Republic of Kenya

FY 2016 Ex-Post Evaluation of Japanese Grant Aid Project

"The Project for the Upgrading and Refurbishment of the Centre for Mathematics, Science and Technology Education in Africa"

External Evaluator: Takako Haraguchi, International Development Associates, Ltd.

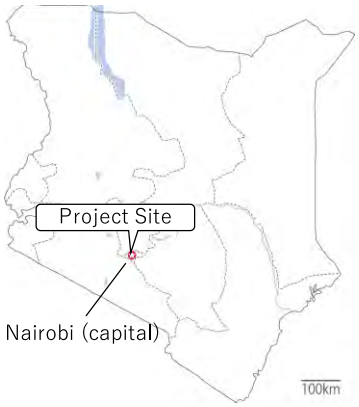
0. Summary

This project aimed to strengthen training and related activities for teachers, trainers for teachers and education administrators on the premises of the Centre for Mathematics, Science and Technology Education in Africa (CEMASTEA), which is the implementing agency of in-service education and training (INSET) in mathematics and science in primary and secondary education in Kenya and serves as a center of the training for promotion of mathematics and science education in Africa, by expanding the facilities of CEMASTEA. The relevance of these objectives is high, as they were consistent with Kenya's and intra-regional development policies and development needs as well as with Japan's ODA Policy, with respect to strengthening teachers' capacity. The effectiveness and impact are evaluated to be high. By utilizing the facilities and equipment delivered by this project, the expected level of quantitative expansion of training was realized overall, missing the target only slightly. In addition, as the result of the improvement of the training and operation environment, the enhancement in the comfort and efficiency of training was confirmed. Coupled with the output of a JICA technical cooperation project, "Strengthening of Mathematics and Science Education" (2009-2013) (SMASE Phase 3), which was implemented almost simultaneously, the activities of CEMASTEA have contributed to the continuation and further development of INSET in mathematics and science in Kenya as well as to the incorporation of the contents of the CEMASTEA training into mathematics and science education in other African countries.

The project's efficiency is evaluated to be fair. While the increase in the project cost was justifiable considering the increase in the outputs, the project period was longer than planned. The sustainability of the project's effects is evaluated to be high, as no major problems have been observed in the institutional, technical and financial aspects of operation and maintenance of the CEMASTEA facilities as well as the implementation of training.

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

1. Project Description



Project Location

The Centre for Mathematics, Science and Technology Education in Africa (CEMASTEA) (From the left) Administration building 1, administration building 2, lecture hall

1.1 Background

Despite the effort made in Kenya to expand access to education by implementing the Free Primary Education policy in 2003 and the Free Day Secondary Education policy in 2008, the improvement in the quality of education was stagnating. To improve the quality of education particularly in mathematics and science, the government of Kenya was promoting INSET in the aforementioned subject areas, with assistance from Japan, through technical cooperation projects such as the "Strengthening of Mathematics and Science in Secondary Education Project" (1998-2003) (SMASE[1] Phase 1) and the "Strengthening of Mathematics and Science in Secondary Education Project Phase 2" (2003-2008) (SMASE Phase 2). The adopted approach for pedagogical improvement was based on a principle of classroom improvement called "Activity, Student-centered, Experiment and Improvisation/Plan, Do, See and Improvement" (ASEI-PDSI). Those INSET programs that used this approach to train mathematics and science teachers, known as SMASE INSET, spread throughout the country. Also, in an attempt to introduce SMASE INSET in other African countries, an intra-regional cooperation network called the Strengthening of Mathematics and Science Education in Western, Eastern, Central and Southern Africa Association (SMASE-WECSA)[2] was launched in 2001 under SMASE

[1] The abbreviated title for the Phase 1 and Phase 2 technical cooperation projects was SMASSE (Strengthening of Mathematics and Science in Secondary Education) since they targeted secondary education (Grade 9 to Grade 12). The Phase 3 was abbreviated as SMASE (Strengthening of Mathematics and Science Education) as it extended its scope to primary education (Grade 1 to Grade 8, of which this project specifically targeted Grade 6 to Grade 8). For convenience, this report uses the abbreviation "SMASE" for all phases from Phase1 to Phase 3, and refers to the entire series of technical cooperation projects without specifying phases as "the SMASE project".

[2] The member countries of SMASE-WECSA reached 27 in total by 2011 (Angola, Benin, Botswana, Burkina Faso, Burundi, Cemeroon, Ethiopia, Gambia, Ghana, Kenya, Lethotho, Mali, Malawi, Mozambique, Namibia, Niger, Nigeria, Rwanda, Senegal, Sierra Leone, South Sudan, Swaziland, Tanzania, Uganda, Zambia, Zanzibar, and Zimbabwe). *In alphabetical order; the Ministry of Education of Zanzibar was registered separately from the Ministry of Education of Tanzania as they are distinct organizations.

Phase 1, reinforcing the efforts by the member countries to promote mathematics and science education and institutionalize the INSET system.

CEMASTEA was created by the government of Kenya in 2003 to lead these undertakings. However, the facilities of CEMASTEA, which had been converted from an existing vocational school, had problems such as lack of a large lecture hall for group training, limited capacity of the training rooms and laboratories, and inefficient administration facilities, which were making it difficult to respond to the increased need for training.

1.2 Project Outline

The objective of this project was to strengthen the training and other related activities of CEMASTEA on its premises in Nairobi for INSET trainers and education administrators by expanding the facilities of CEMASTEA, thereby contributing to the improvement of INSET in mathematics and science in Kenya and in Africa.

E/N Grant Limit or G/A Grant Amount / Actual Grant Amount	581 million yen / 577 million yen
Exchange of Notes Date (/Grant Agreement Date)	August 2011 / August 2011
Executing Agency	The Centre for Mathematics, Science and Technology Education in Africa (CEMASTEA)
Project Completion	October 2013
Main Contractor(s)	Konoike Construction Co., Ltd.
Main Consultant(s)	Matsuda Consultants International Co., Ltd. and INTEM Consulting, Inc.
Basic Design	November 2010 – August 2011 (Preparatory Survey)[3]
Related Projects	"Strengthening of Mathematics and Science in Secondary Education Project" (JICA technical cooperation, 1998-2003) (SMASE Phase 1) "Strengthening of Mathematics and

[3] The basic design study was completed in May 2006, and an exchange of notes was signed by the Japanese and Kenyan governments later in the same year. However, the project was not implemented since the residents near the project site did not agreed on the project plan in the process of the environmental impact assessment (EIA). The Ministry of Education, Science and Technology (MOEST) continued the negotiations with the residents, and finally obtained their consent with the project, which led to the signing of the exchange of notes for the second time.

	Science in Secondary Education Project Phase 2" (JICA technical cooperation, 2003-2008) (SMASE Phase 2) "Strengthening of Mathematics and Science Education" (JICA technical cooperation, 2009-2013) (SMASE Phase 3)

This ex-post evaluation is conducted on a presumption that the objective of the overall plan including this grant aid project[4] was "to strengthen mathematics and science education in primary and secondary education in Kenya and the SMASE-WECSA member countries by training and strengthening trainers (teachers) in mathematics and science in aforementioned countries" (defined by referring to Basic Design Study Report). The overall plan included the activities by CEMASTEA itself and the activities of SMASE Phase 1 through Phase 3. Figure 1 shows the structure of SMASE INSET in Kenya and the scopes of this project and SMASE Phase 3, respectively.

