

Country Name	The Project for Improvement of Machinery and Equipment for Construction of Rural Agricultural Road (Phase 3)
Kingdom of Bhutan	

I. Project Outline

Background	<p>In Bhutan, agriculture was a key industry, in which 62% of the population engaged. Nevertheless, food grain sufficiency rate was around 66% and agricultural income was low because the whole country was in the mountainous terrain and the agricultural land per farming household was quite small. It was essential to improve farm roads necessary for efficient agricultural production and shipment and better access to various public services to increase food self-sufficiency rate, including grain, and agricultural income. The equipment for the farm road construction had been procured through the preceding grant aid projects of JICA (Phase 1 (2005-2006) and Phase 2 (2010-2011)), and Ministry of Agriculture and Forestry (MOAF) constructed 2,609 km of the farm roads by the end of the 10th Five Year Plan (FYP) (2008-2013) in June 2013 with the procured equipment. Under the 11th FYP (2013-2018), MOAF aimed to construct approximately 2,500 km new farm roads and planned to construct approximately 1,300 km of the new roads using the equipment owned by Central Machinery Unit (CMU) under Department of Agriculture, including the one procured through the preceding JICA projects. However, with the existing equipment, CMU would be able to construct only about 843 km of the planned roads with no prospect of completing the remaining 457 km. In addition, with the existing aging equipment, it was difficult to respond to increasing needs for maintenance of the existing farm roads due to rock falls and mud slides. (Figures at the time of ex-ante evaluation.)</p>					
Objectives of the Project ¹	<p>The project aimed to enhance CMU's capacity to construct and maintain farm roads in Bhutan by procuring necessary equipment, thereby contributing to improvement of efficiency of agricultural production and shipment and provision of better access to public services for sustainable economic development of the country.</p>					
Contents of the Project	<ol style="list-style-type: none"> 1. Project Site: CMU head office at Jakar in Bumthang, CMU branch offices at Bhur in Sarpang and at Khangma in Tashigang. 2. Japanese side: Provision of grant necessary for procurement of equipment for farm road construction and maintenance (30 excavators (20 t), 30 hydraulic breakers (1,600 kg class), 30 air compressors, 60 jack hammers, 20 backhoe loaders, 1 fuel taker, 2 self-loader truck, 3 pickup trucks, 2 forklifts, 3 semi-automatic welders, 1 fuel inspection pump tester, and 1 set of spare parts for each equipment) 3. Bhutanese side: Forwarding of equipment, securing of storage sites, maintenance of equipment, etc. 					
Project Period	E/N Date	March 15, 2016	Completion Date (ex-ante)	June 2017	Completion Date (actual)	November 3, 2017 (Date of completion of procurement of equipment (Lot 2))
Project Cost	E/N Grant Limit / G/A Grant Limit: 966 million yen			Actual Grant Amount: 795 million yen		
Executing Agency	Department of Agriculture, Ministry of Agriculture and Forest (MOAF)/Central Machinery Unit (CMU)					
Contracted Agencies	Main Contractor: ITOCHU Corporation Main Consultant: Katahira & Engineers International					

II. Result of the Evaluation

< Special Perspectives Considered in the Ex-Post Evaluation >

- In the Ex-ante Evaluation Sheet, the target year/month for the indicators was set to be 1 year after the project completion (i.e., June 2018, corresponding to the end of the 11th FYP period), expecting that the project was to complete in June 2017. As the project was completed in November 2017, the target year/month was modified to be November 2018.
- The original target and baseline values for the indicators set in the Ex-ante Evaluation Sheet included not only the expected yearly length by the procured equipment (i.e., direct effects of the project) but also the estimated length by the existing equipment² for 5 years during the 11th FYP period from July 2013-June 2018. Since the target year was set to be November 2018 in this ex-post evaluation, it was difficult to properly verify the achievement level of the indicators with the original target figures that included the estimated performance of the existing equipment only until June 2018. In light of the above, the part of the original baseline and target values that corresponded to the direct effects of the project (i.e., expected length of farm road construction/maintenance by the procured equipment) was used in confirming the quantitative effects of the project. In this connection, contribution of the project to the 11th FYP was confirmed under the qualitative effects by using the original baseline and target values of the indicators set in the Ex-ante Evaluation Sheet (Supplementary Information 1).
- The qualitative effects mentioned in the Ex-ante Evaluation Sheet ("Improvement of the agricultural income by the realization and improvement of shipment and sales of farm products, and efficiency of farm works" and "Improvement of the access time to public services (hospitals, schools, government offices) for rural residents") are logical consequence of the outcome of the project; thus, they are considered to be assumed impacts of the project. In this connection, construction and maintenance of the farm roads leading to the markets and public services was confirmed under the qualitative effects (Supplementary Information 2).

