終了時評価調査結果要約表（英文）

<table>
<tr><td colspan="3">I. Outline of the Project</td></tr>
<tr><td colspan="2">Country: The Republic of Sierra Leone</td><td>Project title: The Project For Capacity Development For Maintaining Power Supply Facilities</td></tr>
<tr><td colspan="2">Issue/Sector: Electricity</td><td>Cooperation scheme: Technical Cooperation Project</td></tr>
<tr><td colspan="2">Division in charge: Electric Power Division II, Natural Resources and Energy Group, Industrial Development and Public Policy Dept.</td><td>Total cost: As of September 2013
4.38 million US dollars</td></tr>
<tr><td rowspan="2">Period of Cooperation</td><td rowspan="2">(R/D) : March 2011 to March 2014
(Extension) : April 2014 to September 2015</td><td>Partner Country’s Implementing Organization: Ministry of Energy (MOE) , National Power Authority (NPA)</td></tr>
<tr><td>Supporting Organization in Japan: Yachiyo Engineering CO., Ltd.</td></tr>
<tr><td colspan="3">Related Cooperation: Development Study “The Master Plan Study on Power Supply in Western Area” (July, 2008 - December, 2010) , Grant Aid “The Project for Improvement of electricity power supply to greater Freetown” (2007 - 2010) , Dispatch of Expert: Power Development Plan Advisor (2009 and 2010) , Grant Aid “Project for Urgent Improvement of Power Distribution System in Freetown” (2013 onwards) , and Technical Cooperation of “The Project on Electrical Engineers Training for African Countries (EETA) ” (November 2010 – July 2016)</td></tr>
<tr><td colspan="3">1-1. Background of the Project
Since the civil war ended in 2002, the economy of the Republic of Sierra Leone (hereinafter referred to as “Sierra Leone”) has been gradually recovering with an annual GDP growth rate of 15% (World Bank, 2012) . Coupled with the economic growth, the power demand has been increasing mainly in Western Area, where the capital city, Freetown, is located. Most power generation facilities, however, could not be operated continuously due to deterioration since those were not maintained timely in difficulty of spare parts supply and other reasons caused by the influence of the civil war. Transmission and distribution system could not be replaced after the civil war and accordingly became obsolete. There was a shortage of NPA staff for operation and maintenance (O&M) of the power facilities, thus the power supply facilities were not efficiently utilized. The power demand was estimated to be about 41MW (official figure was 50 MW), while the power supply capacity was 15MW (official figure was 25MW) . This implies the absolute power deficit was 26 MW, and also there was high system loss because of obsolete transmission and distribution facility. In order to improve this situation, through grand aid projects, Japan supported to extend the distribution lines, development of facilities in Regent substation, and construction of power generation facilities at Kingtom power station (Diesel, 10 MW) . Other donors such as the World Bank also supported development of Bumbuna Hydro Power Station, transmission and distribution facilities, and so forth. With these supports, the power supply has been improved in the capital area.
National Power Authority (NPA) of Sierra Leone operates and maintains the almost all power generation facilities in Free Town area, however, did not have experience of planned O&M and could not allocate sufficient O&M cost because of chronic financial deficit together with the lack of NPA technical staff in terms of their number and quality. Therefore, as well as construction and replacement of 1) power generation and 2) transmission and distribution (T&D) facilities, it was imperative to develop the capacity of NPA in</td></tr>
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planning, operating and maintaining the power supply facilities. In this situation, the government of Sierra Leone requested to Japan to support to develop properly the O & M capacity of NPA staff in charge of power generation and T&D facilities.

In accordance to the request above, JICA conducted Detailed Planning Survey and launched the Project in March 2011. Terminal Evaluation Survey was conducted 6 months prior to project termination in order to aim to verify the progress of the Project activities, evaluate the results of the Project, review the duration and contents of the Project, and draw lessons learned to other similar projects. In addition to the above, the mission evaluated the effects of the stable power supply supported by 10 MW (Grant aid "the Project for Urgent Improvement of Electric Power Supply System in Freetown") to Sierra Leone in the transit phase from reconstruction to development in light of the project evaluation on post-conflict countries and areas.

