

**Ex-Post Project Evaluation 2019:
Package IV-4 (Tunisia, Indonesia, India)**

September 2020

JAPAN INTERNATIONAL COOPERATION AGENCY

OPMAC Corporation

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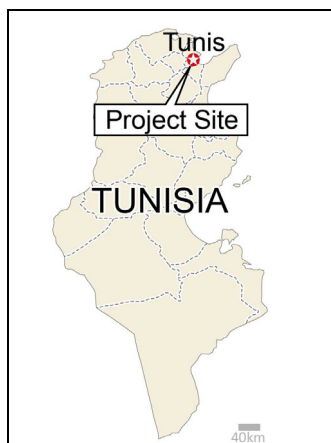
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Country Name	Metropolitan Railway Electrification Project (I)(II)
The Republic of Tunisia	



Project Site



Electrified train procured by the Project at Borj Cedria Station

I. Project Outline

Background	<p>One of the objectives of the <i>Ninth National Development Plan (1997-2001)</i> in Tunisia was infrastructure development, focusing on the communication and transportation sectors as a priority. In the transportation sector development plan, the reduction of urban traffic congestion was one of the key areas identified as an investment target, due to rapid urbanization and population growth in the Tunis metropolitan area. The development of the railway network as urban public transportation in this area was regarded as a critical issue, together with restructuring the National Railway Company of Tunisia (Société Nationale des Chemins de Fer Tunisiens: SNCFT, hereinafter referred to as “SNCFT”) and upgrading the main railways of inter-urban areas. The Tunis metropolitan area, which has a population of approximately two million (1999), is the center of the country's economy, society, and public administration. The increasing population led the metropolitan area to expand rapidly, causing rush-hour traffic congestion coupled with serious environmental degradation. There was a need to take immediate countermeasures for these problems.</p>
Objectives of the Project	<p>The objective of the project is to respond to the increasing transportation demand in the southern part of the Tunis metropolitan area, by the electrification of the 23 km railway (Tunis – Borj Cedria), thereby contributing to the reduction of traffic congestion and to the alleviation of air pollution.</p>
Contents of the Project (Actual)	<ol style="list-style-type: none"> (1) Procurement of train cars (80 cars) (2) Electrification of the 23 km railway between Tunis and Borj Cedria (3) Development of related facilities (signal lights, tracks, facilities, and civil engineering) (4) Consulting services <div style="text-align: right;"> <p>Source: SNCFT</p> <p style="text-align: center;">Stations of Southern Suburb Railway Line</p> </div>
Loan Approved Amount/ Disbursed Amount	<p>(I) 13,171 million yen / 12,900 million yen (II) 4,596 million yen / 4,503 million yen</p>
Exchange of Notes Date/ Loan Agreement Signing Date	<p>(I) December 20, 2000 / February 7, 2001 (II) March 10, 2010 / March 11, 2010</p>
Terms and Conditions	<p>(I) Interest Rate: 1.40%; Repayment Period: 25 years (Grace Period: 7 years); Conditions for Procurement: Untied (II) <Main Portion> Interest Rate: 2.2%; Repayment Period: 25 years (Grace Period: 7 years); Conditions for Procurement: General Untied <Consulting Service Portion> Interest Rate: 0.75%; Repayment Period: 40 years (Grace Period: 10 years); Conditions for Procurement: Bilateral Tied</p>
Borrower / Executing Agency	<p>The Government of the Republic of Tunisia / Société Nationale des Chemins de Fer Tunisiens (SNCFT)</p>
Disbursement Completion	<p>(I) September 2011 (II) January 2018</p>

Project Completion	April 2012
Target Area	Tunis Metropolitan Area
Main Contractors	ALSTOM Transport (France) – Ansaldo (Italy)
Main Consultants	Nippon Koei (Japan)-JRC (Japan)-SCET (Tunisia)

II. Result of the Evaluation

Summary

The project responded to the increasing transportation demand in the southern part of the Tunis metropolitan area, thereby contributing to the reduction of traffic congestion and to the alleviation of air pollution. Transportation capacity was strengthened as train operating rate after railway electrification achieved 80% of the target, and annual running distance of train exceeded the target. The introduction of the new vehicles has also had a qualitative effect in terms of improved transport services and safety. Intended impacts were realized since traffic congestion would have been worse in the Tunis metropolitan area without the project; also, the shift of energy from diesel oil to electricity resulted in CO₂ emission reduction and the alleviation of air pollution. Therefore, effectiveness and impacts of the project are high. However, transportation capacity has been on a relative downward trend since 2017 because some trains have been out of service due to recent train collisions and the number of operating trains cannot be increased due to track deterioration. Efficiency is fair because the project period significantly surpassed the original schedule. The project is sustainable from policy, institutional, and basic technical perspectives. However, at the time of the ex-post evaluation, there are some concerns on perspective on financial aspect since sufficient budget is required to allocate to fix damaged vehicles and replace obsolete railway tracks in order to maximize the use of the train system and then to improve the transportation volume. In addition to avoiding train collision accident, further assured safety measures need to be taken continuously. As a result, sustainability of the project is evaluated to be fair. Considering all of the above points, this project is evaluated to be satisfactory.

Overall Evaluation¹	B	Relevance	③ ²	Effectiveness & Impacts	③	Efficiency	②	Sustainability	②
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<Special Perspectives Considered in the Ex-Post Evaluation>

- In this project, an additional loan was provided because the prices of materials such as steel increased worldwide around 2007. In evaluating efficiency in terms of costs, the actual cost was evaluated in comparison to the total project cost at the time of the provision of the additional loan. The project period was analyzed in comparison to the original schedule at the time of the first project appraisal since there were already significant delays in the detailed design survey before the additional loan.
- At the time of the ex-post evaluation, the project cost had not yet been paid in full to the contractor by the Tunisian side. The unpaid amount did not seem to affect the evaluation rating; therefore, the project cost was evaluated based on the total cost as of February 2020.
- Commencement of railway operations was April 2012, whereas the ODA loan disbursement completion was January 2018. The payment was delayed due to a dispute over the payment amount and specifications of the work between SNCFT and the contractors.

1 Relevance (Rating: ③ High)

<Consistency with the Development Plan of Tunisia at the Time of Ex-Ante Evaluation>

The project is consistent with the development policy at the time of the ex-ante evaluation. In the *Ninth Five-Year National Development Plan (1997-2001)* transportation infrastructure development was stated as one of the key areas of focus; the suburban line in the southern part of the Tunis metropolitan area, included in this project, was prioritized as part of the railway sector development. In the *Tenth Five-Year Plan (2002-2006)* and *Eleventh Five-Year Plan (2007-2011)*, railway development in the Tunis metropolitan area continued to be a high priority as part of public transportation network development, which included buses and other means of transportation. In 2005, the government consolidated a policy for developing an express railway network that connected the center of Tunis and the suburban areas, and this project was recognized as one of the important projects in the initial stages of the development.

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

The project is consistent with the development needs at the time of the ex-ante evaluation. The population of the Tunis metropolitan area is approximately 2.39 million (as of 2008), with a population growth rate of 1.5% per year. It is the center of the economy, society, and public administration in Tunisia. Due to geographical constraints, the increasing population led the metropolitan area to expand rapidly to the north and south, causing serious rush-hour traffic congestion problems and environmental aggravation. The number of private automobiles per 1,000 people rose from 60 in 1994 to 100 in 2002 due to a relaxation of the automobile import regulations, etc., at that time. Moreover, the traffic volume was predicted to rise by 2.6% per year by 2021, thereby exacerbating the problems even further.

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

The project is consistent with the Japan's ODA policy. Under the Japan's ODA policy for Tunisia and the priority areas for JICA assistance, the project is in line with the "level up assistance of industries" and "assistance to activities with environmental consideration." The project is to promote a part of economic infrastructure development in the transportation sector as a level-up of the industry, and to assist the improvement of the environment through the control of air pollution.

<Evaluation Result>

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

¹ A:Highly satisfactory, B:Satisfactory, C:Partially satisfactory, D:Unsatisfactory

² ③: High, ②: Fair, ①: Low

<Effectiveness>

The project achieved the objective of responding to increasing transportation demand in the southern Tunis metropolitan area.

[Operation of Electrified Railway]

As for the operation indicators, operating rate of the vehicles and running distance of trains were mostly achieved the target figures; however, the number of the operations was below the target figure (Table 1). The operating rate of the vehicles has consistently been more than 80% of the target figure of 95.9% (76.7%) for every year except for 2018 and 2019, when the figure slightly decreased to 74.9% and 75.8%. The running distance of train/year exceeded the target of 1,313,000 km between 2013 to 2019, which means that the trains were being fully operated. The number of operations per day (Table 1) increased to 142 in 2012 and 122 in 2013, in comparison to 112 in 2007, before the project; however, it did not achieve 80% of the target figure of 160 (128), except for the completion year in 2012. The reason of reduction of the number of the operations after 2013 was mainly because SNCFT reduced the number of trains, such as by stopping the operation of express trains, and instead, increased transportation volume per train by increasing the number of vehicles from four to eight per train, especially during the peak hours.

[Effectiveness of Electrified Railway: Response to Increasing Transportation Demand]

As the project purpose is to respond to increasing transportation volume, The number of passengers and the volume of transportation (passengers-km) before and after the implementation of the project were examined, and then the effect of the project, i.e., reduction of the running time, was verified. As a result, the number of passengers and the volume of transportation were increased; however, the running time was not reduced to the target figure.

