benefited the most from the facilities from 7 target schools (Phase 1: 1 school, Phase 2: 2 schools, Phase 3: 4 schools) and 2 non-target schools where the students were located at the time of the visit were given anonymous questionnaires.

Role as a Cluster Center

Of the 23 target schools, 10 (43%) are Cluster Centers,[22] which consist of an average of six schools, and are used as venues for teacher training 3 to 4 times per semester. In addition, as students from other schools in the cluster schools conducted experiments in the science laboratory of the target school, the ripple effect of the Projects was also confirmed through the sharing facilities.

Use of barrier-free facilities

In the Projects, in accordance with the "Town and Country Planning Standards and Guidelines for Developments," which must be followed in order to obtain building permits, all the target schools are trying to make their facilities barrier-free by installing toilets and slops for the disabled. However, the number of disabled students enrolled in the ten schools visited was limited to only one and four (three schools), including those enrolled in the past. This is because most of the secondary schools are farther away from home compared with primary schools, making it difficult for the disabled to commute to school, and they tend to be enrolled in schools with hostels. However, it was also pointed out that parents of disabled students cannot easily send their children to schools with hostels due to the high cost of hostel fees. In addition, it was pointed out that many teachers do not have basic knowledge on how to deal with disabled students and that additional teacher training is required to deal with students who need support in order to expand the acceptance of disabled students in the future.

Promote local employment

In the target school, the importance of the facility to the community was recognized. As a policy of the school and PTA members, five to ten school staff such as security guards, cleaners, and cooks are hired using the PTA budget and are paid according to the minimum wage regulations set by the government, thus, creating jobs in the community. The positive impacts of the Projects were confirmed.

From the above, the Projects have achieved their objectives as a plan. Therefore, the effectiveness and impact of the Projects are high.

[22] In Malawi, a cluster system is in operation to improve the capacity of in-service teachers and to share facilities (such as science laboratories) and teaching materials that are in short supply. Six to fifteen secondary schools in close to each other form a cluster, and a leader school (Cluster Center) is assigned within the cluster to jointly conduct teacher training sessions, lend equipment and teaching materials, exchange opinions on common issues, and disseminate information from the DEO. The Cluster Centers are selected based on the availability of necessary facilities and accessibility from other schools.

BOX 3: Contribution of the Projects in the prevention measures of COVID-19

Considering social distancing as a response to preventing the outbreak of COVID-19, the MoE currently recommends that the number of students per class should be no more than 40. In response to this, the target schools of the Projects have been separating classes by utilizing other spaces such as laboratories and multipurpose halls. In addition, it was pointed out that the improvement of the sanitary environment in the schools through providing water supply facilities and flush toilets has contributed to the prevention measures of COVID-19. Furthermore, educational activities to prevent COVID-19 are being conducted for residents using facilities such as the multipurpose hall and the administration building, and it was confirmed that these activities contribute to the prevention measures of infection among residents.

Non-target school
(Classrooms are overcrowded)

Target school
(40 students/class recommended under COVID-19 has been realized)

3.4 Sustainability (Rating: ②)

3.4.1 Institutional/Organizational Aspect of Operation and Maintenance

(1) Central level

The unit in charge of maintaining and managing the Projects at the central level is the EIMU under the Department of Education and Planning of the MoE. The unit has one architect, one structural engineer, one quality control officer, and six other technicians under the administrative head (Deputy Director of the Planning Department). They are involved in the planning of school construction, including support from donors, but their responsibility for facility maintenance is to respond to major repairs of school facilities caused by disasters or other emergencies.