¹ Objectives are based on the Preparatory Survey Report because the outcome mentioned in the Ex-ante Evaluation Sheet (i.e., improvement of efficiency of agricultural production and shipment and provision of better access to public services) was considered to be the impact of the procurement of the equipment.

² At the time of ex-ante evaluation, there were 118 pieces of major equipment at CMU, including 89 procured through Phase 1 (2005-2006) and Phase 2 (2010-2011) of the project and 8 procured through prior cooperation of JICA (i.e., "The Project for the Paro Valley Agricultural Development" (1993-1996) and "Grant Aid Program for Increased Food Production (KR2)" (2004)).

1 Relevance

<Consistency with the Development Policy of Bhutan at the Time of Ex-Ante Evaluation>

At the time of ex-ante evaluation, the project was consistent with the 11th FYP (July 2013-June 2018), the national plan of Bhutan, which set forth “Enhanced rural household income and food grain sufficiency” as one of the key result areas of the first pillar of “Sustainable and Equitable Socio-economic Development” and included improvement of farm roads as marketing facilities as a key intervention as a key performance indicator.

<Consistency with the Development Needs of Bhutan at the Time of Ex-Ante Evaluation >

At the time of ex-ante evaluation, the project was consistent with development needs of Bhutan for improvement of machinery and equipment for construction and maintenance of the farm roads as described in “Background”.

<Consistency with Japan’s ODA Policy at the Time of Ex-Ante Evaluation>

At the time of ex-ante evaluation, the project was consistent with the Country Assistance Policy for the Kingdom of Bhutan (2015), which set forth assistance to “Bhutan’s efforts to improve standard of living in rural areas” in response to the first pillar of the Bhutanese 11th FYP, “Sustainable and Equitable Socio-economic Development”, and included “agriculture and rural development” and “construction of rural basic infrastructure”, including construction of roads/bridges, as areas of assistance under one of the priority areas of “Sustainable economic growth”.

<Evaluation Result>

In light of the above, the relevance of the project is high.

2 Effectiveness/Impact

<Effectiveness>

The project achieved its objective of enhancing CMU’s capacity to construct and maintain farm roads in Bhutan.

As for the quantitative effects, a total of 186 km of farm road was constructed by the target year (i.e., November 2018, 1 year after the project completion) using the procured equipment, which accounted for 41% of the target figure of 457 km. It was mainly because (i) the construction sites left for the procured equipment were in difficult terrains³, (ii) the procured excavators had to be deployed for road maintenance due to urgency⁴, and (iii) the procured equipment was also used for Agriculture Land Development (ALD), the additional mandate of CMU for the 12th FYP (July 2018-June 2023)⁵. Although there were continuing needs for farm road construction in the 12th FYP⁶, the same trend continued due to the same reasons and less than 170 km of farm road was constructed annually after the target year (Indicator 1). On the other hand, a total of 506 km of farm road maintenance was conducted by the target year, which was more than 3 times the target figure of 151 km. The actual result largely exceeded the target owing to deployment of the procured excavators for road maintenance as mentioned above. The same trend continued and more than 260 km of farm road maintenance was conducted annually after the target year (Indicator 2). It is noted that, by the target year, the total length of farm road constructed and maintained using the procured equipment (i.e., 692 km) exceeded the total target length of 608 km. Therefore, it can be said that CMU actually improved their capacity in farm road construction and maintenance in general in the target year. In addition, as of July 2021, almost all the equipment procured under the project was maintained in good condition⁷, and the procured equipment was partially utilized on a quantity basis and mostly utilized on a price basis⁸ for farm road construction/maintenance and ALD.