Examining the number of passengers and the volume of transportation (passenger-km) in Table 2, these figures were increased each year from project completion to 2017. These indicators had a sudden decrease in 2011 in comparison to those in 2010, just before the start of the project, which is caused by the Jasmine Revolution that resulted in a change of government, nationwide anti-government demonstrations and political instability in the country. According to SNCFT, after the revolution, the number of free riders of the train increased for a while, but those people were not counted as passengers; therefore, the actual number at that time should have been more. Operations of the new trains commenced in 2012, just after the revolution, thus the number of passengers around that time may not have accurately reflected the actual number. The number of passengers increased again after 2014, when control of fare payment became more severe by SNCFT staff patrol.

In terms of responding to increasing transportation demand, effectiveness of the project is observed especially during the rush hour. Since data of rash ratio was not available, it was not possible to show a direct quantitative effect of the project; however,, station managers at Hammam-Lif and Borj Cedria who confirmed in the interview that a remarkable effect of the project was the enhancement of transportation volume during rush hours in the morning (07:00-08:00) and in the evening (18:00-20:00).

They also highlighted the reduction of travel time to Tunis station as a direct effect of the project. The time required to commute between Tunis and Borj Cedria stations was 46 minutes by local train and 32 minutes by express train in 2007. This was reduced to 35 minutes by local train and 25 minutes by express train in 2012 at the time of commencement of operations of the project. Compared to the time taken in 2007, the running time was reduced until 2015; however, the target running time for two years after the completion of the project was not achieved, and the actual running time has tended to increase since 2013. (Table 2). According to SNCFT, the reason for the gradual increase was the limit of speed due to the obsolete railway tracks.

For further improvement of operating rate and transportation volume, the measures to be taken are the replacement of obsolete railway track and the recovery of unusable vehicles by collision accidents in recent years. These issues limit the number of trains per day. In addition, the influence of damaged vehicles caused a relatively decreasing trend of running distance, operating rate, and transportation volume.

[Effectiveness of Electrified Railway: Improvement of Safety and Service]

In terms of qualitative effects, based on field observations and comments by SNCFT staff, improved signaling system and the introduction of new vehicles with strengthened structure and greater comfort enhanced the safety and service for passengers. The train also became more punctual along with timetable after the commencement of the project, which allowed passengers to save travel time. In addition, low-income household groups benefited from the project, because those living along the railway line were able to utilize the train whose fares were cheap without any increase in price for the past 10 years.



Inside the train procured by the project

<Impact>

Contribution of the project was confirmed in improvement of air pollution, alleviation of traffic congestion, and regional development.

[Improvement of Air pollution]

The energy shift from diesel fuel to electricity contributed to the intended impacts by improving air pollution through the reduction of particle matters and other gases. According to the data of SNCFT, in 2011, 2,552 TEP (Ton Equivalent to Petro) of diesel oil was consumed; after the commencement of the project, between 2012 to 2019, energy consumption was reduced to about 1,100-1,900 TEP per year. During this period, running distance of the train in 2011 was 864,000 km and the same indicator has been increased since 2012 (Table 1). This shows that the project contributed to the reduction of energy consumption and CO₂ emissions through energy shifting from diesel oil to electricity, reducing the consumption volume of fossil fuel.

[Reduction of Traffic Congestion and Regional Development]

According to the comments from SNCFT and the Ministry of Transport, the project contributed to the alleviation of traffic congestion and to an improvement in the environment; the situation would have been much worse without the project. In addition, it has also had an impact on regional development in the target area. The population in the Tunis metropolitan area increased from 2.38 million in 2008 to 2.64 million in 2014, an increase of about 11 percent. Interviews with station managers at Hammam Lif and Borj Cedria stations confirmed that there was a positive impact in residential area expansion and in the development of some small commercial activities such as coffee shops around these stations, which were not observed before the project. The surrounding area of the Borj Cedria station, which is owned by SNCFT, was converted to a parking lot, and they earned its revenue. Some people drive their car to the station to take a train, using the small coffee shops in the surrounding area. Impact on regional development may include other factors than the railway; however, based on the opinions above, the project may have partly contributed to the regional development.



Shops (above)
Parking area (below) around Borj Cedria Station

<Other Positive / Negative Impacts>

Based on information from the SNCFT monitoring, there were no negative impacts on the natural environment during the project implementation and after commencement of the operation. Regarding the social environment, there was no resettlement required by the project; private land acquisition was necessary; however, this was implemented smoothly since the land was not in use for any other purpose.

<Evaluation Result>

This project has mostly achieved its objectives and brought about intended impacts. Therefore, the effectiveness/impacts of the project are high.

<Quantitative Effect>

Table 1: Operation Indicators

Indicator		Baseline		Target	Actual							
		1999 Project appraisal	2007	2012 2 years after completion	2012 Completion year	2013 1 year after completion	Target 2014 2 years after completion	2015 3 years after completion	2016 4 years after completion	2017 5 years after completion	2018 6 years after completion	2019 7 years after completion
Operating Rate (% / year)	Haulage train	61.2	78	95.9	80	81.5	85.5	84.3	79.8	78.2	74.9	75.8
	Passenger car	84.4	81	95.9	80	81.5	85.5	84.3	79.8	78.2	74.9	75.8
Running Distance of train / year (1,000 km)		995	985	1,313	1,250	1,569	1,801	1,813	1,851	1,763	1,680	1,548
Number of operations (number of trains / day)		118	112	160	142	122	116	109	110	111	105	100

Sources: JICA and SNCFT document

Table 2: Effect Indicators

Indicator		Baseline		Target	Actual							
		1999 Appraisal (Phase1)	2007	2012 (2 years after completion)	2012 Completion year	2013 1 year after completion	Target 2014 2 years after completion	2015 3 years after completion	2016 4 years after completion	2017 5 years after completion	2018 6 years after completion	2019 7 years after completion
Number of passengers (thousand)		n.a.	25,902 (2010) 20,702 (2011)	n.a.	23,410	23,740	24,417	24,216	26,645	26,648	25,870	24,142
Volume of Transportation (1,000 passenger-km)		n.a.	352,258 (2010) 280,858 (2011)	n.a.	320,332	325,901	334,988	332,989	366,832	366,087	355,488	331,984
Running time necessary for the whole section (23 km) (min)												
Local		48	46	35	38	41	42	44	48	49	48	50
Express		32	32	25	29	-	-	-	-	-	-	-
Semi-express train		-	37	30	33	n.a.	32	34	38	39	39	-

Sources: JICA and SNCFT document

Note: Express train has not been operated since 2013 due to the change of the number of vehicles per train, responding to rush-hour demand. Semi-express train has not been operated since 2019.

3 Efficiency (Rating: ② Fair)

The output of the project was mostly as planned. Although there was a cancellation of some equipment and others; however, it did not affect the effectiveness.

The actual total project cost was 18,606 million yen, which was within the planned total cost of 21,825 million yen at the time of Phase 2 (85% of the planned project cost). The project period was 135 months, which significantly exceeded the first plan of 58 months (232% of the plan). The main delay occurred in the period of detailed design during the first loan and construction period. This was due to a difference in interpretation of the work in the contract between SNCFT and the consultant, and between SNCFT and the contractor, which required some time to reach an agreement and thus delayed in detailed design and construction work.

<Reference: Results of Calculations for Internal Rates of Return >

The results of the recalculation of the Financial Internal Rate of Return (FIRR) and Economic Internal Rate of Return (EIRR) at the time of the ex-post evaluation are as shown in the table below. FIRR and EIRR at time of ex-post evaluation are smaller than the calculation results at the time of Phase 2. The reason for this is that there was a delay in the completion of the project and the start of operation and the assumption that the fare will be raised was already in IRR at the planning stage, but it was not actually raised.

FIRR	9.1% (Phase 1)	3.3% (Phase 2)	1.1 % (Ex-post evaluation)
Calculation Items and Conditions			
Cost	Project cost, Operation and maintenance cost		
Benefit	Revenue, Subsidies		
Project Life	20 years from the commencement of operation (Phase 1 & 2) 30 years from L/A signing (Ex-post evaluation) = this period is the same as 20 years from commencement of operation.		

EIRR	25.3% (Phase 1)	32.7% (Phase 2)	30.6 % (Ex-post evaluation)
Calculation Items and Conditions			
Cost	Project cost, Operation and maintenance cost (excluding tax)		
Benefit	Travel time saving, Reduction of congestion on existing roads, Saving of vehicle operating cost, Reduction of road accidents, Saving O&M cost, Saving diesel vehicle investment cost without project, Reduction of air pollution, Reduction of noise		
Project Life	20 years from the commencement of operation (Phase 1 & 2) 30 years from L/A signing (Ex-post evaluation)		

Source: Calculation Results at Phase 1 and Phase 2 are from JICA Documents

<Evaluation Result>

Although the project cost was within the plan, the project period exceeded the plan. Therefore, efficiency of the project is fair.