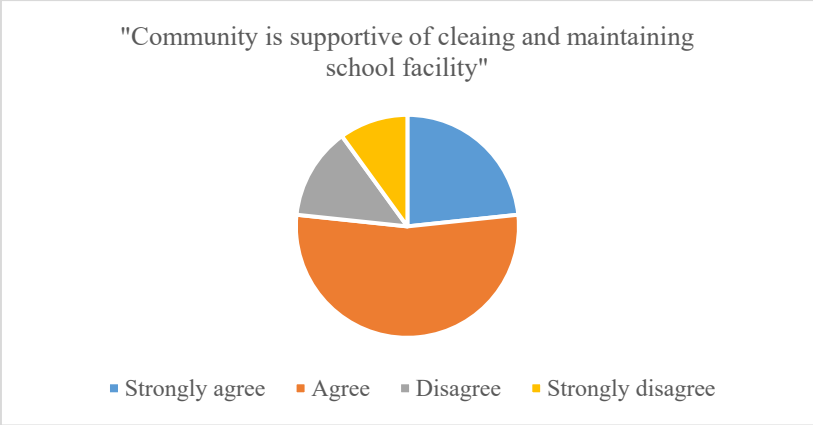
(2) Local level

The central government has six Education Division Offices (hereinafter referred to as "EDOs") in the North, Central West, Central East, South West, South East, and Shire Highland, and under the EDOs, 34 District Education Offices (hereinafter referred to as "DEOs") are located. In the EDOs, the district superintendent of education is in charge of the planning division, human resources division, finance division, auditing division, and school inspection division, and the staff of the planning division is in charge of the operation and maintenance of secondary schools. On the one hand, it is practically impossible for the 6 EDOs to manage the 1,400 secondary schools nationwide; consequently, they have almost no involvement

in the operation and maintenance of secondary schools. On the other hand, the DEO is located in each district (34 offices in total) to monitor the primary schools under its jurisdiction. For secondary schools, however, their functions are limited to the administration of final exams, human resource management for primary school teachers transferring to secondary school, and the revitalization of PTA and School Management Committee (hereinafter referred to as "SMC").[23]

(3) School level

In all target schools, students take daily turns cleaning classrooms, toilets, and so on. In some schools, residents are hired as cleaners to clean the facilities and schoolyards. In some of the target schools, the community conducts monthly cleaning activities around the school as part of the community cleaning program. The results of the questionnaire to the teachers[24] (30 teachers) of the target schools in the figure below also show that 76% of them answered "Strongly Agree" or "Agree" to "Community members are cooperative in school maintenance and cleaning." PTA members in rural areas pointed out that the target school is the only facility in the village with electricity and water supply, and it is the symbol of the community; therefore, the target school can easily get support from the community, which has a supportive attitude toward school maintenance.



Source: Ex-post evaluation questionnaire

Figure 4 Results of questions to teachers regarding school operation and maintenance

[23] In some areas, the EU-supported Improving Secondary Education in Malawi (ISEM) project has started to establish Boards of Governance in 270 pilot schools, replacing the SMC, and the DEOs are responsible for strengthening its functions. However, the actual activities have not yet been implemented.

[24] Anonymous questionnaires were distributed to 30 teachers (21 boys and 9 girls), 5 from each of the 6 schools (Phase 1: 1 school, Phase 2: 2 schools, and Phase 3: 3 schools) whose teachers were present at the time of the visit.

Cleanup by students at the target school

Daily operation and maintenance in the target school are carried out at each school level. Regular cleaning by students and repairs using the PTA budget are conducted in the target schools, and there are no problems in terms of institutional and organizational aspects.

3.4.2 Technical Aspect of Operation and Maintenance

As for the operation and maintenance at the central level, EIMU is not substantially involved in the operation and maintenance of the target schools as shown in "3.4.1 Institutional/Organizational Aspect of Operation and Maintenance." However, with regard to the technical level of operation and maintenance, the project team has sufficient capacity for monitoring, construction, and repair management of the facilities, based on its experience as the Project Implementation Unit for the projects of not only JICA but also the Bank of Africa and the World Bank.