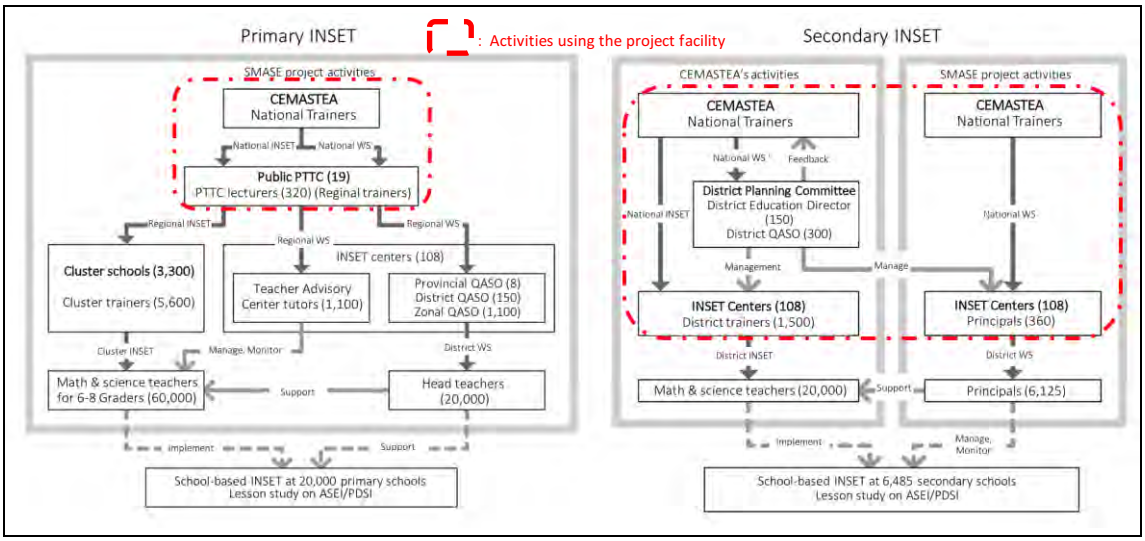


Figure 1: SMASE INSET System in Kenya

Source: Preparatory Survey Report (items encircled by red dotted lines were added by the ex-post evaluator)
Note: Terms are those used at the time of planning. Since 2013, "state" and "county" have been restructured, respectively, into "county" and "sub-county," while "zone" and "cluster" (education administration district) have been abolished. PTTC: Primary Teachers Training College. SMASE Project: SMASE Phase 3 in particular. WS: workshop.

[4] In an evaluation of a grant aid project, an "overall plan" is assumed to include a broad range of projects that are planned by the recipient country's government to resolve development issues.

2. Outline of the Evaluation Study

2.1 External Evaluator

Takako Haraguchi, International Development Associates, Ltd.

2.2 Duration of Evaluation Study

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

Duration of the Study: August 2016 – September 2017

Duration of the Field Study: November 14-22, 2016 and January 16 – February 9, 2017

In parallel to this evaluation, the evaluator conducted ex-post evaluation of SMASE Phase 3. Since the executing agency. Second, the scope and contents of the research conducted for Africa were generally more limited than in Kenya (field research was conducted only in Kenya). Therefore, the reliability of the results of evaluation is expected to be lower than that of the Kenyan evaluation.

2.3 Constraints During the Evaluation Study

The evaluation study faced several challenges due to the multiplicity of observation targets, as the impacts of this project were anticipated to materialize in Kenya and other SMASE-WECSA member countries (27 countries) in Africa. First, although the sampling attempted to achieve an acceptable level of representativeness by including localities and schools in different geographical conditions (urban, suburban, rural, and Arid and Semi-Arid Lands [ASAL]), not only was it non-probability sampling introducing potential biases in the study results, but also the sampling failed to include a sufficient number of cases to adequately compare the tendencies between primary and secondary education. Also, the areas that were difficult to visit due to security reasons were excluded from the study. Second, the scope and contents of the research conducted for Africa were generally more limited than in Kenya (field research was conducted only in Kenya). Therefore, the reliability of the results of evaluation is expected to be lower than that of the Kenyan evaluation.

Table 1: Outline of the beneficiary survey for the ex-post evaluation

Target (population size)			Respondents	Constraints on survey
Kenya	Former Kenyan attendees of CEMASTEA training and workshops	Regional INSET trainers (Approx. 300 individuals for primary education and approx. 1,400 individuals for secondary education)	Valid responses: 22 individuals All trainers who were present at the PTTCs in the two counties and the secondary schools in the seven counties visited by the evaluator.	While the counties and schools visited were representative of the population, respondents were not sampled randomly.
		Local education administrative officers (Total number is unknown but they consist of a few individuals each in 47 counties and their subordinate sub-counties, and principals)	Valid responses: 34 individuals County Directors of Education or Quality Assurance & Standards Officers, and principals of 27 schools (18 primary and nine secondary) in the seven counties visited.	While the counties and schools visited were representative of the population, respondents were not sampled randomly. Sub-county-level administrative officers were not surveyed.
Africa	Attendees of the Third Country Training Program (TCTP) held at CEMASTEA (27 countries in Africa; total number unknown; annual average number of attendees of 135 in 2009-2016)		Valid responses: 21 individuals (11 countries) CEMASTEA delivered the questionnaire via email to 223 individuals it randomly sampled.	Response rate was low. Survey results may be overrated as there may have been a selection bias favoring those attendees who are satisfied or highly utilizing what they learned.
	JICA overseas offices and field offices in the SMASE-WECSA member countries (27 African countries)		Valid responses: 20 offices (20 countries) The evaluator delivered the questionnaire via email to offices in 22 countries. The evaluator requested the offices to have the questions answered by JICA experts, or by other individuals like experts in the related field in case the offices were unable to answer.	The questions were very simple such as "Is there an INSET policy in place?" to which respondents were asked to answer based only on what they knew.

Note: The size of the population was estimated by the ex-post evaluator based on the Preparatory Survey Report, documentation provided by the executing agency, etc.

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

3.1 Relevance (Rating: ③[6])

3.1.1 Consistency with the Development Plan of Kenya

As part of the long-term national development plan "Vision 2030" (2008-2030), which has remained active from the time of project planning to the time of ex-post evaluation, Kenya has made efforts to become a medium income country by 2030 and improve the quality of education and research. With respect to the sector development plan, the Kenya Education Sector Support Programme (2005-2010) and the National Education Sector Plan (2013-2018), which were implemented at the times of planning and ex-post evaluation respectively, both included INSET as one of their priority investment projects.

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

At the time of planning, improvement of teacher's capability in Africa was set as one of the strategic goals in the Second Decade of Education Plan (2006-2015) promoted by the African Union (AU), and the action plan within the Plan counted on the contribution of SMASE-WECSA's intra-regional activities. Revitalization of teaching profession and improvement of educational infrastructure are listed as the first and second strategic goals in the Continent Strategy for Education in Africa (2016-2025) at the time of ex-post evaluation.