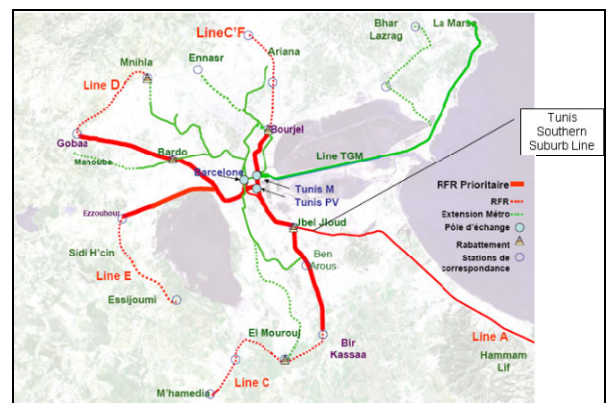
4 Sustainability (Rating: ② Fair)

<Policy Aspect>

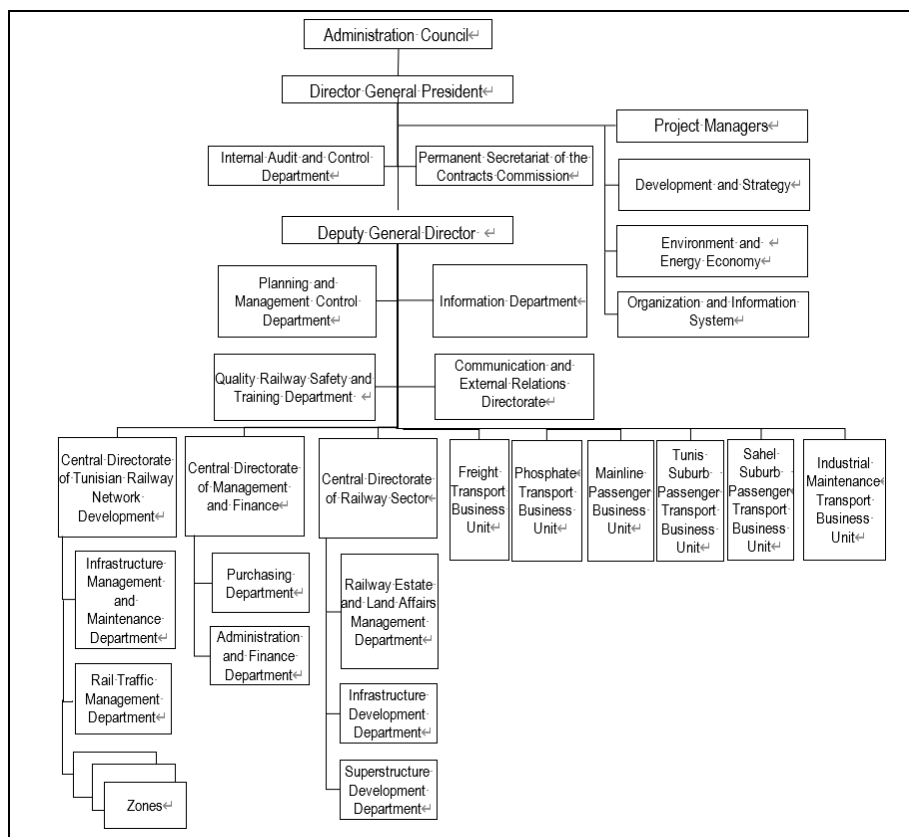
The project is sustainable from a policy perspective. In *Study on National Transportation Master Plan toward the Horizon 2040* and *Transportation sector plan 2016 to 2020*, the SNCFT railway plan 2016-2020, include a plan to extend the Tunis southern suburb line to Soliman (+8 km). The plan 2016-2020 has been delayed and will be postponed to the next five-year plan (2020-2025), which was under preparation as of February 2020. In addition, this line will eventually become part of "Line A" of the five lines (A, C, D, E and F) of the rapid rail network (RER) (refer to the map of the rapid railway network). The Tunis southern suburb line has been prioritized in the operations of all railway networks of SNCFT.

<Institutional Aspect>

There was no problem in terms of institutional aspect of operation and maintenance (hereinafter referred to as "O&M") of railway developed by the project. At the end of 2018, the total number of SNCFT staff was approximately 4,600, of which 509 were management staff and 1,889 were technical experts. This figure had not changed much from about 4,500 at the end of 2011, before the commencement of the electrified trains as part of the project. The SNCFT organization structure as of February 2020 is shown in the chart below. The Tunis Division of the Northeast Zone office, which was under the Central Directorate of the Tunisian Railway Network Development, was in charge of the O&M of the electrified railway facilities, including signaling. However, the Tunis Suburb Passengers Transportation Business Unit (hereinafter referred to as "UABT," located near Erriadh station at the end of the suburb line, was in charge of the O&M of the vehicles procured in this project.



Railway Map of Rapid Rail Network



Source: Translation of SNCFT Document

Figure 1: SNCFT Organization Chart

As of February 2020, there were a total of 40 staff in charge of O&M for the electrified train system. The number of personnel in each facility is shown in Table 3. UABT consisted of three divisions: the management and control division, the production division and the commercial division. There were 18 managers, 88 technical experts and an additional 185 technicians and other workers. Representatives in these departments/units were interviewed, and there were no discrepancies found in the number of staff or their assignments.

Table 3: Number of personnel in charge of each facility by Profession

Facility	Engineer	Superior Technicians	Technicians	Other workers
Signaling	1	2	10	5
Railway	-	-	7	9
Catenary, substation, posts	1	3	1	1

Source: SNCFT

<Technical Aspect>

It is considered that most of the technical knowledge about the operation of the electrified railway section and the maintenance of equipment procured in this project is generally acquired; however, there are some issues in the reliable implementation of safe driving. The O&M personnel employed as managers and technical experts (superior technicians) all received a university or technical college education. At the time of project appraisal, it was suggested that staff receive adequate training from experts because this is the first case of high-density operations for SNCFT. O&M personnel in charge of vehicles and signaling system confirmed in interviews that they had received sufficient training from suppliers through the project and that they had adequate technical capacity. Station managers who were interviewed also confirmed that there were no technical issues or challenges identified.

In addition to training and manuals provided by the suppliers, SNCFT had its own training system in place including introductory courses in each area of expertise. At the time of the ex-post evaluation, the 2019-2021 training plan was in place, and a full range of training was systematically provided, including signaling and telecommunications, electric lines, railways, mechanical knowledge for vehicle maintenance, etc.

However, between 2015 and 2018, there was one collision accident per year. SNCFT has identified that the cause of the accident was that the train drivers did not respect the driving rules, and SNCFT took countermeasures by providing training on safety measures after the accidents. In this regard, it is necessary to continuously focus further on taking safety measures.

<Financial Aspect>

SNCFT faces challenging issues in financial aspect. The table below highlights SNCFT's main financial results. Net loss has been



Operation Control Room with equipment procured by the Project

increasing for the last five years. This was mainly due to the fact that fares had been set at very low prices and had not been raised in the past 10 years or more, alongside a sudden increase of free riders for some time, which led to a decline in revenue.. Furthermore, a sharp decrease in freight transportation revenue after the Jasmine Revolution in Tunisia seriously affected the SNCFT financial statement. As for the Tunis southern suburb line, necessary daily O&M costs for the facilities have been allocated to date. According to SNCFT, financial difficulty has prevented the repair of the damaged vehicle in the project's section and replacement of obsolete railway tracks in a timely manner, which has resulted in speed restrictions on trains and therefore has limited the number of operations and transportation volume per day.

Table 4: SNCFT Main Financial Result

Items	Unit: Tunisian Dinar				
	2014	2015	2016	2017	2018
Operating Income	162,599,306	153,626,643	165,780,149	164,119,580	157,822,605
Operating Expenditure	209,811,159	213,372,050	223,589,712	228,523,267	226,228,644
Operating Result	△47,211,853	△59,745,407	△57,809,563	△64,403,687	△68,406,039
Net Loss (After Tax)	△58,765,710	△70,266,742	△73,232,421	△81,281,747	△91,069,322

Source: SNCFT financial statements

<Current Status of Operation and Maintenance>

At the time of the ex-post evaluation, 16 vehicles needed to be fixed because of the collision accidents. It was also necessary to upgrade and replace the obsolete railway tracks. SNCFT is gradually working on them; however, because of budget constraints, it is not possible to replace them all.

The trains are periodically maintained according to the manufacturer's recommendations with different frequencies and contents: 1) Weekly visit; 2) Limited visit; 3) General visit; 4) Whole general visit.

From the field visits and interviews with station managers and SNCFT head office, and there were no problems identified for project facilities including signaling system, electric line and posts, substations, etc.

Necessary spare parts were available although it took time to communicate with suppliers.

<Evaluation Result>

The project is sustainable in policy, institutional and technical aspects. With regards to the financial aspect, a basic O&M budget was allocated; however, it was not sufficient to fix damaged vehicles and replace the obsolete railway tracks, which constrained full train operation and finance. Therefore, the sustainability of the project effect is fair.

III. Recommendations & Lessons Learned

Recommendations to Executing Agency:

Countermeasures for better Operation and Maintenance

Due to obsolete railway tracks, the speed of the trains was limited. Also, the damage to the 4 vehicles by recent accidents restricted the number of operations and transportation volume per day. During the next five- year plan (by 2025), in order to maximize the use of trains and the electrification system, a recommendation would be to continue the efforts to further improve the operation and to implement necessary investment on upgrading the railway track, recovering damaged vehicles, and implementing safety measures continuously. In order to secure the budget to realize further improvements, an increase in train fare should be considered to increase revenues, while also taking into account low-income passengers. At the same time, in order to ensure the passengers' safety, it is critical to continue the efforts to prevent accidents by thoroughly implementing countermeasures based on analyzing the causes for the collisions in recent years.