1-2. Project Overview

The Project aims to develop the basis of daily operation of power generation, transmission and distribution work by NPA in the capital area of Freetown and to develop the capacity of maintain power supply facilities through development of planning and implementing capacity of O & M by technical and management capacity development of power generation, transmission and distribution system, and thereby to contribute to improvement of power supply service.

(1) Overall Goal

Power supply service of NPA is improved.

(2) Project Purpose

Capacity of National Power Authority to operate and maintain diesel generation facilities, and transmission and distribution systems is developed.

(3) Outputs

1. Business Infrastructures to conduct technical work of diesel generation, and transmission and distribution systems in Western Area are developed.
2. Technical and management capacity to operate and maintain generating facilities in Western Area is developed.
3. Technical and management capacity to operate and maintain transmission and distribution systems in Western Area is developed.
4. Technical capacity to plan and manage operation and maintenance work for generation, and transmission and distribution systems is developed.

(4) Inputs (as of September 2013)

Japanese Side:

1) Short-term Experts: 15 experts (51 times, 76.8MM in total)
2) Trainees in Japan / the Third country: 13 persons
3) Equipment: Foreign Currency: 3,975 US dollars, 15,760,449 JPY
   Local Currency: 115,943 thousand Le
4) Local Cost: 59,016 thousand JPY

Sierra Leonean Side:

1) Counterpart: 51 persons

2) Land and Facilities: Project office space and facilities in NPA headquarters, Kingtom Power Station, and Falcon Bridge Substation

3) Local Cost: Project office administration and equipment cost 41,055 thousand Le

II. Evaluation Team

Member of Evaluation Team	Team Leader	Mr. Hiroshi SUMIYOSHI	Senor Resident Representative, Ghana JICA Office
	Evaluation Planning	Mr. Katsuya KUGE	Deputy Director, Electric Power Division, Industrial Development and Public Policy Department, JICA
	Evaluation Analysis	Ms. Risako IMAI	Evaluator, Kokusai Kogyo CO., Ltd.
Period of Evaluation	14/September/2013～29/September/ 2013		Type of Evaluation: Terminal Evaluation

III. Results of Evaluation

3-1. Current Achievement of the Project

(1) Likelihood of Achievement of the Project Purpose

In-class training and OJT by the Project has been improving technical and management capacity of NPA staff at individual level, which resulted in the improvement of O & M capacity on power generation, transmission and distribution system. For instance, NPA staff has formulated yet O&M plan for generation based on those trainings and guidance by Japanese experts and conducted 4,000 Hour and 8,000 Hour maintenances. As to T&D division, 1) NPA completed listing up of facilities of T&D, 2) checked the current conditions (equipment diagnosis and load shedding) in 250 secondary substations to formulate upgrade plan, and 3) completed system diagram in western area supported by Japanese experts. Nevertheless, the generation division was affected greatly by the frequent breakdowns of Bumbuna Hydro Power Station so that periodical maintenance was carried out ahead of schedule. The level of NPA staff has not reached to implement periodical maintenance such as 12,000 Hour and 16,000 Hour yet since they requires more advanced technically than what NPA conducted before. For T&D division, it is currently difficult to implement maintenance plan as scheduled at the mercy of daily breakdowns of degraded facilities and equipment and frequent accidents in distribution system in Freetown. It is thus hard for NPA's own capacity to implement O&M plan both in generation and T&D in six months by the termination of the Project. Regarding forced outage rate of the generators, statistical data for electric outage has been collected and its analysis is in process. Therefore it is possible to make a comparison between the data of the beginning of the project and that of the the project termination.

(2) Current Achievement of the Outputs

By the time of the Terminal Evaluation in September 2013, Output 1 was almost achieved. As for Outputs 2 and 3, while technical and management capacity was judged to be improved through in-class training and OJT, some activities such as data collection of forced outage ratio were just initiated, slightly delayed in the plan, although O&M manuals are to be created in the rest of the Project period, it is difficult to complete those manuals at the appropriate level. As to Output 4, information sharing was improved through Management

Group (MG) and Technical Management Team (TMT) meetings ; however, it is necessary to strengthen further their function to support and instruction more properly from management side during the remaining project period. In addition, submission timing and quality of the periodic reports have to be achieved by reinforcing the activities for them. On the other hand, it is necessary to review and clarify the indicators for Outputs to monitor the progress and evaluate the achievement more properly.