3.1.2 Consistency with the Development Needs of Kenya

As discussed above, INSET is called upon as a means toward the improvement in the quality of education. There is continuous need for INSET in Kenya, where the number of schools as well as teachers has risen in both primary and secondary education (Table 2). CEMASTEA holds a significant position as the country's sole implementing body of INSET in mathematics and science.[7]

Table 2: Overview of Education in Kenya

		2010	2012	2014
Primary education	Number of public schools	19,059	20,307	21,718
	Number of private schools	5,055	6,242	7,742
	Total number of all schools	24,114	26,549	29,460
	Number of teachers (person)	173,388	191,034	299,697
	Number of students (person)	9,381,211	9,970,900	9,950,746
	Gross enrolment rate (%)	107%	106%	104%
Secondary education	Number of public schools	5,296	6,188	7,686
	Number of private schools	905	986	1,048
	Total number of all schools	6,201	7,714	8,734
	Number of teachers (person)	52,935	64,109	78,719
	Number of students (person)	1,653,384	1,914,823	2,331,697
	Gross enrolment rate (%)	46%	51%	58%

Source: Ministry of Education, Science and Technology (MOEST); Kenya National Bureau of Statistics.

The needs for improving teacher's capacity are inferred from the statistics[8] for the member countries of SMASE-WECSA between 2009 and 2014, which showed an expansion of teacher population in all countries. In the ex-post evaluation survey conducted with the previous attendees of the Third Country Training Program (TCTP) (21 respondents consisting of the central and local education administrative officers of the member countries as well as INSET trainers), several respondents pointed out the importance of continuous efforts to strengthen teacher's capacity.

Further, in the period between the planning and the ex-post evaluation, in addition to

[7] Outside of CEMASTEA, INSET is implemented by the Kenya Education Management Institute, which operates training in education management, and the Kenya Institute of Special Education, which operates training in special education.

[8] UNESCO Institute of Statistics website.

serving continuously as the center of the TCTP in Africa, CEMASTEA has functioned as the secretariat of the Inter-Country Quality Node for Math and Science Education (ICQN-MSE) within the Association for the Development of Education in Africa (ADEA),[9] and for SMASE Africa, which had been called SMASE-WECSA until 2013. CEMASTEA, thus, plays a significant role as the hub for intra-regional cooperation in mathematics and science education.

3.1.3 Consistency with Japan's ODA Policy

Japan's ODA: Rolling Plan for the Republic of Kenya (2009) designates human resource development as a key area, and the expansion of primary and secondary education as a key development agenda.

In Africa, Japan's basic approach toward ODA in Kenya states that Japan will "facilitate Kenya's self-supporting efforts and assist its efforts in poverty reduction and sustainable growth. It will also consider a regional approach that would bring positive effects to surrounding countries.[10]" Also, the Yokohama Action Plan (2008), which was adopted in the Fourth Tokyo International Conference on African Development (TICAD IV), promotes a goal of "expanding teacher training in mathematics and science through SMASSE (targeting more than 100,000 teachers)".

In this way, this project has been highly relevant to the country'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

This evaluation confirmed that the output was produced mostly according the plan. Modifications of the plan were minor, and the reasons were appropriate (Table 3).

[9] ADEA is a network created in 1988 to debate and exchange information on education policy in Africa. It facilitates intra-regional cooperation in education in Africa by working closely with AU.
[10] The Ministry of Foreign Affairs, "Data by country" 2010 edition.

Table 3: Planned and actual outputs of the project

	Plan	Actual
Japanese side	Civil works and procurement of equipment (1) Facilities: Total floor space of 3,349.41m^2 Two administration buildings, a lecture hall, a lecture building, a laboratory building, a dining hall, a connecting hall, a kitchen, a transformer, electric generator rooms, access corridors, and exterior structures. (2) Equipment: Educational equipment in mathematics and science (13 items for physics including electronic analytical scales, 11 items for chemistry including vacuum pumps, six items for biology including microtomes, three items for mathematics including geometric model sets); training equipment (audio-visual equipment and a courtesy bus); information and technology equipment (PCs and networking equipment); lecture hall equipment (audio-visual equipment); training furniture (whiteboards for the lecture hall, lab benches, etc. for laboratories, bookshelves, etc. for the library); and equipment/tools for accommodation, kitchen and dining hall.	Civil works and procurement of equipment (1) Facilities: Total floor space of 3,348.42m^2 Mostly as planned with minor modifications in some of the specifications and locations of the facilities based on the instructions from MOEST and the Ministry of Public Works, requests from the executing agency, and technical judgments based on the detailed review of the design, etc. (e.g., entrances were added to handle a large number of trainees at one time; some walls were changed to glass walls to obtain more natural light, etc.). (2) Equipment: Mostly as planned with small changes in models of some equipment due to discontinued production by the manufacturers.
	Consulting services Design, construction supervision, etc.	Consulting services Same as plan.
Kenyan side	Civil works Removal of existing buildings and site preparation before construction works.	Civil works Mostly as planned, but the kei apple (plant) hedges to separate the property from neighborhood were changed to stone walls with a gate for a security concern.

Source: Preparatory Survey Report; responses received from the executing agency; field research.

3.2.2 Project Inputs

3.2.2.1 Project Cost

The total project cost was 618 million Yen, and when it is nominally compared to the cost estimate, it exceeded the plan (102% against the plan) due to an increase in the project cost as the result of the changes Kenyan partners made on project output (Table 4). However, as those changes represented additional output that was necessary to enhance the facilities' security, the increase in the cost was proportional to the increase in the expansion of the output.

3.2.2.2 Project Period

The project period lasted longer than planned (129% against the plan) because a portion of the construction work required a longer time than expected and the confusion that occurred in the country following the presidential election protracted the construction of facilities and procurement of materials (Table 5).

Although this does not affect the project's rating when employing JICA's project evaluation method, it should be noted that an exchange of notes for this project was signed in the Japanese fiscal year (JFY) 2006 but the project was not implemented as it failed to obtain

residents' consent (see Footnote 3). According to the initial plan, SMASE Phase 3 was to be implemented in the facilities after completion of constructions, but the actual completion and handover of the facilities did not happen almost until the completion of the technical cooperation project. Although the technical cooperation project took place in the old facilities, CEMASTEA as well as former Japanese experts reported that the implementation of activities was not significantly affected. Some of the comments pointed out that this outcome had forced CEMASTEA to begin operating and maintaining the facilities on its own as soon as the facilities were handed over to it; as it will be discussed later, active administration of the facilities by the Kenyan partners worked positively for the development of SMASE INSET.

Table 4: Planned and actual project cost

	Plan	Actual
Japan	581 million yen	577 million yen
Kenya	24 million yen (24 million KSh)	41million yen (40 million KSh)
Total	605 million yen	618 million yen

Source: Preparatory Survey Report; documentation provided by JICA.
Note: Local currency is Kenya Shilling (KSh). The exchange at the time of planning was 1 KSh=1.04 yen (February 2011) and the actual rate was 1 KSh=1.02 yen (average for 2011-2013).