Recommendation to JICA:

None

Lessons Learned:

Necessary Study Items for Middle-income Countries during Project Formation Period

Due to a difference in understanding and interpretation of work content between the executing agency and the consultant/contractor, disputes arose between them, and the project period was significantly extended. In general, in middle-income countries that are influenced by European technical standards, the requirements of the quality of engineering services tend to be high and strict. The consultant/contractor assumes a high risk in the contract when working in a country that implements severe penalties once failing to meet the executing agency's requirements. Based on the experience of this project, in order to avoid significant delays, it would be better to consider the following issues during the project formation period:

➤ Clarification of Work Specifications and Quality of Experts

At the time of the project formation study, when preparing the consultant's draft terms of reference for project implementation, it is necessary to carefully discuss details with the executing agency in the local context of the target country. The results of the discussion need to be clarified in terms of study items and required professional qualifications. For example, in this project case, issues that should have been noted include technical matters in the electrification of the train system and geographical conditions, etc.

➤ Importance of Contract Management

Based on legal issues and the customs of the target country, it is necessary to be cautious and to pay particular attention to the wording and interpretation of the contract with the consultant and contractor. This is especially true in countries where the official

language is not English, because the risk of miscommunication is high. It is better to have a clear understanding of the contract risk early on from the time of project formation and to prepare in advance the points to be noted and have countermeasures in place when procuring consultants and contractors for project implementation. From the time of the project formation study, it is important for the development assistance agency to identify the risks during the project implementation and to prepare countermeasures with the participation of a contract management expert, who is familiar with the legal system and practices of the target country, as part of the study team.



Carthage Bridge constructed by the project,
a view from Tunis Station



Haman Lif Station in target railway in the project

FY 2019 Simplified Ex-Post Evaluation Report of Japanese ODA Loan Project

External Evaluator: Miho Kawahatsu OPMAC Corporation (September 2020)

Duration of the Study: October 2019-September 2020

Duration of the Field Study: February 9, 2020-February 29, 2020

Country Name	North-West Sumatra Inter-connector Transmission Line Construction Project
Republic of Indonesia	



Project Site



The Padang Sidempuan Substation expanded by the project (North Sumatra)

I. Project Outline

Background	In 2005, actual peak power demand in the North Sumatra system was recorded at 1,054 MW. However, accompanying economic growth in the region, the power demand was expected to increase to 1,910 MW in 2011. Additionally, peak demand in the West Sumatra system was recorded at 1,294 MW in 2005, with the demand projection expected to increase to 2,586 MW in 2011. On the other hand, supply reliability in terms of duration and frequency of power outages in Sumatra was low in comparison to the national average for Indonesia. Therefore, the development of power transmission facilities was deemed to be urgent in establishing an adequate power supply system in that region. It was considered more economical to develop as a single power system through interconnection rather than to develop power generation facilities within each system, Especially, despite being the backbone of power supply and distribution systems in Sumatra, the North Sumatra system and West Sumatra system were not yet interconnected.
Objectives of the Project	To connect two existing substations, the Padang Sidempuan Substation in North Sumatra and the Payakumbuh Substation in West Sumatra, through the construction of 275 kV double transmission lines; and to expand existing facilities to elevate the substations' voltage level from 150 kV to 275 kV, the project aimed to improve power supply capacity in order to meet the increasing power demand and improve reliability in the Sumatra power system in both regions, thereby contributing to regional economic development through an improvement in the investment environment.
Contents of the Project (Actual)	<ul style="list-style-type: none"> • Construction of high voltage transmission lines (275 kV double circuit transmission lines, approx. 276 km), and 747 transmission towers • Expansion of existing 2 substations, elevating the voltage level from 150 kV to 275 kV • Consulting Services (preparation of tender documents, supervision of works, etc.)
Loan Approved Amount/ Disbursed Amount	16,119 million yen/10,046 million yen
Exchange of Notes Date/ Loan Agreement Signing Date	March 28, 2007/ March 29, 2007
Terms and Conditions	Interest Rate: 1.5%, Repayment Period: 30 years (Grace Period: 10 years), Conditions for Procurement: International competitive bidding (ICB)
Borrower/Executing Agency	Republic of Indonesia / PT. Perusahaan Listrik Negara (PLN)
Disbursement Completion	January, 2017
Project Completion	February, 2019
Target Area	North Sumatra, West Sumatra
Main Contractors	Construction work: HYUNDAI ENGINEERING & CONSTRUCTION LTD. (Korea) / PT MULTIFABRINDO GEMILANG (Indonesia) (JV) PT REKADAYA ELEKTRIKA (Indonesia) [PLN's portion] Procurement and Installation of Equipment: PT SIEMENS INDONESIA (Indonesia)
Main Consultant	NEWJEC Inc. (Japan)

II. Result of the Evaluation

Summary

This project aimed to connect two existing substations, the Padang Sidempuan Substation in North Sumatra and the Payakumbuh Substation in West Sumatra, through the construction of 275 kV interconnector transmission lines, and to expand existing facilities to elevate the existing substations' voltage level from 150 kV to 275 kV. The project would, therefore, improve power supply capacity in order to meet increasing power demand and improve reliability in the Sumatra transmission system in both regions, thereby contributing to regional economic development through an improvement in the investment environment. The project was consistent with the development policy and development needs of Indonesia, and the Japanese ODA policy at the time of the ex-ante evaluation. Thus, the relevance of the project is high. However, during the course of implementation, the project cost slightly exceeded the plan, and the project period substantially exceeded the plan. Therefore, efficiency is low. As for the project effects, power supply reliability improved to achieve the target both in North Sumatra and West Sumatra. Furthermore, through the interconnection of power transmission between the two provinces, power supply stability also improved. In terms of impact, the number of corporate customers of PLN increased considerably in both provinces since the project contributed to improving the investment environment essential for corporate activities in the private sector through the provision of a stable power supply. Therefore, the effectiveness and impact of the project are high. Regarding sustainability, operation and maintenance were systematically carried out in the transmission facilities in line with PLN's work program and standards. Thus, no major problems were observed in terms of institutional, technical financial aspects, and the status of operation and maintenance. Therefore, sustainability is high.

Considering all of the above points, this project is evaluated to be satisfactory.

Overall Rating¹	B	Relevance	③ ²	Effectiveness & Impact	③	Efficiency	①	Sustainability	③
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<Special Perspectives Considered in the Ex-Post Evaluation>

The timing of the final disbursement of the loan (January 2017) did not coincide with project completion due to significant delays in the project. After the final disbursement of the loan, the remaining portion of the construction work was continued at the expense of the executing agency. The project was finally completed in 2019, which was a significant delay from the original completion date of 2011. As described in "3. Efficiency" below. Therefore, in order to examine the quantitative effects of the project in terms of effectiveness, the actual number and related information as of the completion year in 2019 were to be mainly verified, instead of data from two years after project completion as stated in the initial plan.

1 Relevance (Rating: ③ High)

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

The project was consistent with the development policy of Indonesia: it was highlighted as one of the priority power development projects in *the National Electricity General Plan (2006-2020)* of the Ministry of Energy and Mineral Resources of Indonesia. As per the plan, the construction of the backbone power supply and transmission was highly prioritized in the power interchange/supply system development in the country. Thus, to create an interconnected power system was essential for the realization of efficient and high-quality power supply. In Sumatra, it was deemed urgent to develop interconnection transmission lines between the power systems of North Sumatra and West Sumatra in particular.



The transmission lines constructed by the project shown in the Sumatra power system diagram

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

The project was consistent with the development needs to have a stable power supply in response to the increase in demand in Indonesia. At the time of the ex-ante evaluation, the interconnection system for power interchange remained vulnerable in the target area of Sumatra, as the North Sumatra power system and the West Sumatra power system had not yet been connected and there was no power interchange between them. It was therefore difficult to provide a stable power supply in the region. Furthermore, both power systems were predicted to have a tight supply in 2011 based on the level of peak demand for power in 2005. As such, it was deemed necessary to improve reliability in the power supply in Sumatra.

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

The project was consistent with Japan's ODA policy for Indonesia at the time of the ex-ante evaluation. According to *the Country Assistance Program for Indonesia* (November 2004), "private sector-led sustainable growth" was highlighted as one of the priority areas for assistance to the country, with emphasis placed on the "improvement of economic infrastructure" for the investment environment as a measure. In addition, one of the priority areas for JICA (formerly Japan Bank for International Cooperation), which was set out in *the Medium-Term Strategy for Overseas Economic Cooperation Operations* (April 2005), was to develop infrastructure providing "a foundation for sustainable growth." It intended to provide support to improve socio-economic infrastructure to promote sustainable development, including in the energy sector. Also, as stated in *the Country Assistance Strategy*, as Indonesia was undergoing a transition from a stage of stabilization to growth following the Asian financial crisis, it was to assist in the development of imperative economic infrastructure that would help to improve the investment environment as one of its priority areas.

¹ A: Highly satisfactory, B: Satisfactory, C: Partially satisfactory, D: Unsatisfactory

² ③: High, ②: Fair, ①: Low

<Evaluation Result>

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

2 Effectiveness/Impact (Rating: ③ High)

<Effectiveness>

At the time of the ex-post evaluation, it was confirmed that the actual values of the operation indicators for the project mostly achieved the target values.

As shown in Table 1 below, the intended project effects (reliability and stability of power supply) were measured quantitatively using four indicators, whose target values were set at the time of the appraisal. The actual value of the availability factor (Indicator 1) in 2019 was 30.4%³, and the achievement level was 71%, which turned out to be slightly lower than expected. On the other hand, the annual forced power outage time (Indicator 2), was 0 minutes/year, indicating that no forced power outage had occurred in the operation record and that the achievement level was 100%; the stability of the power supply had therefore been realized. Furthermore, the actual value of the voltage drop at the end-user (Indicator 3), was 98.6%, with an achievement level of 99%. Since the voltage drop at the end-user is related not only to the performance of power transmission facilities but also to power distribution facilities, the value itself could not be attributed exclusively to the project. Nonetheless, confirmed favorable operation status after project completion indicates a general improvement of the power infrastructure of the entire target area. As for transmission loss (Indicator 4), as the actual rate was only 0.2%, it should be noted that the level of transmission efficiency between the two systems had been achieved by the project. Based on the above, on the whole, the achievement of the quantitative effects is considered to be high.