Furthermore, it is not possible to complete information sharing, establishment of monitoring system and its continuous utilization between generations and substations within the project period. At the time of terminal evaluation mission, a tender for monitoring system is to be held in January 2014, arrival of its equipment in October 2014, and then completion of installation, test drive, and operation guidance are to be done in December 2014.

(3) Progress towards Overall Goal

At the time of Terminal Evaluation, it was not calculated the reduction rate of voltage drop yet, however, the data of voltage drop had been accumulated since the beginning of the project. In terms of number and duration of power outage, it is difficult to achieve project purpose in six months as stated in 3-1 (1) as above, therefore it is the same in overall goal as project purpose unless the duration of the Project is extended.

3-2. Summary of Evaluation Results

(1) Relevance

Relevance of the Project is high, and this is likely to be maintained until the project completion and from then on.

The Project is consistent with the development plan and policy of Sierra Leone as improvement of power supply is prioritized issue in long-term plan "Vision 2025" formulated in 2003 and also Poverty Reduction Strategy Paper II (PRSP II) from 2009 to 2012. O&M capacity development in power generation, transmission and distribution system is also relevant to the needs of NPA and the Government of Sierra Leone. The project approach and design are appropriate since it targets all level of NPA staff and divides the capacity development phase from update the inventory of power generation, transmission and distribution facilities, analytical skill development through in-class training and OJT, and finally O&M plan formulation and implementation capacity development. In terms of project evaluation on post-conflict countries, it was right timing to implement the Project for continuous electricity supply as a result of dividend of peace, which the people of Freetown were aware of consolidation of peace.

The Project is also relevant to the Japanese Official Development Assistance Policy towards Sierra Leone on the basis of 'economical and human resource infrastructure towards moving forward in development' by focusing on 'infrastructure building' and 'enforcement of human resource infrastructure'.

(2) Effectiveness

At the time of the Review, effectiveness of the Project is still low. It is unlikely to achieve the Project Purpose by the end of the Project.

Effectiveness of capacity development was confirmed through some outputs, such as the updating inventory (equipment and facilities) and capacity development through in-class and OJT trainings. However Outputs 2 to 4 are still in an initial stage. Since July 2012, those activities were done such as launch of pilot project,

8,000 Hour/ 12,000 Hour overhauls for power plants, drafting the O&M plans and manuals, and improvement of O&M reports. Regular meetings of both generation and T&D had been constantly held, however meetings at management level had not been regularly held. Regarding Kingtom power station, it will be strengthened though higher level class-room trainings by Generation expert together with OJT electrical parts to generation by Electrical expert. Then it is expected that T&D shall learn more on OJT through pilot implementation on NPA's own capacity. Thus, it is necessary to make further efforts for NPA to develop the capacity through these activities towards achievement of outputs and project purpose.

Moreover, it is not negligible to consider that the operational conditions of Bumbuna Hydro Power Station (load to Kingtom Power Station in its breakdowns) which were added to important assumptions of both project purpose and outputs. Although Bumbuna was expected to produce stable power supply during the rainy season, it had been broken down often since its operations in 2010. This affected the Project tremendously so that periodical maintenance of overhauls was forced to set earlier than planned. Therefore it should be considered to monitor Bumbuna's operations as assumptions not to delay the procurement process as scheduled. As of September 2013, one of two generators in Bumbuna was broken down.

(3) Efficiency

Efficiency of the Project is fair by the time of the Terminal Evaluation.

By the time of the Evaluation, the inputs by both Japan and Sierra Leone sides were almost done as planned. For the Japanese side, dispatch of the Japanese experts was reviewed as appropriate to conduct the activities and to produce the outputs as planned. For the Sierra Leonean side, allocation of personnel and facilities was as planned, and MG and TMT contributed to more smooth activities. However, in order to assure the project activities as scheduled in the remaining period of time, however, tremendous commitments by TMT for monitoring and allocation of budgets are necessary especially for O&M both in generation (overhauls of 12,000 Hour and 16,000 Hour maintenance) and T&D (installation of distribution network system) . To strengthen supports by the TMT, it shall be significant to involve the Minister of Energy to the Project for the MOE to provide leadership at policy level.