Regarding qualitative effects, the project contributed to the 11th FYP because CMU could achieve its targets for farm road construction and maintenance for the 11th FYP using not only the existing equipment but also the procured equipment (see the table titled “Cumulative length of farm road construction/maintenance by CMU in the 11th FYP period” below for more details). Degree of contribution to farm road construction was less than expected due to delay of the project completion by 5 months in addition to the reasons (i) and (ii) stated under the quantitative effects above, but this was the result of reallocating resources as necessary to achieve the objective and did not diminish the effectiveness of the project. Also, degree of contribution to farm road maintenance was more than expected due to the reason (ii) above⁹ (Supplementary Information 1). The farm roads leading to the markets and public services were constructed and maintained

³ Since construction at most of the easier sites in the fine terrains had been already completed during the 10th FYP and during the first 3 years of the 11th FYP, the most difficult ones were left to construct which took a longer time for completion. CMU also deployed the procured equipment to the challenging complicated landscape since it was new.

⁴ After the monsoon season in 2018, all the existing farm roads were blocked due to landslides etc. and transportation of the procured equipment to the construction sites were not possible unless the existing farm roads were cleared with the procured excavators.

⁵ Farm road construction had been a priority from the 9th FYP (2002-2007) and the 11th FYP. By the end of the 11th FYP, about 95% of farm road construction had been completed and almost all the villages had been connected to farm roads. Considering the outstanding achievement in farm road construction in the past FYPs, the government decided to put more focus on ALD and then to the farm roads in the 12th FYP. Some agriculture lands were not arable even with access to farm roads and fallow land in Bhutan was rising. So, ALD was expected to mitigate this issue. Farm road and ALD were closely connected in achieving the food security, which was included in one of the National Key Result Area of the 12th FYP.

⁶ MOAF had a target to construct 2,500 km of new farm road for the 12th FYP, which was the same as the target for the 11th FYP. As of August 2021, CMU was waiting for its share target from MOAF.

⁷ One of the excavators was damaged due to accident in July 2021. Upon inspection, CMU found out that 39 spare parts were required to mend it; however, they were not included in a set of spare parts procured under the project, and local suppliers could provide quotation for only 9 spare parts. It was assumed that the local suppliers were hampered by COVID-19 pandemic to restock the spare parts due to border restriction, but it was not clear to what extent this constraint affected the above quotation. (It is possible that the local suppliers could not supply some of the spare parts even without COVID-19 pandemic.) It was also difficult for CMU to procure these spare parts in the international market because CMU as a government agency had to follow procurement regulation of the Royal Government of Bhutan where direct purchase by an agency in the international market was strictly restricted.

⁸ In terms of quantity, 73 out of 182 pieces of the procured equipment was not utilized. In addition to the damaged excavator mentioned in footnote 7, 53 out of 60 jack hammers, procured as attachments to 30 procured excavators, and 19 out of 30 air compressors were not in use due to the additional mandate of CMU, ALD, whereby the use of frequency was less than farm road construction. However, there was a room for utilization of these unused jack hammers and air compressors in the future because of the needs for farm road construction in the 12th FYP (see footnote 6) and the prioritization of construction of 1,582 km of road by the Economic Contingency Plan initiated by the Gross National Happiness Commission under COVID-19 situation. In terms of price, the total cost of the unutilized equipment accounted for 14% of the total cost of the procured equipment excluding spare parts. It is noted that 2 out of 30 hydraulic breakers were standing by at the CMU head office and deployed upon the request of the branch offices.

⁹ Despite the delay of the project completion, CMU could achieve the overall target for the farm road construction for the 11th FYP because the actual

using the procured equipment (see <Impact> below for more details) (Supplementary Information 2).