According to PLN, the project also contributed to the reduction of rolling power outages. Thus, as reference data related to the effectiveness of the project, the number of the rolling power outages⁴ was also verified in the target area at the time of the ex-post evaluation. According to the record of PLN, as shown in Table 2 below, a rolling power outage occurred more than 100 days per year in both provinces in 2017. However, after project completion in 2019, the annual number decreased to 40 days in the North Sumatra system and 6 days in the West Sumatra system, and it remained at zero in both systems as of February 2020. As indicated in Table 4 below, the total power generation capacity of the power plants located in Sumatra had not increased significantly. Therefore, a reduction in the number of rolling power outages indicates the stability of the power supply as a direct result of the power system improvement typified by this project.

Moreover, it was assumed that the project would contribute to the following two points through the power interchange of the inter-connector transmission lines: (1) to eliminate the imbalance in the electric power source structure due to the uneven distribution of existing power plants; (2) to fulfill the required power supply reliability through smaller-scale facilities, compared to a power supply through separate systems.

In order to determine whether the project had contributed in terms of the two points above, the trend of the reserve margin based on the power supply capacity in both target systems was examined. Furthermore, using data on the capacity extended by the development of power generation and transmission respectively in Sumatra, the variation on the year-on-year change ratio in the power infrastructure during the implementation period was cross-checked.

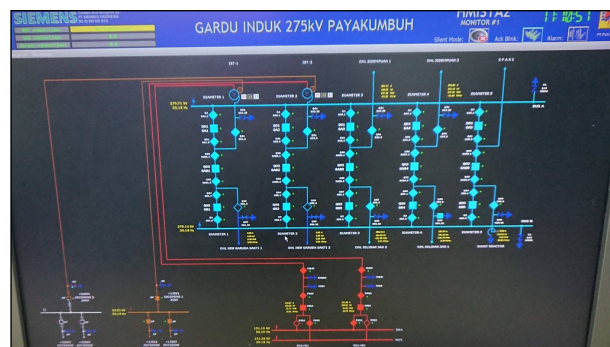
As indicated in Table 3, based on the variation of power supply in the target area, the reserve margin of the North Sumatra power system increased after project completion in 2019. On the other hand, in the West Sumatra power system, the power supply, which had been extremely unstable in 2015 and 2016, had improved to allow a reserve margin of more than 4-5% since 2018, specifically after the start of the test and commissioning at the end of 2017. From a broad perspective, the PLN's power development plan for Sumatra⁵ had positioned the project as an integrated part of the development of the entire power system which was meant to interconnect the North and South Sumatra power systems. The aim was to enable power interchange between the two target systems: primarily transmission from the West Sumatra power system to the North Sumatra power system, which was ridden with relatively higher power demand. Then, to outline a process towards the achievement to date, as a result of an increase of a reserve margin in the West Sumatra power system stemmed from other undertakings of development on the total system in Sumatra over the same period, the project ultimately contributed to stabilizing the power interchange between the two target systems.

Furthermore, based on the achievement of power interchange described above, the year-on-year change ratio in power generation and transmission lines in Sumatra was verified as shown in Table 4 below. According to the data in 2017 and 2018, which coincided with the period when the construction of transmission towers was fully underway as part of the project, the output growth of the transmission line development was greater than that of the power generation development. It can, therefore, be concluded that as a result of prior optimization of power transmission over power generation, the stabilization of power supply as shown in Table 3, was achieved by increasing the reserve margin in each region.

From the above, it was confirmed that the project contributed to the power system development in Sumatra.

<Impact>

It was confirmed that the project contributed to an improvement in the investment environment in the target areas, as well as the feasibility



A monitor of 275 kV power transmission surveillance installed at the substation in the project

³ PLN plans and operates the power system under the "N-1 criteria." Using a double-line, it planned a power system that was to withstand an unexpected failure or outage of a single system component in the system integration planning. The maximum availability factor of the facilities of the project was assumed to be about 50%, and the target value was set at 43%, as it was necessary to use another line in the transmission network as a contingency. Therefore, the actual value was calculated based on the criteria.

⁴ Rolling power outages are implemented by an electric power company, as a rotational load shedding measure to avoid a total blackout through power shutdown where electricity delivery is stopped over different parts of the distribution area when demand for electricity exceeds supply. The shortage of power supply capacity occurs either due to insufficient power generation capacity at the power plants, or insufficient transmission capacity of a transmission network (transmission lines, transformers, etc.).

⁵ Regardless of the regional administrative boundary, PLN divided the total Sumatra transmission network in the plan into two power systems: The North Sumatra power system and the South Sumatra power system. Aceh and North Sumatra are part of the North Sumatra power system; West Sumatra, where one of the target substations for the project is located, is part of the South Sumatra power system, along with Riau, Riau Islands, Bangka-Britung, Jambi, South Sumatra, Bengkulu, and Lampung.

of a wider inter-regional power system.

As for the investment environment in Sumatra, the annual number of corporate customers in each province categorized as “industry” (defined as a private company above a certain size) in the tariff table of PLN was verified. As indicated in Table 5, the number of customers temporarily declined the first year after the start of the project in 2011, presumably due to the Sumatra Earthquake which occurred in 2012, it increased steadily in both North and West Sumatra from 2013 to 2019, when the project was completed, with a significant increase noted in both provinces in 2018. This was especially the case for West Sumatra, where the numbers had almost doubled by 2019 in comparison to the initial number of customers in 2011; by the project completion year in 2019, the cumulative total number of the customers increased by 22.5% in North Sumatra, 102.4% in West Sumatra, and by 28.4% in both provinces, respectively. The stable power supply in the wider area as a result of the improvement of the power infrastructure system created a favorable investment climate, resulting in an increase in the number of industrial customers in Sumatra.

Furthermore, as mentioned in “effectiveness” above, PLN was able to optimize the entire power system in Sumatra by the sequential completion of the extension work of the transmission network, which allowed power to be transmitted between the power systems of South and North Sumatra. This project was a linchpin to the network: the project was not just limited to providing an interconnection between North Sumatra and West Sumatra, but enabled to connect South and East (Central) Sumatra through the Payakumbuh substation upgraded by the project in West Sumatra. It is therefore believed to have contributed to the infrastructural power system development of the entire Sumatra region.

At the time of the ex-post evaluation, while PLN did not forecast a rapid increase in power demand in Sumatra, it was considered urgent to address a tight power supply in Java. In the framework of nationwide power infrastructure development, having completed the project and others in Sumatra, the entire regional power system made feasible to aim for the development of a wider-scale power system; such as inter-island interconnection, that would enable PLN to transmit surplus electricity from Sumatra to Java.

As for the impact on the natural environment, this project fell under category B in *the Guidelines for Confirmation of Environmental and Social Considerations* (established in April 2002). The project was considered unlikely to have a significant adverse impact on the environment due to the sector and characteristics of the project per se. Also, the region was not susceptible to such an impact. Nonetheless, according to PLN, the effect on the forests within the target area caused by the construction of a considerable number of transmission towers was well-recognized from the initial stages of the project. Furthermore, after project completion, at Unit Pelaksana Transmisi (UPT), the regional transmission service units located in Pematang Siantar in North Sumatra and Padang in West Sumatra, assigned the identification number to each of wild trees around transmission towers. Then with the close cooperation of the local resident groups living around the transmission towers, PLN’s dedicated monitoring app “SRINTAMI” was used to methodically implement vegetation management and monitoring in the target area without delay.

Regarding the impact on the social environment (land acquisition and resettlement), it was necessary to acquire about 4,700 m² of land from approximately 1,000 landowners for the construction of the 747 transmission towers that were built in total. According to a construction manager at Unit Induk Pembangunan (UIP), the Central Development Unit located in Medan, as indicated in the special perspectives above, it took a long time to acquire the land, mainly due to the revision of related laws and regulations of Indonesia amid ongoing project implementation. However, having individual and deliberate negotiations with the landowners made it relatively easy to proceed once consensus was reached, and the acquisition of land was implemented in compliance with domestic law. On the other point of concern, there was no resettlement caused by the project, thus no ramifications in this aspect. The job creation effect for local residents was confirmed as an unintended positive impact of the project. Some of the construction sites for the transmission towers were in forest areas which were inaccessible by vehicles; it was thus essential to elicit the assistance of local residents during construction. In addition, the collaborative working relationships with the local resident groups have continued after project completion, allowing for the commissioning of ground patrols for surveillance and to monitor the transmission towers.

No negative impact was confirmed.

<Evaluation Result>

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

<Quantitative Effects>

Table 1: Operation Indicators of the Project

Indicator	Baseline 2006 Year of Planning	Target 2013 2 Years after Completion	Actual (achievement level %) 2019 Completion Year*5
Availability factor (%) *1	N/A	43	30.4 (71%)
Forced power outage time (min/year)*2	120	0	0 (100%)
Voltage drop at the end-user (%) *3	92	100	98.6 (99%)
Transmission loss (%) *4	N/A	1.3	0.20 (100%)

Source: PLN

Note 1: newly constructed transmission lines by the project [peak load (MW) / supply capacity (MW)] of 275 kV]

Note 2: Annual forced outage time at the Padang Sidempuan substation of North Sumatra Power system (min/year)

Note 3: [Maximum voltage drop (V)/voltage baseline (V)] at the Padang Sidempuan substation of North Sumatra Power system

Note 4: Newly constructed transmission lines by the project [(Power sent at the sending end (kWh) -Substation power consumption (kWh) -Power delivered at the receiving end (kWh)/Power sent at the sending end (kWh)]

Note 5: Project completion was defined as the expiration of the defect liability period. Test and commissioning started at the end of 2017.