Regarding the repair of facilities at the school level, on the one hand, the repair of pumps, cracks in facilities, replacement of drainage pipes, and welding of furniture have been outsourced to specialized companies and have not caused any technical problems. On the other hand, some items, such as fluorescent lamps and some water pipes, were not available in the local market, and substitutes were used or repairs were neglected in some cases. In many of the target schools, laboratory equipment was damaged or broken, but the science teachers managed the equipment themselves without using inventory for management. In only one of the schools, the PTA employs its own lab technicians to support science experiments; consequently, the school can operate and properly manage the science laboratory and laboratory equipment. In addition, in schools where the Japan Overseas Cooperation Volunteers (hereinafter referred to as "JOCV") (science and mathematics teachers) have been assigned, the 5Ss in the science laboratory are properly practiced regardless of the target schools. Therefore, technical support is required, especially for handling and maintenance of laboratory equipment.

Regarding the operation and maintenance manual, some target schools are using it for facility repairs and handling of science equipment; however, only a few schools are using it, and many of them do not know where it is. The Projects did not include any technical support components for operation and maintenance, and only guidance was provided by the contractors at the time of handover, so the operation and maintenance skills of school staff, PTA, and SMC members varied from school to school.

From the above, it can be concluded that there are some issues regarding the technical aspect of sustainability.

3.4.3 Financial Aspect of Operation and Maintenance

The national budget for the MoE for 2019/20 is 292 billion MK,[25] which represents an average increase of 116% over 5 years (2015/16–2019/20). The education budget as a percentage of GDP has averaged about 4.5% over the past 5 years, with an overall upward trend. However, 66% of the budget is spent on the salaries of primary and secondary school teachers, and the remainder on the purchase of teaching materials and operating expenses for primary and secondary schools. In addition, 63% of the budget goes to preschool and primary education, 12% to secondary education, and 22% to higher education; the ratio of secondary education is low. Therefore, the costs of maintaining school facilities depend mainly on the school budget. In addition, there are concerns about the impact of the COVID-19 pandemic on tax revenues and reduced support[26] from development partners.

Table 6 Budget of the MoE

(Unit: billions of MK)

	2015/2016	2016/2017	2017/2018	2018/2019	2019/2020
MoE Budget (Year–on–year change)	163	179 (110%)	228 (127%)	254 (111%)	292 (115%)
As a % of GDP	4.6%	4.2%	4.3%	4.5%	4.7%

Source: MoE

As a condition of being targeted by the Projects, all target schools are now approved as the Cost Center that can be applied for the Other Recurrent Transactions (hereinafter referred to as "ORT") to the Ministry of Finance and receive a direct allocation of the recurrent budget, except for teachers' salaries. However, it was pointed out that although ORT is used for school materials, training, supplies such as chalk, and photocopying, the allocated budget is not sufficient to maintain the facilities and purchase old equipment and chemicals for science experiments in many of the target schools. Therefore, the PTA fund,[27] collected mainly from the students' families, and a part of the hostel fees collected from the students in the target schools with hostels are also used to maintain the facilities. However, PTA membership and hostel fees are mainly used for repairing and expanding old facilities on the same site, and there is not enough budget for maintaining the facilities upgraded by the Projects. Furthermore, the budget available for these operations and maintenance has been increasing with the increase in the number of students, but in 2020/2021, PTA membership and hostel fees have decreased due to the impact of the COVID-19 pandemic.

[25] Marawi Kwacha (hereinafter referred to as "MK") 1MK = 0.14 yen (as of June 2021)

[26] Support from development partners in the education sector accounts for 23% of the total budget, but the impact of the COVID-19 pandemic is expected to reduce support from development partners by about 30%.

[27] The annual fee per student at the target schools varies from about 6,000 to 15,000 MK (about 800 to 2,000 yen) depending on the school.

The table below shows the average ORT, PTA membership fees, and hostel fees in the target schools for 2018/19–2020/21.