In terms of cooperation with other projects, the following projects worked effectively with the Project ; 1) Grant aid "Project for Urgent Improvement of Power Distribution System in Freetown, 2) Distribution network project proposed to both World Bank and Islamic Development Bank. Onwards 2014, It is planned to send a couple of NPA staff every year as trainees to The Project on Electrical Engineers Training for African Countries (EETA) for strengthening Electric Company of Ghana (ECG) training center.

(4) Impact

The impact level is medium at the time of the Terminal Evaluation.

The Overall Goal is unlikely to be achieved because it is dependent directly on financial issues of NPA which have not been solved although several positive impacts appeared already as a result of the Project implementation.

It is a notable achievement that the Project provided power supply continuously through operation of Kingtom power station where Japanese expert stationed. The Kingtom power station is the sole station which provided electricity to the citizen of Freetown all through the presidential election, which resulted in the stable political situations. It is significant to provide political stability in evaluation of projects in post-conflict

countries and areas in terms of dividend of peace.

The results of questionnaires in pilot area in George Brook Community revealed that 72% of the community is satisfied with the implementation of this Pilot Project and they look forward to the completion of the Pilot Project aiming the reduction of voltage drop in the area. Such positive impacts were confirmed that 1) Education (increase in time of study at night), 2) Better communication (mobile phone), 3) Entertainment (TV), 4) Improvement in area security (street lighting) and 5) Increase in income (small enterprises) . It is anticipated that technical transfers in loss reduction and voltage drop through implementation of the Pilot Project.

Regarding financial situations of NPA in terms of Important Assumptions of the PDM, it is notable that 2 million dollars were allocated for the maintenance of generators.

(5) Sustainability

Sustainability of the Project is medium from the following aspects.

1) Policy /institutional aspect

For the Government of Sierra Leone, political support for improvement of electric power supply will be continuously committed in the future as the National Electricity Act was enacted in December 2011 to improve the performance of the energy sector. However it is necessary to consider the possibility of restructuring of the power supply business in accordance with the National Electricity Act.

2) Organization aspect

Equipment was provided in the Project such business infrastructure as PCs, printers and internet access in Generation and T&D as well. The Evaluation Team confirmed attitude changes in C/Ps and well-established regular meetings both Generation and T&D on a weekly basis, which resulted in the bottom up of the organizational capacity of NPA. On the other hand, more proactive attitude of TMT is required to get involved in the Project.

In a short term period, there is no negative factor which might affect the capacity for O&M in terms of organization aspect of NPA. However, the Project might be affected in terms of its sustainability if NPA is divided into two entities: the Electricity Generation and Transmission Company and the Electricity Distribution and Supply Authority, as mentioned in the National Electricity Act. According to the progress of this reorganization during the remaining period of the Project, it is necessary to confirm between the Japanese and Sierra Leonean sides how the Project should be incorporated into it in order to assure the sustainability.

3) Technical aspect

The commitment of NPA personnel for improving the technical capacity of the O&M is admitted, and the technical transfer at the Project sites was most likely sustainable. NPA's capacity to formulate and manage O&M plan by their own capacity both Generation and T&D is unlikely to reach the appropriate level in six months, therefore it is necessary for NPA to be supported by the Japanese experts in terms of technical assistance after the Project termination. Unless the monitoring function and allocation of budget are further strengthened at the NPA head office in the remaining period of the Project, it is hard to secure the effectiveness and its sustainability.

4) Financial aspect

Under the current financial constraints, NPA has a difficulty to allocate sufficient budget for O&M (overhauls of generators, checkup and repairs of auxiliary machine such as purifiers, maintenance of monitoring of power supply system and so forth) . Capacity development of technical personnel in NPA was confirmed ; however it is required to encourage TMT (managerial personnel) by leadership of MOE in budgetary arrangements.

In November 2013 after the Evaluation Team left Sierra Leone, it was confirmed that a loan agreement with Islamic Development Bank would be launched for the rehabilitation plan for distribution and transmission lines in Freetown in total amount of 10 million dollars.

3-3. Promoting Factors

(1) Elaborated Needs Assessment

Based on the accumulated experiences from the related projects in the past and elaborated needs assessment in the planning phase, the project approach was designed properly and highly coherent to the needs of the Project site.