Table 2: The Annual Number of Rolling Power Outages in North and West Sumatra Power Systems

Indicator		2017	2018	2019	2020
				Completion year	As of February
The number of rolling power outages (day)	North Sumatra Power System	105	7	40	0
	West Sumatra Power System	115	0	6	0

Source: PLN

Table 3: Balance of Power Supply and Demand in North and West Sumatra Power Systems

Indicator		2015	2016	2017	2018	2019
North Sumatra Power System	Peak demand (MW)	1593.9	1691.9	1673.3	1794.2	1841.0
	Supply capacity (MW)	2345.1	2182.9	2650.3	2576.3	3038.7
	Reserve margin (%)	5.8	8.9	32.3	6.4	17.3
West Sumatra Power System	Peak demand (MW)	552.3	559.9	646.1	579.9	596.8
	Supply capacity (MW)	635.4	658.9	635.6	672.6	646.1
	Reserve margin (%)	0.0	1.0	4.6	5.4	5.8

Source: PLN

Table 4: The Development Status of Power Infrastructure (Power Generation/Transmission) in Sumatra

Indicator	Actual				Planned	
	2015	2016	2017	2018	2019	2020
Power Generation (MW) (Year-on-Year Change Ratio (%))	7,415.14	8,171.31	9,074.06	9,084.79	9,958.79	11,680.79
		10.2	11.0	0.1	9.6	17.3
Transmission line (km) (Year-on-Year Change Ratio (%))	11,076.33	11,969.10	14,024.64	16,159.82	19,809.82	23,380.82
		8.1	17.2	15.2	22.6	18.0

Source: PLN

<Impact>

Table 5: The Annual Number of Corporate Customers of PLN in North and West Sumatra

	2011 Start of the project	2012	2013	2014	2015	2016	2017	2018	2019 Project Completion
North Sumatra (Year-on-Year Change Ratio (%))	3,555	3,492 -1.8	3,691 5.7	3,698 0.2	3,724 0.7	3,867 3.8	4,031 4.2	4,313 7.0	4,356 1.0
West Sumatra (Year-on-Year Change Ratio (%))	283	277 -2.1	312 12.6	336 7.7	370 10.1	395 6.8	427 8.1	521 22.0	573 10.0
Total (Year-on-Year Change Ratio (%))	3,838	3,769 -1.8	4,003 6.2	4,034 0.8	4,094 1.5	4,262 4.1	4,458 4.6	4,834 8.4	4,929 2.0

Source: PLN

3 Efficiency (Rating: ① Low)

The output of the project was mostly produced as per the plan, and the project achieved the planned design capacity. The intended project effect was unaffected by changes from the planned output, due to revisions and changes to the number of materials and equipment that had to be adjusted in line with the status at substations, and decrease in the number of transmission towers due to the route changes with the shorter length of the transmission lines.

The total project cost was planned to be 21,645 million yen (of which the ODA loan portion was 16,119 million yen), while the actual project cost was 21,799 million yen (of which 10,046 million yen was by ODA loan disbursement) which slightly exceeded as 101% of the plan. When the final loan disbursement deadline was approaching in 2017 prior to project completion, PLN decided to use its funds to implement the remaining portion without extension of the deadline. Thus, the loan disbursement ratio was low.

The actual project period was 144 months as opposed to 62 months planned period (232% of the plan), and therefore, significantly exceeded the plan. During the process of land acquisition, it was necessary to assess the land price individually for approximately a thousand landowners by complying with the domestic law of Indonesia; also, there were villages in certain areas that opposed the idea of selling the land and it took an exceedingly long time to resolve these issues. As mentioned in the special perspectives section above, the construction of transmission towers had to be put on hold for quite a while due to the delay in antecedent land acquisition. The reconstruction of several transmission towers was also required due to a natural disaster. As a result, the project period was significantly extended to completion.

As indicated above, the project cost only slightly exceeded the plan, but the project period significantly exceeded the plan. Therefore, efficiency is low.

4 Sustainability (Rating: ③ High)

<Institutional Aspect>

The O&M system had changed at the time of the ex-post evaluation due to the organizational restructuring of PLN, which had taken place after the time of the appraisal. However, there were no institutional issues raised by PLN as the basic framework of the system had mostly remained unchanged. Also, considerable time had already passed as the restructuring was enforced during project implementation.

At the time of the ex-post evaluation, the responsibilities for the O&M of the project were clearly defined and shared among the related organizational units; they were carried out by UPT Padang (West Sumatra) and UPT Pematang Siantar (North Sumatra) from the start of

test and commissioning, following the completion of construction work. In compliance with PLN's internal regulations, each of the UPTs managed the Payakumbuh substation in West Sumatra and the Padang Sidempuan substation in North Sumatra. It should be noted that although the power transmission facilities of the project were planned to be officially owned by UPT Padang and UPT Pematang Siantar respectively, the ownership transfer procedure has not been completed, and the Central Development Unit, UIP Medan which was in charge of the construction work, retained ownership status at the time of the ex-post evaluation⁶. Therefore, UIP3BS, the Dispatch Center of Sumatra located in Pekanbaru, Riau was procedurally in charge of budget control of transmission facilities under UIP, in addition to the primary responsibilities of transmission management, data collection, and analysis for the entire power network of Sumatra.

There are two specific perspectives for the O&M in line with the manpower allocation for the project: "operation of two substations" and "maintenance of two substations and 747 transmission towers and transmission lines." Regarding the operation of the substation, 5 staff (including 1 supervisor) were deployed at the Padang Sidempuan Substation in North Sumatra and 8 staff (including 1 supervisor) were deployed at the Payakumbuh Substation in West Sumatra. As there were no accidents or failures reported according to the track record in operation at UIP3BS, personnel distribution for the operation was considered to be generally appropriate⁷. With regards to the maintenance of the substations, transmission lines, and transmission towers, 8 staff were deployed at the Padang Sidempuan Substation and 9 staff were deployed at the Payakumbuh Substation. There were no problems with the maintenance of the substations as a result of mutual cooperation between the staff in charge of the operations at each substation. As for surveillance of the transmission lines and transmission towers located in the widespread area, UPT Pematang Siantar contracted 18 local residents to conduct ground patrols to check on the 338 towers in North Sumatra and UPT Padang contracted 23 local residents to check on the 409 towers in West Sumatra. The maintenance was duly executed, based on real-time remote monitoring and surveillance by utilizing the specialized "SRINTAMI" app distributed to the commissioned residents in the area.

<Technical Aspect>

As for the technical aspects of O&M for the facilities of the project, there were no problems as existing staff were experienced in power transmission. The supervisors of the two substations had been deployed since the start of the test and commissioning phase, so at the time of the ex-post evaluation, had gained a lot of experience and hands-on practice in operating the newly introduced equipment. Furthermore, there was a common understanding among all staff in charge that the high voltage transmission of the project was considered essential for the entire transmission system of Sumatra. Therefore, the supervisor conducted staff management through careful assessment of attendance and performance status in regularly held PLN's training programs. In addition, regarding the organizational efforts to retain the technical level in PLN, not only were all assigned staff qualified in each technical field, but each of them was also required to take training at least once a year. The refresher training that was needed has been held every month since. According to the training course and attendance record submitted at the time of the ex-post evaluation, training on the operation of substations and the maintenance knowledge required (for transmission lines, etc.) were systematically executed in accordance with PLN's training program. The training contents related to the O&M of power transmission was considered to be standardized and uniformly executed throughout the entire organization.



Staff engaged the maintenance at the Payakumbuh substations (West Sumatra)

<Financial Aspect>

There have been no problems regarding the financial aspects of O&M related to the project. *The National Electricity General Plan (2006-2020)* referred to at the time of appraisal was still valid and effective at the time of the ex-post evaluation. Therefore, the improvement of the overall Sumatra power system including the project remained to be of national importance. Both UPT Padang and UPT Pematang Siantar accordingly applied to UIP3BS for all operation costs, including the O&M of the substations and the transmission towers. The applications were approved, and the monies disbursed promptly without any delay. It was acknowledged that there were no financial issues in both UPTs. PLN Headquarters also confirmed that the operation and maintenance budget was secure, so there was no discrepancy in recognition in terms of financing the O&M of the project.

On the other hand, in order to verify the overall debt solvency of PLN, the following items were analyzed based on the data calculated from the balance sheet of PLN since 2016. As the current ratio was below 100%, there was some concern about short-term cash flow, but this improved significantly in 2019. Regarding long-term solvency, there was no outstanding issue since the debt to equity ratio, which is the percentage of the interest-bearing debts to the entire equity, was consistently less than 100%. Although the equity ratio was on a downward trend, it was still considered to be generally stable. Based on all the above, there were no outstanding financial problems at the time of the ex-post evaluation. Considering that the transmission lines of the project were a crucial part of the overall power system in Sumatra, it can be concluded that the O&M budget for the project would continue to be duly secure and disbursed.

⁶ Due to current ownership, UIP3BS was responsible for the budget application and expenditure management for the O & M of the project. When the registration of the asset transfer is completed, each of the UPTs will become the budget control entity for the facilities.