Table 7 Budget trends in target schools

(Unit: thousand MK)

	2018/2019	2019/2020	2020/2021
ORT	9,933	10,479	12,900
PTA fund	9,132	11,225	9,630
Hostel fee[28]	20,880	25,215	16,840

Source: Ex-post evaluation questionnaire

In the Projects, multipurpose halls were installed in target schools in urban areas. Such halls are not only used for school meetings and events but are also rented out for community activities (awareness-raising activities, weddings, church activities, etc.) for a fee, for example, MK 80,000 (Approximately JPY 11,000) per day for weddings, and the proceeds are used to maintain the facilities. Simultaneously, PTA members grow vegetables in the schoolyard and use part of the income to maintain the facility.

Although there have been some efforts to secure maintenance costs at the target school as described above, the overall lack of budget for the renewal of laboratory equipment, purchasing of reagents, and maintenance is identified, which indicates that there are some issues in the financial aspect of sustainability.

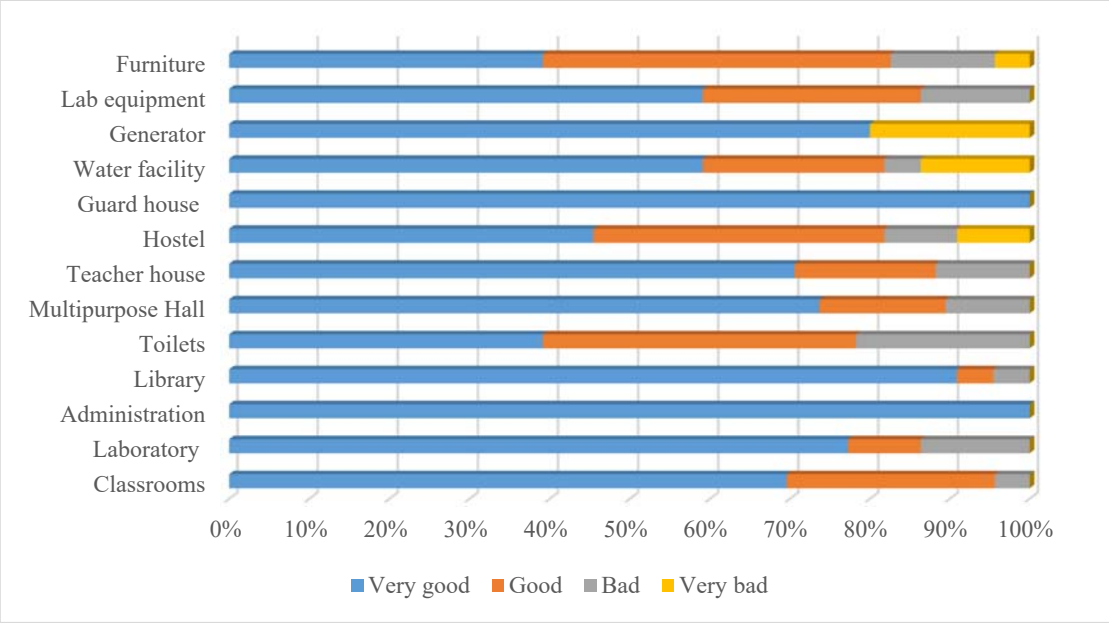
3.4.4 Status of Operation and Maintenance

Facilities such as classrooms, science laboratories, administration, and libraries are being used without problems owing to their robust design and routine maintenance. However, some of these facilities were found to be damaged by bat droppings, spider webs, termite damage, and cracks in the walls. In particular, many of the target schools needed to repair facilities mainly related to water, such as toilets (flush components), water facilities, and damaged showers in student hostels. In addition, many of the target schools from Phases 1 to 3 had to repair or procure nondurable properties such as laboratory equipment and furniture (desks and chairs). In some target schools, cooking kilns in the kitchen attached to the multipurpose hall were not in use because of the lack of electricity. In addition, school staff reported that they were unable to renew reagents and damaged equipment for experiments due to budget shortages and, thus, could not conduct the planned experiments. In addition, the gas valves in the science laboratories procured in accordance with the national “Standard Guidelines for School Facilities” is unused in all the visited schools because of the difficulty in obtaining gas cylinders in local markets, and an alcohol lamp procured by the Projects was used instead; thus, the rationale for procuring such equipment is questioned.