(2) Implementation Process

One of the promoting factors to achieve the capacity development through OJT /class room trainings, core NPA staff committed themselves to those trainings and they motivated other personnel at the same time. Secondly the Japanese experts were deployed at Kingtom power station and Falcon Bridge Substation respectively for longer period, more than 6 months per year, and they provided NPA staff on daily basis to support ordinary work at NPA power station and substations. Longer assignments contributed to NPA's capacity development and smooth communications between JET and C/Ps in the Project.

3-4. Hindering Factors

(1) Important Assumptions and Project Period

It was not anticipated that Bumbuna Hydro Power Station would be frequently broken down at the time of project formulation of this technical cooperation. Actually faulty conditions of Bumbuna exhausted Niigata No.7 and No.8 at Kingtom Power Station and advanced periodical overhauls earlier than scheduled in O&M plan. Therefore it was decided to add Bumbuna's operational conditions to important assumptions in PDM version 3.

Besides, this project proved that it would require longer time to develop human capacity in post-conflict countries than in other countries because there had been a lot of drains of core human resources in those countries that experienced conflicts/civil wars.

(2) Implementation Process

As for slight delay in O&M planning, manuals, and periodical maintenance, it is attributable to the lack of driving force by NPA's ownership to promote O&M activities above. Budget allocation to those activities must be strengthened by TMT at NPA head office in a timely manner, and MOE must be also encouraged by Japanese side for the MOE to acquire enough budgets for the smooth implementation of the Project.

3-5. Conclusion

The Project Purpose is unlikely to be achieved by the time of the project completion. Therefore it is

appropriate to extend the project period for one and half years.

Relevancy of the Project is high since the Project is consistent with the development plan and needs of both Sierra Leone and the Japanese ODA policy. Effectiveness and efficiency are both medium at this time, therefore it is hard to achieve aimed Outputs for the following reasons ; as to Generation, 1) it is difficult to conduct periodical maintenance as scheduled due to the fact that NPA power stations are affected directly by the frequent breakdowns of Bumbuna hydropower station, or major power suppliers in Freetown, and 2) the need of advice and guidance by the Japanese expert for overhauls of at least 12,000 hours and 16,000 hours (scheduled in 1.5 years later) arose as the result of lack of core personnel together with aging workforce at NPA that takes more time for human resource development. Also in T&D, it is not possible to complete information sharing, establishment of monitoring system and its continuous utilization between generations and substations (Indicator 4-5) within the project period. At the time of terminal evaluation mission, a tender for monitoring system is to be held in January 2014, arrival of its equipment in October 2014, and then completion of installation, test drive, and operation guidance are to be done in December 2014. Thus, it is necessary and appropriate to extend the Project period in one year and half.

Both Japanese and Sierra Leonean sides shall make maximum efforts to achieve the Project Purpose in the remaining and extended period of the Project by using 2 million dollars for generators maintenance as well as 50 new technical staff. Regarding Effectiveness, Efficiency and impact of the Project, important assumptions were added in PDM. Sustainability of the Project is likely to be high in policy level, however financial and organizational aspects are likely to be medium at the time of the Terminal Evaluation.

Lastly, the following were approved to be inserted to PDM version 3 in M/M on 25 September 2013.

(1) Extension of the project period

March 2011 to March 2014 (3 years) → March 2011 to September 2015 (4.5 years)

(2) Insert of Important Assumptions to Project Purpose and Outputs

As stated in 3-2 (2), “The discharge of Bumbuna Hydro Power Station is stable as the same level or higher than that of September 2013.” were added to Project Purpose and Outputs respectively in Important Assumptions columns.

(3) Changes in Indicators of Output 2 and Output 3

The number of targeted engineers and technicians were increased in accordance with the extension of the Project period as shown below.

Former indicator: Output 2-1. Approximately 25 of them (NPA engineers and technicians) are trained.

Revised indicator: Output 2-1. Approximately 40 of them (NPA engineers and technicians) are trained.

Former indicator: Output 3-1. Approximately 50 or more of them (NPA engineers and technicians) are trained.

Revised indicator: Output 3-1. Approximately 70 or more of them (NPA engineers and technicians) are trained.

3-6. Recommendations

(1) <u>Enhancement of the Function of Technical Management Team</u>

In order to achieve the Project Purpose, the remaining activities should be progressed further in both generation and T&D. Therefore it is recommended that TMT shall get more involved in monitoring the

progress of the Project, and provide timely support particularly for procurement of spare parts of O&M for both generation and T&D.