⁷ According to the field survey, there was some concern that the Padang Sidempuan Substation may run short on manpower and would be stretched too thin for a 24/7 operation if an unexpected situation or accident were to occur, as there was no backup staff deployed. Likewise, at the Payakumbuh Substation, the high-voltage transmission lines were to be extended to two other substations aside from Padang Sidempuan. For this reason, suggestions were made to increase the number of supervisors involved in each operation oversight.

Table 6: The Outline of Profit-and-Loss Statement and the Financial Stability Analysis of PLN

	Unit: Billion IDR			
	2016	2017	2018	2019
Revenue	222,822	255,295	272,898	285,641
Operating Expenses	254,550	275,474	308,189	315,440
Government's Electricity Subsidy	58,043	45,738	48,102	51,712
Income	8,150	4,428	11,576	4,322
Current Ratio (%)	81.04	67.44	71.83	95.02
Debt to Equity Ratio (%)	44.83	53.55	60.93	70.54
Equity Ratio (%)	69.04	65.12	62.13	58.63

Source: PLN

<Current Status of Operation and Maintenance>

There were no problems regarding the O&M status of the project. With regards to the two substations and the overhead transmission lines of the project, the implementation status of the O&M of facilities and equipment was confirmed. No power transmission accidents or failures due to abnormalities or breakdowns in the substations were reported from project completion to the time of the ex-post evaluation. It should be noted that a transmission tower in West Sumatra had collapsed due to massive flooding that occurred in 2018. UIP Medan promptly responded to the reconstruction of that tower, which was to be located 80 meters away from the original site. As for maintenance activities, in accordance with the maintenance rules of PLN, regular inspections were conducted daily by following the level of the inspections internally specified based on each type of equipment. Also, necessary spare parts and consumables were still amply stored in the warehouse. Problems to do with shortages have not occurred.

<Evaluation Result>

Therefore, the sustainability of the project's effect is high.

III. Recommendations & Lessons Learned

Recommendations to Executing Agency:

None

Recommendations to JICA:

None

Lessons Learned for JICA:

(1) In cases where the land acquisition of a widespread area is a prerequisite, due confirmation and support is needed for the process at an early stage

During the process of land acquisition, it was necessary to assess the land price individually based on the domestic law of Indonesia for approximately a thousand landowners; also, there were villages in certain areas that opposed the idea of selling the land and it took an extremely long time to resolve these issues. The construction sites of the power transmission towers came in a variety of prices. The asking price should be agreed on by the landowner based on the third-party assessment by the designated certified appraiser. As a result, it complicated the procedure. It should be noted that such an extensive delay of the project resulted in opportunity loss and a real increase in cost price, which would not have been incurred if the power supply had been realized as planned.

Regarding the acquisition of land for transmission lines, it was necessary to establish an efficient institutional structure for land acquisition, in order to deal with the local stakeholders right from the start when making a routing plan and examining details of each candidate site. As transmission was explicitly impossible if even one site had not been acquired along the route of the transmission lines between two substations, it was necessary to promptly share detailed local information with all parties and to set up a viable mechanism for prompt coordination among them. As in this project, the construction of transmission lines tends to be in widespread areas and requires the land acquisition of multiple plots of private land. Therefore, a considerable number of landowners, local governments, and groups of local communities become vital stakeholders, thus it must have substantially raised the consequent costs in coordinating with all those parties. Other alternatives should have been considered as soon as the process of land acquisition became long and arduous, and adjustments made for the local conditions by the consultant and contractor responsible for the project's technical and construction work. This alternative should have resolved this site-procurement issue, as this was a major premise of technical design. Nonetheless, the project was under irregular circumstances that occurred in Indonesia during implementation, involving a revision of the relevant law. It should be noted that in any country, land acquisition for transmission lines and compensation of the land under the line is known to be a complicated and time-consuming process.

Thus, in case that land acquisition involves a considerable number of private landowners and is a prerequisite for the power transmission project in widespread areas, the progress of land acquisition and compensation plan and preparation carried out by the executing agency should be confirmed. And then if deemed necessary, provide prudent assistance to expedite the process from the early stages of project planning (preferably by the time of detailed design study, in case if ODA loan project preparatory survey has not been conducted). In addition, it is important to establish a project implementation mechanism with contractors and consultants, to allow for the project to be carried out smoothly throughout implementation.

(2) Monitoring the portion of the project implemented by the Partner Government/Executing Agency is needed

After the construction of the transmission lines by PLN was completed, one of the transmission towers built near the river in West Sumatra collapsed due to the eroded foundation when flooding occurred in November 2018. Also, the four towers connected to the collapsed tower were beveled. As a result, it was necessary to rebuild them on different plots from the original sites, which caused a further delay in power

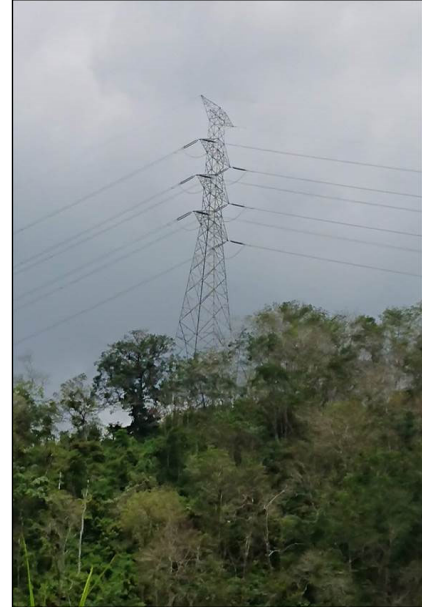
transmission between the systems. PLN considered the extreme flood as a force majeure event. Nonetheless, at the time of the ex-post evaluation, it was not possible to confirm the detailed causes of the accident that had led to property damage or might have caused serious injury if the worst had happened.

It should be noted that the progress of land acquisition by PLN and the subsequent construction of the towers by the contractor could not be aligned with the milestones of the project. As such, since 2016, PLN decided to shoulder the costs of the remaining portion of the construction work alone, and this was positioned outside of the scope of the ODA loan. However, it was reported that PLN was engaged in the construction since 2016, by following the original detailed design covering transmission tower specifications, construction methods, and routing submitted by the contractor under the supervision of PLN and the consultant.

As described above, one of the transmission towers collapsed in the section implemented by PLN. This resulted in a need for reconstruction, which further delayed launching power transmission and delayed the project effects. Although the accident occurred in a section outside the scope of the ODA loan, it remained an integral part of the project. It is thus considered that the project should have been monitored and verified as a whole, in light of appropriateness of the route selection and construction method adopted in the detailed planning and implementation stages.



The Payakumbuh Substation expanded by the project
(West Sumatra)



A power transmission tower constructed on a hill in the forest area of Sumatra along the transmission route of the project

FY 2019 Simplified Ex-Post Evaluation Report of Japanese Grant Aid Project

External Evaluator: Miho Kawahatsu OPMAC Corporation (September 2020)

Duration of the Study: October 2019-September 2020

Duration of the Field Study: January 19, 2020-February 1, 2020

Country Name	The Project for Improvement of the Institute of Child Health and Hospital for Children, Chennai
India	



Project Site



Outpatient building constructed by the project

I. Project Outline

Background	<p>As of 2000, the infant mortality rate in India was 64 per 1000 live births and the under-five mortality rate was 87 per 1000 live births; by 2011, these numbers had decreased to 47 and 61 per 1,000 live births respectively. Despite the significant improvement in these health indices during this time, the challenges remained unchanged and considerable effort was still required to achieve the Millennium Development Goals (MDGs) by 2015: 26.27 and 42 respectively. <i>The 12th Five Year Plan</i> of the Government of India (2012-2017) focused on the health sector and strived to provide quality medical services for low-income groups in the urban areas to ensure a broader coverage of health service provision. Under the circumstances, the project targeted the Institute of Child Health and Hospital for Children (ICH), as it was regarded as the top referral public sector hospital for pediatric care in the State of Tamil Nadu; prior to project implementation, it admitted a considerable number of outpatients - up to 2,000 to 2,500 per day. Moreover, as an affiliate hospital of the Madras Medical College (MMC), the ICH also served as a top medical education institute. However, the clinic functions were physically dispersed in various buildings due to infill extensions to accommodate the ever-increasing demand for specialized care. The ICH was therefore unable to fully provide quality care or to offer an efficient learning environment for clinical skills in the existing buildings at the time.</p>						
Objectives of the Project	<p>To enhance the capacity of the outpatient services provision and its educational function in developing clinical skills for the medical personnel in the Institute of Child Health and Hospital for Children (ICH), by constructing an outpatient building and procuring necessary medical equipment in the ICH of Chennai, Tamil Nadu, thereby contributing to the improvement in the health status of children in Tamil Nadu and, in the broader sense, in South India.</p>						
Contents of the Project (Actual)	<ol style="list-style-type: none"> 1. Project Site: Chennai, Tamil Nadu 2. Japanese side <ol style="list-style-type: none"> (1) Construction Work Construction of a new outpatient building (four-story with the basement, of reinforced concrete) (2) Procurement of equipment Procurement of Medical equipment (Ultrasound scanner, Endoscopes, Digital X-ray unit, Transport incubator, EMG, etc. total of 65 items) 3. Indian side: <ol style="list-style-type: none"> (1) Construction work <ol style="list-style-type: none"> 1) Demolition and removal of existing buildings and relocation of the boiler on the project site 2) Demolition and removal of concrete pavement and fences etc. on the project site 3) Setting up utilities on the project site 4) Construction of necessary fences, gates, and vegetation 5) Procurement of necessary furniture and fixtures (2) Procurement of equipment <ol style="list-style-type: none"> 1) Preparation of air-conditioned environment for installed equipment 2) Procurement of basic medical equipment and furniture (examination table, desk, and chair, etc.) 						
Project Period	<table border="1" style="width: 100%;"> <tr> <td style="width: 20%;">E/N Date</td> <td>January 25, 2014</td> </tr> <tr> <td>G/A Date</td> <td>February 7, 2014</td> </tr> </table>	E/N Date	January 25, 2014	G/A Date	February 7, 2014	Completion Date	September 30, 2016 (date of handover)
E/N Date	January 25, 2014						
G/A Date	February 7, 2014						