The table below shows the results of the survey on the operation and maintenance status of facilities and

[28] The average amount is shown only for the target schools that have hostels (8 schools).

equipment for all target schools.[29]



Source: Ex-post evaluation questionnaire

Figure 5 Maintenance of facilities at target schools

Damaged chairs

Messy science equipment

Damaged toilet sinks

From the above, some issues can be seen in the status of operation and maintenance.

As for the sustainability of the Projects, although problems have not been observed in terms of the institutional/organizational aspect, there are minor technical problems, such as the unavailability of some consumables in the local market, the operation and maintenance skills for science equipment, and the lack of equipment inventory, as well as problems in the financial aspect, such as the lack of maintenance budget. Therefore, the sustainability of the Projects' effects is fair.

[29] The Japanese evaluators and research assistants visited all 23 target schools and evaluated the condition of the facilities and equipment on a four-point scale using the following criteria "Very good: No malfunctions or failures," "Good: Some signs of malfunctions or failures, but they have been repaired and are in use," "Poor: in use, but needs some repair," and "Very poor: not in use due to malfunctions or failures."

4. Conclusion, Lessons Learned and Recommendations

4.1 Conclusion

The Projects were implemented to solve the shortage of classrooms and improve the learning environment in the target schools by expanding and upgrading existing secondary educational facilities and providing education–related equipment, including science laboratory equipment, thereby, contributing to the improvement of the quality and accessibility of secondary education in the target areas.

On the one hand, the purpose of the Projects is well in line with the development policy and development needs of Malawi, as well as the aid policy of Japan; thus, the relevance of the Projects is high. On the other hand, although the cost was in line with the original plan, the project period exceeded the plan due to the rebidding, insufficient distribution of imported materials, natural disasters caused by heavy rains during the rainy season, and financial and administrative problems of some contractors, resulting in the efficiency of the Projects as "fair." As for effectiveness, the quantitative and qualitative effectiveness indicators set at the planning stage were mostly achieved. Moreover, as it has been confirmed that the Projects have had an impact on promoting girls' school enrollment, preventing the spread of COVID-19 in schools, and improving student performance through the synergistic effect of technical cooperation for the capacity building of science and mathematics teachers, their effectiveness is evaluated to be high. In terms of sustainability, there are no major issues in the system of project operation and maintenance, but some financial issues, such as the inability to secure sufficient operation and maintenance costs for experimental equipment, were identified. Therefore, project sustainability is also fair.

Considering the above, the Projects are evaluated to be "satisfactory."

4.2 Recommendations

4.2.1 Recommendations to the Executing Agency

<u>Measures for target schools without water and electricity supply and walls</u>

On the one hand, the construction of water supply facilities in schools through the Projects has greatly contributed to countermeasures against COVID-19. On the other hand, the MoE is required to provide support to restore schools that are not connected to the water supply system or that have difficulty in using sanitary water due to theft of pumps or damage to pipes. In addition, some of the target schools have no electricity connection, which hinders self-study at night and teachers' preparation for classes. It was also confirmed that the installation of walls has a significant impact on the operation and maintenance of school facilities. Therefore, the Education Planning Department and EIMU in the MoE are required to instruct the EDO to identify schools without electricity and water conation and walls and to order the relevant work.

Effective use of barrier-free facilities

The target schools are equipped with barrier-free facilities such as toilets and slops for the disabled in accordance with the "Urban Planning and Development Guidelines," which must be complied with in order to obtain building permits. However, unlike primary schools adjacent to the community, a limited number of secondary schools and large school catchment areas impose difficulties in providing access to students with disabilities. On the other hand, the target schools with hostels that do not require commuting to school have a good track record in accepting students with disabilities. Therefore, the promotion of inclusive education by effectively utilizing these facilities, mainly in target schools with hostels, is required by giving priority admission to students with disabilities and developing a support system for hostel fees.