<Impact>

As assumed at the time of ex-ante evaluation, the project contributed to improvement of the agricultural income in the rural communities by realization and improvement of shipment and sales of farm products, and efficiency of farm works. For example, the farm road construction and maintenance helped in realizing the government's initiative such as buyback policy of the produce from farmers and linking schools and hospitals through School and Hospital Feeding Program, which used to be quite challenging due to poor farm road networks in the past. An easy access to market with construction of the farm roads encouraged farmers to practice commercial farming. The constructed farm roads also provided a means for vegetable vendors to collect agriculture products directly from the production areas, thereby, reducing the cost which was earlier borne by the farmers to transport their product. The project also contributed to improvement of the access time to public services (hospitals, schools, government offices) for rural residents as envisaged. For example, according to CMU, it took 3 days for the people in a community in Nahi Block in Wangduephodrang District to avail basic services such as health, school, and other public centers in the block center before the farm road construction. With the farm road constructed with the procured equipment, it only took 3 hours to reach the center. A female from Chungphel Village in Bumthang District interviewed by the ex-post evaluation team stated that about 3 pregnant women had been expired on the way while travelling for delivery to the basic health facility centre before the farm road was constructed, but now, such issue was very rare.

Other positive impacts were also observed. The project contributed to well-being of the people in the rural areas where the farm road was constructed/maintained. For example, according to CMU, mechanization of the labor-intensive agriculture work in the rural areas (e.g., use of power tiller, tractor, thrasher, rice mill etc.), which had been difficult due to poor farm road networks, became possible with construction and maintenance of the farm roads. A man from a village where farm road was constructed under the project mentioned that the villagers had at least managed to have electrical appliances and cold storage (refrigerators) because transportation of such heavy equipment became easier with the farm road, which reduced burden of living comparing to the olden traditional ways. Furthermore, as shown in <Effectiveness>, part of the procured equipment was deployed for ALD in the 12th FYP period. As of November 2020, 1,138 acres of ALD was implemented by using the procured equipment.

Meanwhile, no negative impacts were observed.

<Evaluation Result>

Therefore, the effectiveness/impact of the project is high.

Quantitative Effects

>Cumulative length of farm road construction/maintenance by CMU using the procured equipment

Indicators	Baseline 2015 Baseline Year	Target November 2018 1 year after Completion	Actual November 2018 1 year after Completion	Actual November 2019 2 years after Completion	Actual November 2020 3 years after Completion	
Indicator 1: Length of farm road construction (km)	0	457(*1)	186	282	445	Source: CMU
Indicator 2: Length of farm road maintenance (km)	0	151(*2)	506	903	1,302	Source: CMU

*1: Yearly length by newly procured equipment (1.25 km (average length by the existing excavators in the 10th FYP/month/unit) X 12 months X 30 new excavators)

*2: Monthly maintenance capacity of a newly procured backhoe loader ((0.63 km/unit) X 20 units) X 12 months

Qualitative Effects

> Contribution of the project to the 11th FYP (based on cumulative length of farm road construction/maintenance by CMU in the 11th FYP period using the existing and procured equipment)

Supplementary Information	Baseline June 2015 (Bhutanese Fiscal Year (BFY) 2014/15)	Target June 2018 (End of the 11th FYP =BFY2017/18)	Actual June 2018 (BFY 2017/18)	Ref June 2019 (BFY2018/19)	Ref June 2020 (BFY2019/20)	
Length of farm road construction (km)	337(*1)	1,300(*2)	1,313	1,551	1,691	Source: CMU
Length of farm road maintenance (km)	335(*1)	988(*3)	1,506	2,056	2,719	Source: CMU

*1: Actual performance of CMU by the existing equipment (July 2013-June 2015)

*2: Estimated performance of the existing equipment for 5 years (843 km) + Yearly length by newly procured equipment (457 km)

*3: Estimated performance of CMU by the existing equipment for 5 years (837 km) + Monthly maintenance capacity of a newly procured backhoe loader (151 km)

3 Efficiency

While the project cost was within the plan, the project period exceeded the plan (ratio against plan: 82% and 129% respectively). The actual period exceeded the planned because installation of Lot 1 and Lot 2 equipment was delayed respectively due to an administrative issue (i.e., delay of issuance of visa for the main contractor to visit Bhutan) and a dispatch error by one of the suppliers. Meanwhile, the outputs of the project were produced as planned. Therefore, the efficiency of the project is fair.