Table 5: Plan and actual project period

	Plan	Actual
Grant Agreement	September 2011	August 2011
Detailed design	(4 months)	September 2011 – January 2012 (5 months)
Tender	(3 months)	February-April 2012 (3 months)
Civil works / procurement of equipment	(13 months)	June 2012 – October 2013 (17 months)
Project completion (duration)	May 2013 (21 months)	October 2013 (27 months)

Source: Preparatory Survey Report; documentation provided by JICA.

In sum, while the increase in the project cost was justifiable considering the increase in the outputs, the project period was longer than planned. Therefore, the efficiency of the project is fair.

3.3 Effectiveness[11] (Rating: ③)

By referring to the analyses in existing reports, the evaluator identified and organized expected impacts of this project in the following way. The direct outcome (effectiveness) was measured by "the qualitative improvement and quantitative expansion of training at CEMASTEA," and the resulting indirect outcome (anticipated impacts) was measured by "qualitative and quantitative expansion of INSET in mathematics and science in Kenya and other countries in Africa." The subsequent impacts on "improvement in learning in mathematics and science" were classified as other impacts. All of these impacts have mostly materialized by the time of ex-post evaluation.

[11] Sub-rating for Effectiveness is to be put with consideration of Impact.

3.3.1 Quantitative Effects (Operation and Effect Indicators)[12]

As shown by the planned and actual operation and effect indicators (Table 6), the project in general achieved quantitative expansion of training through the utilization of the facilities as planned, missing the target only slightly in certain dimensions.

The actual values for Indicator 1 (the number training attendees per year) and Indicator 2 (the number of training courses per year) both increased consistently, and the average target achievement rate for these two indicators was 89%. In addition, when Supplemental Indicator 1 (the operation rate of CEMASTEA based on the anticipated number of training sessions per week as set in the planning) was added to the mix of the two indicators, the average target achievement rate was relatively high, at 88%. From the time of planning to the time of ex-post evaluation, national training and the TCTP have constituted the core of the training courses of SMASE INSET (INSET trainer's training) for primary and secondary education.

The operation rate of the facilities achieved more than 80% for both Supplemental Indicator 2 (the daily operation rate of CEMASTEA computed from the total number of users) and Supplemental Indicator 3 (the number of days in which the number of users exceeded the maximum capacity prior to the project); these two indicators are likely to reveal a more practical operation rate given that the project enabled CMASTEA, which had focused on weekly training prior to the project, to diversify the utilization of its facilities by hosting such activities as large conferences at the lecture hall and many daily seminars and conferences. By increasing training facilities' capacity from 92 people to 200 people,[13] CEMASTEA now offers training and other activities at a scale that was impossible before the project.

The possible reasons for the missed target in Indicator 1 include the scale down in the TCTP according to the agreement between JICA and CEMASTEA after completion of this project and in CEMASTEA's implementation of INSET for primary education as the result of the changes in the budgetary allocation by the Ministry of Education, Science and Technology (MOEST), as well as CEMASTEA's efforts to increase the efficiency and effectiveness of INSET by such means as offering training in counties and conducting monitoring and evaluation of schools at a greater scale. Although the shift in activities from training at CEMASTEA facilities to field activities at schools may work against the project's contribution to the operation rate of CEMASTEA, it can deliver positive outcome in terms of the

[12] Although Indicator 1 (the number of training attendees per year) and Indicator 2 (the number of training course per year) set at the time of planning can be both classified as operation indicators, it was found difficult to quantitatively capture the effect indicators as the result of project operation; therefore, these operation indicators were viewed to function also as effect indicators, and the effects of operation were evaluated by examining qualitative information. Also, in order to grasp the status of operation of the facility more accurately, the evaluator collected data of operation rate of CEMASTEA as Supplemental Indicators (operation indicators) and used it in the assessment.

[13] Since the bed capacity remains 92, CEMASTEA has been outsourcing accommodation. According to the documentation provided by JICA, expansion of the accommodation had been initially reqested from the Government of Kenya but dropped from the project scope in consideration of harmony with the local community (i.e., not to increase the night-time population of CEMASTEA much).

improvement of the quality of training as it made it easier to grasp the conditions at schools. In order to compensate for the shift, CEMASTEA is making efforts to expand facility utilization by hosting single, stand-alone seminars and conferences as mentioned above.

Table 6: Operation and Effect Indicators

		Baseline	Target	Actual			
		2010	2016	2014	2015	2016	
		Planned Year	3 Years After Completion	1 Year After Completion	2 Years After Completion	3 Years After Completion	Achievement
Indicator 1: Number of training attendees per year (person) (1)	Total	964	5,539	2,052	2,581	3,949	71%
	Kenya	-	-	1,995	2,354	3,724	-
	Africa	-	-	57	227	225	-
Indicator 2: Number of training courses per year (1)	Total	18	33	27	32	35	106%
	Kenya	-	-	26	26	31	-
	Africa (2)	-	-	1	6	4	-
(Supplemental Indicator 1) (3) Operation rate of CEMASTEA (weekly rate based on the number of training sessions per week) (%)		44	83	63	77	73	88%
(Supplemental Indicator 2) (4) Operation rate of CEMASTEA (daily rate based on the total number of users) (%)		20	38	22	31	32	84%(5)
(Supplemental Indicator 2-2) Total number of users per year (person day)		4,820	27,695	16,034	22,937	23,718	86%
(Supplemental Indicator 3) Number of days in which the number of users exceeded the maximum capacity of 92 people prior to the project		0	-	81	113	131	-

Source: Preparatory Survey Report (baseline values, target values); documentation provided by the executing agency (actual values).
Note: (1) Including the seminars and conferences that used CEMASTEA facilities. The number of attendees is the total of the attendees of individual courses.
(2) Among the training for other African countries, the number of TCTP courses implemented by JICA was one in 2014, five in 2015, and two in 2016.
(3) Calculation method at the time of planning: Operation rate = (the number of weeks in which training was held at CEMASTEA) ÷ (52 weeks) × 100%.
(4) Additional calculation method used in the ex-post evaluation: Operating rate = (total number of users) ÷ (maximum capacity x 365 days) × 100%. The maximum capacity was 92 in 2010, and the target and actual number for 2016 was 200. Note that the baseline and target values for Supplemental Indicator 2 were calculated by the ex-post evaluator using the actual operation results and the operation plan at the time of the ex-post evaluation.
(5) The target achievement rate does not match its source value (the target achievement rate in Supplemental Indicator 2-2) due to an error introduced when the operation rate value was rounded.

3.3.2 Qualitative Effects (Other Effects)[14]

In terms of the qualitative impacts, it was anticipated at the time of planning that the improvement on the training rooms and laboratories and the consolidation of functions at the

[14] The ex-ante evaluation sheet listed "improving training environment/improving training quality" and "improving mathematics and science education in Africa" as the qualitative effects of this project, but the latter was re-assigned as an impact.

administration office would lead to improved training environment, hence an improvement in the quality of training. The project has largely accomplished this goal by the time of ex-post evaluation.