(2) Improved O&M Plan and its Implementation

One of the critical activities in order to achieve the Project purpose is drafting O&M manuals and plans ; however, the activity is in progress. It is recommended that NPA draft the plans and manuals, tentatively implement O&M accordingly, and revise them at least once in the remaining Project period. Therefore, it is necessary for NPA staff to complete drafting plans and manuals in a timely manner and make first drafts by the beginning of 2014.

(3) Securing Financial Resources

In case the financial condition of NPA is not improved in a short-term, it is necessary to secure financial resources by not only TMT but also the strong leadership of Minister of Energy. Japanese Expert Team is expected to be supported logistically by JICA Ghana Office and Sierra Leone Field Office as well in order to progress the Project effectively and efficiently.

3-7. Lessons Learned

The following are the lessons learned from the Project to other JICA projects (incl. project evaluation aspects of post-conflict countries and areas) .

(1) Provision of Stable Electricity and Economic Growth

Sierra Leone is in transition stage from reconstruction to development, and economic growth and employment are major challenges. In this context, it was significant to implement the Project that contributes to providing stable and cheaper electricity to support the economic growth of private sector. It is required to provide swift action towards provision of electricity in the early stage of reconstruction. Besides, provision of electricity is seen as dividend of peace that can see in reality, which also get the citizen who experienced the civil war aware of consolidation of peace.

(2) Quick Recovery of Power Supply Facilities in Reconstruction Stage

For the countries in the reconstruction stage, electricity consumers are dependent on off-grid power system like diesel generators since most power supply facilities such as generators, transmission and distribution lines were attacked, damaged, dilapidated or not possible to use in other reasons. The high-speed diesel generators cause high cost, therefore new installation of power supply facilities is urgent issue after the conflict/a civil war is over. In this stage, those countries in post-conflict cannot afford to implement large scale development project such as hydro power development and construction of thermal power plant, thus the needs of diesel generators become higher because of relatively low initial cost. Also the needs of rehabilitation and update/ extension of transmission and distribution lines are high, which requires a large amount of investment. In this context, it is necessary to use grant aid scheme and provide quicker installation of power supply facilities, at the same time, master plan of the target area should also be supported through efficient coordination among development partners.

(3) Strengthening Capacity of Power Supply Facilities

All sector lacks in core human resources who have higher education and experiences in post-conflict

countries, therefore it is essential to provide technical cooperation of human resource development as well as grant aid by installing power supply facilities towards stable power supply in the area. Especially O&M components are to be strengthened by technical cooperation alongside the grant aid project. In most cases, newly recruited personnel are rarely available in this situation of drains of human resources. In case of Sierra Leone, thus NPA was requested by Japanese side to hire new staff for sustainable O&M of power supply facilities.

On the other hand, newly hired human resources have not been always received education in a good quality due to the split of time caused by the conflict/civil war. In this situation, it should be considered to set the cooperation period not as the same level as other project, but longer period of the Project is appropriate. Additionally, granted power generators shall be designed for the recipient to conduct periodical maintenance easily by their own capacity.

(4) Budget for O&M

In general, financial situation of power supply company in post-conflict countries has been fragile for a long time In this situation, the Project prioritized to provide continuous electricity supply by supporting NPA financially in procurement of relevant equipment and fundamental tools. Therefore it is significant to stress the importance of strong leadership by Minister of the Energy in securing enough budgets for procurement of O&M spare parts at the phase of the project formulation.

(5) Way Forward to Reduction of Generation Cost and Electrical Loss

Electricity business in a post-conflict country is generally in a negative circle of deficit balance that is caused by 1) costly high speed diesel generation and 2) a large amount of transmission and distribution losses using dilapidated colonial era's facilities. Moreover, the rate of tariff collection is lower due to the poor quality of electricity because the electricity is frequently faulty, which does not meet consumers' needs. It should be carefully decided whether the post-conflict country will have an IPP contract to purchase electricity. Due to the country risk doing in business in the post-conflict area, IPP tends to put this risk on top of the electricity selling prices. Electricity is of public nature ; in fact, it is not a sustainable measure to adopt IPP system in the financial deficit situation. In this context, it is most important to reduce electricity losses and simultaneously improve cost reduction of power generation for future investment environment.