4 Sustainability

<Institutional/Organizational Aspect>

The 12th FYP for Renewable Natural Resource Sector, prepared by MOAF, set forth enhancement of agriculture infrastructure and farm mechanization, including farm road construction/maintenance. In the 12th FYP, farm road construction and maintenance were continued to be the important mandate for CMU although the primary mandate was shifted to ALD (see footnote 5 for details), for which the procured

result by the existing equipment largely exceeded the plan. According to CMU, the main reason was easier access to and fine terrains of the construction sites.

equipment was also used. CMU continuously had the head office in Bumthang District and 2 branch offices. Under each head and branch offices, there were 3 technical sections: i) Maintenance; ii) Equipment & Work; iii) Store. CMU considered that the necessary number of staff was secured to conduct O&M of the procured equipment properly. As of July 2021, 106 persons were allocated for operation and maintenance (O&M) of the procured equipment at CMU head and branch offices, including 58 operators and helpers who were additionally recruited specifically for the procured equipment. In addition, 40 more CMU operators were placed at the district government offices, whose salaries were paid by the district governments.

<Technical Aspect>

CMU maintained necessary skills and knowledge to conduct proper O&M of the procured equipment by applying the manuals developed under the project, organizing in-house seminars for the staff to share knowledge and learn from each other, and utilizing the several opportunities of technical training offered by Royal Civil Service Commission. It is noted that a Japan Overseas Cooperation Volunteers (JOCV) volunteer in equipment maintenance and construction, dispatched by JICA in 2018, strengthened O&M capacity of CMU through hands-on training and technical supports¹⁰. In addition to technical transfer, the JOCV volunteer also motivated and inspired the staff, making them more dedicated to their responsibilities.

<Financial Aspect>

The necessary budget for O&M of the procured equipment was provided by the central government. The central government allocated 45 million Ngultrum annually for O&M of the procured equipment.

<Current Status of Operation and Maintenance>

Necessary maintenance activities were conducted. Necessary spare parts and consumables were procured in timely manner except for the spare parts of the excavator damaged in July 2021, for which local suppliers could provide quotation for only 9 out of 35 required spare parts (see footnote 7 for details).

<Evaluation Result>

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

5 Summary of the Evaluation

The project achieved its objective of enhancing CMU's capacity for construction and maintenance of the farm roads. Meanwhile, the expected impact of improvement of efficiency of agricultural production and shipment and provision of better access to public services was observed. Regarding the sustainability, no major problems were observed in terms of the institutional/organizational, technical, and financial aspects of the executing agency. As for the efficiency, the project period exceeded the plan. Considering all of the above points, this project is evaluated to be highly satisfactory.

III. Recommendations and Lessons Learned

Lessons Learned for JICA:

- I Good association of this grant aid and the JOCV dispatched after this grant aid contributed to proper O&M of the procured equipment. For any kind of project in Bhutan, it is useful to consider implementing other JICA scheme(s) like JOCV as follow-up(s) to sustain the effects of the project.
- Also, at the end of a grant aid (GA) project for equipment procurement, it is useful to consider suitable follow-up scheme(s) to revamp the running period of the procured machines even after the end of the project.



Farm Road constructed by using the procured equipment in Bumthang District connecting national highway, making easy access to the public facilities for the people of Chungphel Village.



A beneficiary being interviewed by national staff of JICA Bhutan Office during ex-post evaluation survey at Chungphel Village in Bumthang District to understand the impacts of the farm road constructed by using the procured equipment.

¹⁰ It is noted that a JOCV volunteer dispatched in 2004 also strengthened O&M capacity of CMU then, which contributed to proper care and maintenance of the equipment procured through the preceding grant aid projects.