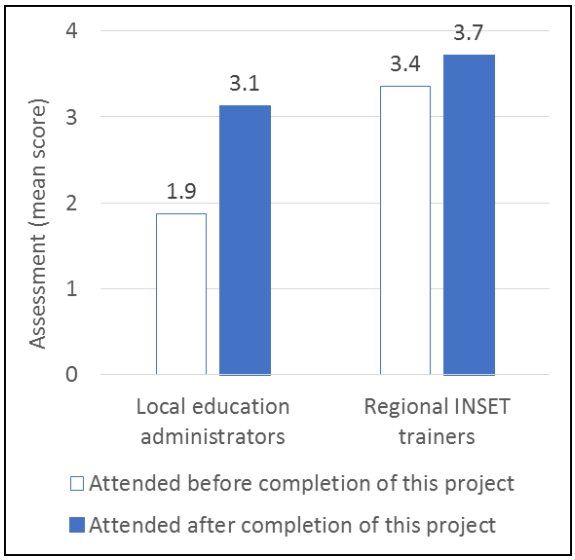


Figure 2: Evaluation of CEMASTEA facilities by former attendees

Source: Beneficiary survey
Note: Responses were scored by assigning the following points: 4 points for "Very good," 3 points for "Good," 2 points for "Fair," 1 point for "Not very good," and 0 points for "Not good."

(1) Improving the quality of training by improving training environment

The academic staff at CEMASTEA (the national INSET and TCTP instructors[15]) agreed that although the contents of the training did not vary significantly with or without the facilities,[16] "we can now provide high quality training because the laboratory and equipment have been renewed," and "the training can now be done more comfortably because of the spacious and convenient facilities." In addition, the academic staff had been spread over multiple buildings and rooms before the project, but the new academic office building now has separate offices for different subject areas, in which there are enough desks for all instructors (about ten); a staff member said, "it is now much easier to exchange information and discuss when we engage in activities such as creating training modules." Moreover, the improved library allowed resources and teaching materials that had previously been scattered to be consolidated in one location, and it now houses math and science textbooks from various countries the attendees of the TCTP brought, enhancing its function as an information clearing house in Africa. According to the CEMASTEA staff in charge of facility management, the logistical aspects also have dramatically improved as electricity supply, water supply, cooking, laundry, and shuttle service became more functional.

The attendees also gave high marks to the training facilities. The results of the surveys CEMASTEA conducted during training showed that the attendees were satisfied with the training facilities. Further, according to the results of the survey of previous attendees (local education administrative officers and INSET trainers) conducted at the time of the ex-post

[15] Interviews with the head of each subject area (mathematics, physic, biology, chemistry) and several other personnel who were present during the site visit.
[16] An evaluation of training conducted by the academic staff at CEMASTEA and Japanese experts in SMASE Phase 3, which provided technical cooperation to this project, confirmed that the target has been reached. The same academic staff continuously engage in provision of training after completion of this project.

evaluation, those who participated in the training and workshops at CEMASTEA after the completion of the project rated the facilities higher than did those who had attended earlier (Figure 2).[17]

(2) Status of training facility utilization

In addition to compiling the facility utilization data as shown in Table 6, the status of facility utilization has also been examined during the field visit. For example, SMASE Africa was holding an intra-regional meeting at CEMASTEA during the field visit for this ex-post evaluation, and the participants from Kenya and eight member countries were using the lecture hall as well as other facilities and equipment enabled by this project (before the project, large conferences had been held at hotels and other external facilities because a lecture hall was missing).

The facilities that existed before this project are being used as hostels (to increase the bed capacity so as to accommodate more attendees) in addition to printing and other support services offices such as Accounts and Human Resources. Also, a JICA's senior volunteer has repurposed the space that had been used as the laboratory before the project to display teaching materials produced by teacher-attendees of the training and himself, using it as a site to demonstrate *Improvisation* (turning resources and materials that are available at hand into teaching materials), which is one of the key components of SMASE INSET.

An international conference at the lecture hall built by this project

Laboratory

3.4 Impacts

3.4.1 Intended Impacts

The project contributed to the anticipated impact: "the improvement of INSET in

[17] However, according to CEMASTEA, attendees who are accommodated outside the center have raised concerns due to time spent in commuting. Also, the accommodation at CEMASTEA is double occupancy with common washroom area, which lowers attendees's satisfaction with the accommodation facility compared with other facilities.

mathematics and science in Kenya and in Africa." INSET in mathematics and science has continued to be operational since the completion of the project even though it has undergone changes in the implementation scale and selection methods for prospective teacher-attendees. In the member countries, although the status of implementation is not uniform and is affected by specific condition in each country, there has been a steady increase in the number of INSET trainers and education administrators who have studied at CEMASTEA, resulting in the incorporation of what was learned in the training into mathematics and science education in the member countries.

CEMASTEA is making positive contribution by serving as the center of teacher and trainer training in Kenya and Africa and as the implementing body of INSET in primary and secondary education. Although these accomplishments are the results of not only the present project but also the "overall plan" that encompasses technical cooperation projects and the undertakings by MOEST of Kenya, the expansion of the facilities and equipment at CEMASTEA is enabling its continuous activities particularly through the growth of attendees (quantitative expansion) and the improvement of the training and working environment. Further, the project enhanced CEMASTEA's status as an educational institution in Kenya and had positive impacts on its policy, institutional, and financial sustainability by upgrading the training facilities to the level appropriate to the greater ability to conduct training it achieved through technical cooperation projects and the central role it plays in mathematics and science education in Kenya and Africa.

(1) Implementation of INSET in mathematics and science in Kenya

Table 7 shows the status of SMASE INSET implementation. SMASE INSET for primary education started in 2010 under SMASE Phase 3, and became Kenya's first INSET in mathematics and science in primary education. SMASE INSET was temporarily interrupted when the technical cooperation was completed in 2013, but, since 2014, MOEST and CEMASTEA have implemented SMASE INSET in primary education in the ASAL areas, which were not part of the SMASE project, and conducted workshops on lesson study in several sub-county areas that were included in SMASE.[18]

Because almost all math and science teachers in secondary education have attended SMASE INSET by 2013, the original system in which all teachers would receive one cycle of training each year in a total of four cycles (four years) was replaced by a new, experience-specific system starting in 2014 (in a given year, only teachers who have the target number of

[18] Lesson study workshops are conducted in respective sub-counties (one sub-county in each of the 31 counties) by sub-county (district at the time of project implementation) education administrative officers called the Curriculum Support Officers (CSOs) who participated in training in Japan under the SMASE project (CSOs were used to be called Teacher Advisory Centre (TAC) tutors at the time of project implementation), and monitored and evaluated by CEMASTEA.

experience set for that year would be trained in a module designed for their amount of experience). As a result, the number of attendees has fluctuated between years. Also, teachers strikes were the primary reason why the workshops for school principals and education administrative officers were not held in 2010 and 2011.