4.2.2 Recommendations to JICA

Technical support for target schools

A more effective operation and maintenance of science laboratories and laboratory equipment in the target schools is expected by assigning JOCVs (science and mathematics teachers) preferentially to the target schools to provide technical support such as experimental guidance, preparation of science teaching materials, 5S, and preparation of inventory for laboratory equipment.

4.3 Lessons Learned

Achieving impact through the development of complex facilities

The Projects were not limited to the construction of classrooms, but also included the development of complex facilities, such as teachers' houses, student hostels, science laboratories, libraries, and flush toilets, in accordance with the "Standard Guidelines for School Facilities" established by the MoE to contribute to the quality of education and the improvement of girls' enrollment. The science laboratory promotes the study of science-related subjects, the library provides sufficient teaching materials, and the teachers' houses and student hostels reduce the commuting time for teachers and students, which contributes to ensuring class preparation and learning. In addition, the establishment of teachers' houses enables the retention of female teachers who can provide generous support for girl students. Furthermore, the girls' hostel will reduce the safety risk for girl students when commuting to school, contribute to securing learning opportunities by reducing chores in their households, and the installation of clean toilets will improve the learning environment for girls, those therefore promote girls' enrollment. To stimulate the quality of education and girls' enrollment, it is advisable to plan for providing comprehensive facilities.

Importance of school wall construction

The construction of walls in schools greatly affects the current status of school facilities. In the Projects, since the construction of walls in target schools was requested as necessary at the expense of the Malawian government but it was not a prerequisite (obligation), some target schools do not have walls or have walls that are still under construction. Those schools are facing problems in operation and maintenance, such as damage caused by unauthorized use of the facilities, graffiti, and theft by outsiders. The installation of school walls in the target schools is highly effective in terms of school operation and maintenance, and it is desirable to include them as a component of school construction projects or to make it a prerequisite for the recipient government to provide support.

Necessity of Follow-up on Government's Responsibility

In the Projects, the cases where the Malawian government have not completed their burdens of the connection of electricity and running water to the target schools were identified. The completion of those burdens is supposed to be confirmed at the defect inspection a year after project completion, but the lack of a follow up mechanism, even if identified not to be completed, cased to generate this kind of uncompleted burdens of recipient country. Therefore, it is necessary to confirm the completion of the unimplemented items confirmed by defect inspection by the follow-up of the JICA local office.

Utilization of lessons learned from other similar projects by prior phases and donors

Some issues were found in the layout and specifications of the facilities; for example, the toilets for boys and girls are located next to each other and away from the girls' hostel, which poses a safety issue, and the lack of privacy for using the sanitary napkin incinerator also makes it difficult to use. These improvements are expected to contribute to the further promotion of girls' enrollment. In addition, it was difficult to obtain consumables (fluorescent lights and gas cylinders for experiments) in the local market. Although the specification of facilities and equipment are determined by the local standard It is necessary to closely examine the operation and maintenance of secondary school facilities in schools from previous phases and schools supported by other donors, and reflect the lessons learned from the identified advantages and challenges in the facility design and equipment specifications by referring the local standard. This will make it possible to increase the use of facilities and provide support with a higher return on investment.

Collaboration with technical cooperation and JOCV

The in-service training for science and mathematics teachers introduced through the technical cooperation project has been incorporated into the government's program and is being implemented continuously. In the target schools of the Projects, on the one hand, it was confirmed

that the science teachers who participated in the training were able to make effective use of the well-equipped laboratories and equipment, and the students' interest in science and their performance have also been improved. In addition, synergistic effects, such as proper management of laboratory equipment, were observed in schools where JOCV science and mathematics teachers were assigned. On the other hand, it is assumed that the use of schools developed through Grant Aid projects as a basis for technical cooperation and JOCV activities will facilitate the activities and easily obtain support from school staff. Therefore, the effects of both infrastructure and technical cooperation will be improved by selecting target schools and planning the specifications of facilities and equipment, considering the synergistic effect with technical support at the planning stage of Grant Aid projects.