Although SMASE INSET is the only INSET in mathematics and science for secondary education, for primary education MOEST, with assistance from other organizations such as the United States Agency for International Development (USAID), implements INSET in mathematics skills development program (Early Grade Mathematics, EGMA) for early grades (1st and 2nd grades).[19] According to the implementation team of EGMA, the program adopts a teacher-centered approach rather than a student-centered approach like ASEI-PDSI in order to strengthen most foundational skills when students are still in early grades so that the student-centered instructions in advanced primary grades (6th to 8th grades) can be implemented effectively.

Table 7: Number of Kenyan participants in SMASE INSET and related workshops

(Unit: person)

		2009	2010	2011	2012	2013	2014	2015	2016
Primary Education	National training (1)	0	272	286	284	274	0	28	47
	Regional training (1)	0	59,813	51,097	47,027	39,136	0	300	3,554
	Lesson study workshop (2)	0	0	0	0	0	0	2,578	762
	Workshops for principals and education officers	0	897	832	841	1,473	0	252	47
Secondary Education	National training (1)	509	0	1,412	1,412	0	1,330	1,330	1,323
	Regional training (1)	0	4,420	4,164	4,021	4,118	2,864	8,481	7,301
	School-based lesson study (3)	0	0	0	0	0	0	90	125
	Workshops for principals and education officers	1,113	0	0	5,540	3,430	94	1,420	2,601

Source: SMASE Phase 3 Terminal Evaluation Report; responses and documentation received from the executing agency.

Note: (1) National training is a type of INSET CEMASTEA provides to teachers who serve as regional INSET trainers (regional INSET trainer training); regional training is a type of INSET in which regional INSET trainers give to teachers. (2) Lesson study workshop for primary education (a workshop designed to spread the school-based training [lesson study]) was implemented at the sub-county level. The figure for 2016 reflects only those attendees who attended training in eight sub-countries monitored by CEMASTEA (it is unknown whether workshops were held in other sub-countries). (3) The figures for the school-based lesson study for secondary education were estimated by multiplying the number of schools where CEMASTEA conducted monitoring (18 in 2015 and 25 in 2016) by five, which is an estimate, based on interview results, for the number of teachers per school that attended training (no records were available for the actual number of participants).

[19] EGMA is organized under the Global Partnership for Education (GPE) and is part of the Kenya Primary Education Development Project (PRIEDE) supported by the World Bank, USAID, and others (2015-2018, with a plan to be extended to March, 2019). EGMA, together with TUSOME (a program in Swahili and English languages; meaning "Let's read" in Swahili), distributes learning materials to primary schools around the country and provides training for all primary school teachers in order to strengthen the foundational learning skills for early graders in reading, writing, and calculation (in Swahili, English, and mathematics),

As the implementation body of INSET in mathematics and science, CEMASTEA undertakes the development of modules, implementation of national training and workshops, and monitoring and evaluation of regional training. CEMASTEA also makes significant contribution to EGMA mentioned above, as it sends academic staff on loan to the implementation team of EGMA, and many of EGMA's master trainers (trainer education instructors) are either academic staff at CEMASTEA or regional INSET trainers who received national training at CEMASTEA.

(2) Implementation of INSET in mathematics and science in the African region

As shown in Table 7, CEMASTEA has provided training for attendees from Africa from the time before this project to the time of ex-post evaluation although the number varied from year to year. According to the survey of JICA's overseas offices and field offices on the implementation status of INSET in mathematics and science in member countries, respondents representing 15 countries out of the 20 member countries that responded to the survey reported "INSET in mathematics and science is actually implemented at the time of ex-post evaluation." The reasons cited for non-implementation (including those cases in which INSET was interrupted) were mainly related to implementation budget and institutional limitations in the education ministry in respective countries, which implements INSET. The responses from as many as 16 out of 20 countries agreed that "the TCTP at CEMASTEA contributed to the building and implementation of the INSET system in the member country." The content and modes through which such contribution was made include: "CEMASTEA attendees returned home and trained key personnel who would lead domestic efforts to promote INSET in math and science"; "what was learned was reflected when creating INSET modules and teaching materials in math and science"; "attendees are considering how they can apply what they learned in the country's context;" "attendees shared what they leaned with other teachers, trainers, and professionals in math and science education including those with the education ministry." Although this project may not be the exclusive reason for these results as these results are likely to reflect the outcome of the TCTP in the old CEMASTEA facilities before completion of this project, the contribution of this project should be acknowledged as it has supported the undertakings by CEMASTEA since 2014.

The results from the survey of former attendees of third country training were consistent with those of the JICA office survey just reported above. Seventeen out of 19 individuals who attended TCTP at CEMASTEA after the completion of the project reported that "I use what I learned at CEMASTEA (frequently, or at a certain level)." In terms of the content and circumstance of the use, all responses included concrete descriptions such as the incorporation of the ASEI-PDSI approach and inquiry based approach into module development and teacher

training, and sharing of knowledge and information with other teachers and education administrative officers.

(3) Contribution to TICAD IV "Yokohama Action Plan"

The total number of teachers who attended SMASE INSET between 2009 and 2012 exceeded 150,000 in primary education and 15,000 in secondary education. The total number of people who attended training at CEMASTEA from other countries in the region was 719, representing all 27 member countries of SMASE-WECSA. Based on the evidence, the implementation of SMASE INSET and TCTP have contributed positively to the following targets in TICAD IV "Yokohama Action Plan" (2008) set by the Japanese government: "to expand SMASE to train 100,000 teachers" by 2012; "to facilitate sharing of experience among SMASE-WECSA member countries"; and "to provide teacher training in math and science in all SMASE-WECSA member countries."

3.4.2 Other Positive and Negative Impacts

This evaluation identified other positive impacts. No negative impacts were found.

(1) Contribution to the improvement of math and science class and learning (in Kenya)

This impact is a higher order impact than the impacts discussed in "3.4.1 Intended Impacts." The ex-post evaluation for SMASE Phase 3, which was conducted along the present ex-post evaluation, found that the implementation of ASEI-PDSI for teachers in primary and secondary education had grown, contributing to greater motivation among students for class participation and learning.[20] The support this project has provided to the implementation and continued operation of INSET is also considered as one of the contributing factors.

(2) Impacts on the Natural Environment

At the time of planning, this project was evaluated to be a cooperation project with no serious adverse impacts on the environment and society, and was thus classified as Environment Category B as described in JICA Guidelines for Environmental and Social

[20] Major findings are as follows. 1. In the teacher survey (153 valid responses for primary school teachers and 100 for secondary school teachers), the results of self-scoring for the "Lesson Innovation Index" (0.00-4.00; the index is a simplified version of the measuring method used in the SMASE project), which measured the degree to which ASEI-PDSI was practiced, the average score for the primary school teachers was 3.44 out of 4 (target was 3.30) and 3.00 for secondary school teacher (target was 3.30). 2. In the detailed analysis by an expert conducted as part of the ex-post evaluation of SMASE Phase 3 (expert: Hideo Ikeda, professor emeritus, Hiroshima University), video analysis of nine mathematics and science classes confirmed the practice of ASEI-PDSI in primary and secondary education classes. 3. In the teacher survey mentioned above (finding #1), 84% of primary school teachers and 78% of secondary school teachers reported that the use of ASEI-PDSI contributed to an "improvement in student motivation." 4. Interviews with school principals and senior teachers (18 primary schools and nine secondary schools) revealed specific results such as reduction in anxiety in math and science and improvement in curiosity, and for secondary education, an increase in the enrollment in science electives such as physics and improvement in students' understanding and grades.

Considerations (enacted in April 2004). CEMASTEA obtained the environmental impact assessment license in 2010, implemented an environmental management plan to meet the incidental conditions of the issuing of the license, and was certified in 2013 in the environmental audit conducted by the National Environmental Management Authority of Kenya for carrying out the environmental management plan such as noise control as planned. While there is a wildlife reserve near the project site, it was anticipated at the time of planning that the project would have little impact on the ecosystem of the reserve. Concerns in this regard were not expressed by CEMASTEA during the ex-post evaluation interview.

In terms of operating its new facilities, CEMASTEA attempted to establish good relations with the local community by providing landscape work such as tree planting, thoroughly informing facility users about the importance of conducting themselves in a proper way on the premises, and reducing the use of underground water by recycling rain water. Environmental measures and monitoring have been reported to the Environmental Management Authority each year, and, in 2016, for example, the Authority evaluated that CEMASTEA met 95% of the "environmental sustainability goals" it had set. Consequently, CEMASTEA has not received complaints from the neighbors.

The project did not involve relocation of residents or acquisition of lands.

(3) Designing barrier free facilities

The training building constructed in this project used a barrier free design. According to CEMASTEA, its facilities such as wheelchair accessible to restrooms and the buildings that allow wheelchair to travel to the highest floor have become the role model of barrier free public facilities, and have been visited by personnel from schools and other public institutions in Kenya.

A ramp at the facilities
The ramp allows wheelchair travel between the lecture building and laboratory, and between floors.

Wastewater treatment/water recycling plant in the facilities.
The treated water meets the quality standards set by the Environmental Management Authority without using chemicals except for chlorine.
The fence and plant pots made from recycled PET bottles were installed after the completion of the project to raise awareness among visitors.
The plant has been visited by attendees from as far as India during their training at the Kenya Water Institute.

As stated above, this project has largely achieved its objectives. Therefore, the effectiveness and impact of the project are high.

3.5 Sustainability (Rating: ③)

3.5.1 Institutional Aspects of Operation and Maintenance

CEMASTEA is responsible for its own operation and maintenance as it was at the time of planning. The supervising office in MOEST was the Field Service Department at the time of planning, but after the reorganization in February 2017, it was handed over to the Director General's Office for Field Coordination and Co-Curricular Activities that succeeded the function of the Field Service Department. According to MOEST, the reorganization did not affect the function, staffing, and the relationship with CEMASTEA.

The organizational structure of CEMASTEA has not changed. Of the 107 employees in total in 2016, 47 were academic staff including the director and vice director, and 60 were non-academic staff. The academic staff are responsible for operation management, module development, national INSET lectures, monitoring and evaluation of regional INSET, and research in mathematics and science education; although a total of 60 positions were originally created, with 15 positions in each of mathematics, physics, biology, and chemistry, the actual number of staff has declined because vacant positions after staff retirement have not been filled. Even though the operation is carried out by fewer than expected number of personnel, the staff size does not seem to be an issue because the understaffing did not hinder activities, and new projects, development and revision of modules, and other activities continue to be undertaken.[21]

Additional non-academic staff have been brought in as the result of the facilities expansion in this project. In the areas concerning the maintenance of the facilities and equipment of this project, five facilities maintenance personnel, four information and communication technology engineers, and three Science Laboratory assistants are currently assigned. While these personnel operate the facilities and equipment and conduct routine maintenance and minor repairs, regular maintenance and repairs are outsourced to professional service providers.

At the time of ex-post evaluation, the INSET policy to strengthen teachers' instructional abilities is being drawn up among MOEST, CEMASTEA, the Teachers Service Commission (an independent administrative agency that manages the employment of public school teachers and strengthening of teacher's capacity), and others; accompanying this policy discussion is a restructuring plan for the implementation agencies for INSET in Kenya. This plan would consolidate three existing bodies (CEMASTEA, the Kenya Education Management Institute,

[21] According to CEMASTEA, training on gender and integrity is commissioned to resource persons (external experts).

and the Kenya Institute of Special Education) into the Kenya School of Education, which, according to MOEST, will be formed by the end of 2017. According to CEMASTEA, the existing structure of CEMASTEA will remain intact under the changes in the plan, and it will continue to function as the specialized institution for math and science education (although a new name such as the Kenya School of Education CEMASTEA Campus is being considered). Further, a future plan is being considered to designate an existing teacher's college for primary education as the implementation body for non-math/science INSET and place it under the Kenya School of Education. The likelihood of CEMASTEA's continuation seems to be very high because CEMASTEA is the only organization that has experience and knowledge in INSET in individual subject areas.

As for the institutional setting for continued impacts of CEMASTEA in Africa, CEMASTEA is likely to remain as the center of intra-regional cooperation in mathematics and science, as it acts as the secretariat of ICQN-MSE and SMASE Africa.

Therefore, the institution of managing operation and maintenance is considered to be adequately established.

3.5.2 Technical Aspects of Operation and Maintenance

CEMASTEA is not facing any technical problems in operation and maintenance of its facilities as they are commissioned to outside agents except for routine maintenance and minor repairs. All personnel including the personnel in operation and maintenance receive a performance assessment and training in the organization. During the site visit by the ex-post evaluator, the person in charge of operation and maintenance provided thorough and accurate descriptions of individual facilities and equipment, demonstrating this person's adequate level of knowledge and experience. In addition, the evaluator observed that the instruction manuals and documentations for instruments and equipment were properly filed and were ready to be used.

In terms of the skills in conducting training and research, all academic staff have received technology transfer in the SMASE project, and have continued to engage in such activities as INSET in primary and secondary education (including updating of teaching materials and developing new modules), hosting of relevant conferences and workshops, training needs assessment with teachers, monitoring and evaluation of schools, research projects (including impact assessment), and continuation of intra-regional cooperation (TCTP, intra-regional conferences); they continue to upload some of the teaching materials and reports they create to the CEMASTEA website.

Therefore, this evaluation considers that an adequate technical level in operation and maintenance has been established.

3.5.3 Financial Aspects of Operation and Maintenance

The bulk of CEMASTEA's budget is allocated by MOEST and comes from the education budget within the national budget. The education budget has grown, even though its share in the national budget has decreased since the time of planning, and the share of general management expenses, which was criticized for being too high at the time of planning, has decreased (Table 8).

Table 9 shows CEMASTEA's budget. Although the budget is on an increasing trend, the expenses for training have fallen below the level before the project reflecting the fact that INSET in primary education is no longer administered nationally. On the other hand, the large increase in the development budget and training expenses for the Kenyan fiscal year (FY) 2015 reflected a change in the payment channel for the SMASE Fund in secondary education (SMASE INSET receives each year 1% of the capitation grant,[22] which is now paid to CEMASTEA rather than to individual schools as done in the past. According to CEMASTEA and local education offices, the change was welcoming because it directed the funds straight to SMASE INSET and eliminated the delay in payment to teachers who attended training. Although CEMASTEA has been requesting to MOEST for the creation of SMASE Fund in primary education in order to offer INSET in primary education in a national scale again, no development has taken place toward implementation. MOEST cites the availability of another INSET program in primary education other than the one provided by CEMASTEA as a factor for the lack of progress (although restricted to mathematics for early primary grades, EGMA will continue making INSET available nationally until March 2019; see Footnote 19).

With respect to the budget for the intra-regional cooperation in Africa, JICA is responsible, until JFY2017, for a portion of the training expenses for the TCTP, and continues its assistance on the training by dispatching an individual expert ("Regional Advisor"). Although there has not been any indication so far to suggest that the Kenyan government will foot the cost to continue the operation, this is not an issue because it has never been planned for the national government to independently continue the training for other African countries after the termination of JICA's TCTP. Other expenses for intra-regional cooperation would include the expenses for having meetings, but these expenses are expected to be covered through CEMASTEA and other member countries' own effort. A SMASE Africa meeting was held at CEMASTEA in November 2016 and collected fees from attendees, becoming the first intra-regional meeting that was held without financial assistance from donors.

It is, thus, reasonable to conclude that the financial aspects of operation and maintenance are adequately sound even though the funding for INSET in primary education remains to be further improved.

[22] Capitation grant = (unit amount) x (the number of enrolled students in each school)

Table 8: National budget and education budget (Unit: million KSh)

	FY2013	FY2014	FY2015
Total expenditure	1,532,993	1,950,709	2,223,980
of which, education	253,632	301,448	319,426
% of expenditure	17%	15%	14%
Breakdown of education expenditure			
Administration	171,104	181,711	193,218
Pre-primary and primary education	16,770	21,165	22,620
Secondary education	23,056	30,861	34,053
Higher education	40,436	60,471	62,255
Others	2,266	7,240	7,280

Source: Kenya National Bureau of Statistics
Note: The average exchange rate used by JICA in 2015 was 1 KSh = 1.22 yen.

Table 9: CEMASTEA budget (audited)

(Unit: thousand KSh)

	FY2010	FY2013	FY2014	FY2015
Revenue				
From national recurrent budget	71,433	106,935	106,432	104,824
From national development budget	200,000	97,374	155,801	586,023
Others (1)	27,969	6,638	16,779	13,391
Total	299,402	210,947	279,012	704,238
Expenditure				
Personnel	7,912	21,252	27,351	32,392
Training	259,858	117,464	134,754	530,183
Others including maintenance of facilities and equipment	75,721	79,259	122,677	128,272
Total	343,491	217,975	284,782	690,847

Source: Preparatory Survey Report (FY2010); documentation provided by the executing agency.
Note: (1) Other donors including JICA; income from rent; etc.

3.5.4 Current Status of Operation and Maintenance

The site visit during ex-post evaluation confirmed that the facilities and equipment enabled by this project are in good condition. CEMASTEA was certified on ISO 9001:2015 (quality management by an organization) by the Kenya Bureau of Standards, and the organization's documentation such as the maintenance records revealed that the maintenance has been managed according to the requirements. According to the documents at the time of planning including the Preparatory Survey Report, the facilities enabled by this project were designed to do away with advanced systems and complex specifications to achieve the ease of maintenance; as mentioned above, maintenance work except for routine maintenance and minor repairs are commissioned to outside vendors. According to CEMASTEA, expired parts such as the fuel pump on the generator have been properly replaced.

Based on the evidence, the status of operation and maintenance is free of any major problems.

Overall, no major problems have been observed in the institutional, technical, financial aspects as well as in the current status of the operation and maintenance system. Therefore sustainability of the project effects is high.

4. Conclusion, Lessons Learned and Recommendations

4.1 Conclusion

This project aimed to strengthen training and related activities for teachers, trainers for teachers and education administrators by expanding the facilities of CEMASTEA, which is the

implementing agency of INSET in mathematics and science in primary and secondary education in Kenya and serves as a center of the training for promotion of mathematics and science education in Africa. The relevance of these objectives is high, as they were consistent with Kenya's and intra-regional development policies and development needs as well as with Japan's ODA Policy with respect to strengthening teachers' capacity. The effectiveness and impact are evaluated to be high. By utilizing the facilities and equipment delivered by this project, the expected level of quantitative expansion of training was realized overall, missing the target only slightly. In addition, as the result of the improvement of the training and operation environment, the enhancement in the comfort and efficiency of training was confirmed. Coupled with the output of SMASE Phase 3 implemented almost simultaneously, the activities of CEMASTEA have contributed to the continuation and further development of INSET in mathematics and science in Kenya as well as to the incorporation of the contents of the CEMASTEA training into mathematics and science education in other African countries.

The project's efficiency is evaluated to be fair. While the increase in the project cost was justifiable considering the increase in the outputs, the project period was longer than planned. The sustainability of the project's effects is evaluated to be high, as no major problems have been observed in the institutional, technical and financial aspects of operation and maintenance of the CEMASTEA facilities as well as the implementation of training.

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

4.2 Recommendations

4.2.1 Recommendations to the Executing Agency

None.

4.2.2 Recommendations to JICA

Since CEMASTEA is expected to remain as the center of intra-regional cooperation in Africa by serving as the secretariat of ICQN-MSE and SMASE Africa after the completion of JICA's TCTP in JFY2017, JICA should maintain close contact with CEMASTEA. JICA should also continue dispatching a senior volunteer to CEMASTEA and maintain cooperative relations by co-hosting conferences to exchange information and opinions on math and science education.

4.3 Lessons Learned

(1) Effective coordination of technical cooperation projects and facilities development

This project stands as a good example in which the sustainability of project impacts was realized because the facilities were delivered at the right moment when the technical cooperation succeeded in strengthening the capacity. Specifically, CEMASTEA's status as the

country's education agency has risen as a result of the facilities improvement, which matched the central role it began to play in education after receiving technical cooperation. Moreover, the timing allowed the executing agency to put the knowledge transferred in the technical cooperation project to practical use while operating the facilities with a high degree of ownership from the very start.

The sequence between the technical cooperation and the ensuing facilities development worked well in this project because the technology transfer, which was part of the overall plan that targeted basic education in mathematics and science, did not require advanced systems or complex specifications, nor did this grant aid project introduce sophisticated equipment (if it did, the project would have necessitated specific technology transfer for introducing such equipment).

(2) Building facilities in harmony with the local community

Even though the lack of consent from the nearby residents initially prevented the project from being launched when the first exchange of notes was signed in 2006, this project avoided causing friction with the local community by consulting with the residents and making such efforts as providing landscape work like tree planting, thoroughly informing facility users about the importance of conducting themselves in a proper way on the premises, and reducing the use of underground water by recycling rain water. Thus, as it happened in this project, smooth implementation and administration would ensue by incorporating, at the time of project planning, such processes as locating the source of anxiety and concern among the residents and undertaking measures to address potential issues (in case of this project, deterioration of the environment in the surrounding area and lowering of underground water level by excess use had been the issues of particular concern) upon adequate discussion between the executing agency and the local community.