Project Cost	E/N Grant Limit / G/A Grant Limit: 1,495 million yen, Actual Grant Amount: 1,064 million yen
Executing Agency	Government of Tamil Nadu / the Institute of Child Health and Hospital for Children (ICH)
Contracted Agencies	Main Contractor(s): Fujita Corporation Main Consultant(s): Yokogawa Architects & Engineers Inc., Yamashita Sekkei Inc., Binko International Ltd. (JV) Procurement Agent: Sirius Corporation

II. Result of the Evaluation

Summary

This project aimed to enhance the capacity of the outpatient services provision and the educational function to develop clinical skills for medical personnel in the ICH, Chennai, by the construction of the outpatient building and procurement of medical equipment, thereby contributing to the improvement in the health status of children in Tamil Nadu and, in a broader sense, in South India. The project was consistent with the development policy, development needs of India and the Japanese ODA policy at the time of the ex-ante evaluation. Thus, the relevance of the project is high. During the course of implementation, although the project cost was within the plan, the project period exceeded the plan. Therefore, efficiency is fair. As for project effects, enhancement of medical services for the patient and educational environments were realized, and the newly constructed facilities and procured equipment were confirmed as being fully utilized in the ICH. Also, the number of ultrasonographic and X-ray examinations conducted in response to ever-increasing outpatients and critical care patients signified that the ICH was now capable of providing better outpatient services and that the project objectives were fully attained. Furthermore, the educational environment had improved in terms of physical capacity to receive more trainees and to provide quality medical training and hands-on practical experience using sophisticated medical equipment, notably in emergency medicine. In terms of impact, the ICH served the health status of the target child population in South India and data collected confirmed that the cure rate had improved, and that in-hospital mortality was reduced. The under-five mortality rate of Tamil Nadu had improved steadily from 2010 to 2017, and in 2017, was less than half of the national average. Therefore, the effectiveness and impact of the project are high. Regarding the operation and maintenance of the procured equipment, the Government of Tamil Nadu and the ICH established that the O&M activities would be managed periodically through public funding. Although a systematic budgetary update was needed for some medical equipment, no major problems were observed in terms of the institutional, technical, financial aspects, and the status of operation and maintenance. Therefore, sustainability is high.

Considering all of the above points, this project is evaluated to be highly satisfactory.

Overall Rating¹	A	Relevance	③ ²	Effectiveness & Impact	③	Efficiency	②	Sustainability	③
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< Special Perspectives Considered in the Ex-Post Evaluation >

The project aimed to improve the capacity of outpatient service provision and the educational function of the ICH. To minimize the traffic of outpatients, the outpatient building was designed and constructed based on a layout that arranged those departments with interrelated disease areas together. The Emergency Room (ER) was also placed on the first floor of the outpatient building, to secure a wider space and to shorten the patient transportation time compared to that in the previous setting. Therefore, in addition to medical services for general outpatients, the benefits to the department of emergency medicine, such as the capacity to provide services for critical care patients, were to be included in the ex-post evaluation study. It should be noted that the project procured not only the medical equipment necessary for a general outpatient practice, but also medical devices suited for the emergency room, such as mobile X-ray and ultrasonography (USG). Furthermore, it also procured various devices for clinical tests at labs (biochemistry, pathology, bacteriology). And it was intended to meet various diagnostic needs of a wide variety of patients through the provision of testing devices such as EEG, EMG, as well as a hemodialysis machine, all of which were used for inpatients as well. As this ex-post evaluation was to verify the effects of the medical equipment and devices procured by the project, it is thus imperative to confirm the improvement of the capacity to provide medical services not only for outpatients but also inpatients and critical care patients as well.

1 Relevance (Rating: ③ High)

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

The project was consistent with the development policy of India as well as the Government of Tamil Nadu at the time of the ex-ante evaluation. In *the 12th Five Year Plan* (2012-2017), support for maternal and child health was one of the major thrusts to promote the quality of medical care services in the urban areas in India. Furthermore, *the Vision Tamil Nadu 2023 -Strategic Plan for Infrastructure Development in Tamil Nadu* (2012 and 2014) issued by the Government of Tamil Nadu also aimed to markedly improve the health indicators to surpass the national average through reinforcement of tertiary level health facilities.

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

The project was consistent with India's development needs at the time of the ex-ante evaluation, particularly in the state of Tamil Nadu and the region of South India. Even before project implementation, the ICH provided free specialized medical services at the tertiary level to the poor people in Tamil Nadu and neighboring states. In 2011, it was estimated that 72 million children were living in Tamil Nadu and 178 million children in neighboring states (Andhra Pradesh, Karnataka, Kerala). These children were the intended beneficiaries of the project, and so there was a palpable need for the ICH to upgrade the quality of the facility as a tertiary care pediatric hospital, to respond to the medical needs of the children residing in the region.

¹ A: Highly satisfactory, B: Satisfactory, C: Partially satisfactory, D: Unsatisfactory

² ③: High, ②: Fair, ①: Low

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

The project was consistent with Japan's ODA policy for India at the time of the ex-ante evaluation. *Country Assistance Program for India* (2006) positioned health and sanitation as one of the priority areas in "Improvement of Poverty and Environmental Issues." It stated that it is considered effective to assist in the establishment of health care infrastructure, in which the construction of facilities and installation of equipment was implemented alongside the capacity development of health workers.

<Evaluation Result>

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

2 Effectiveness/Impact (Rating: ③ High)

<Effectiveness>

The objective of the project was achieved in terms of the enhancement of the capacity of outpatient service provision and its educational function in the ICH.

The quantitative effect was considered to have been achieved using two operation indicators: the number of ultrasonographic examinations; and the number of X-ray examinations significantly exceeded the target as shown in Table 1. These were driven in parallel by the increase in demand from patients actualized for an accurate and immediate diagnosis. Also, it was conceivable to explicate the achievement that there was a considerable increase in outpatients and critical care patients, and the actual working hours of the outpatient building was longer than initially assumed during the time. At the time of the ex-ante evaluation, the target value for each indicator was calculated by adding 10% over the maximum number of patients that could be examined within 4 hours per day. However, the field survey confirmed that although the nominal consultation time was three and a half hours in the outpatient building, the actual consultation time was six hours. It was also confirmed that the ER was operating 24 hours a day. Furthermore, this can be also corroborated by the actual number of X-ray examinations; mobile X-ray device procured by the project was recognized eminently serviceable to respond to the time-sensitive situation in the ER. With regards to the staffing needs for image diagnosis, the number of medical personnel assigned to the department of radiology increased to 16 as planned, to allow for the increase in the number of patients seen. For this reason, there was no exorbitant increase in workload per staff member noted, despite the significant increase in image diagnosis.



X-ray image checked at the department of radiology

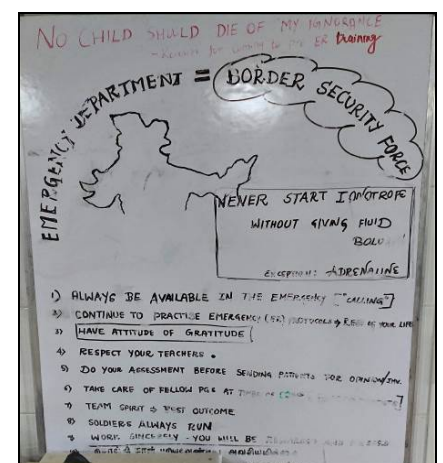
The intended qualitative effects of the project were originally assumed as follows: 1) satisfaction of patients; 2) improvement in the motivation of medical staff at the ICH; and 3) improvement in the satisfaction of residents with the educational environment. Regarding the first point, the satisfaction of patients; the survey had not been conducted by the ICH to be a basic reference point, and therefore a statistically significant comparison study at the ex-post evaluation was not possible. So that it was inferred based on the analysis of "improvement in capacities of service provision for patients." Also, the third point, the level of satisfaction of residents, etc. was also examined in the context of "improvement of the education environment as a clinical education institution," with surveyed opinions of stakeholders in the hospital. The second point, the motivation of medical staff at the ICH, was surmised and described in "improvement of the education environment as a clinical education institution" based on the results of the field survey, as it was precisely observed in medical students and residents. The intended qualitative effects are discussed below and are deemed to have been fully realized at the time of the ex-post evaluation.

[Improvement in Capacities of Service Provision for Patients]

Regarding the improvement in the quality of medical services, this was first verified in the track record, which showed whether more patients were benefitting from the medical services. As shown in Table 2 below, the annual number of patients of all types kept increasing since project completion in 2016. As mentioned above, the emergency medical service, in particular, was to be expanded by the project. A notable increase in the number of critical care patients indicates that more patients benefitted from the medical services after project completion.

The field survey confirmed that the outpatient building was constructed with the emergency department on the first floor. This had a well-ventilated ceiling and a slope to the top floor that enabled patients to be transported on a stretcher to the upper floors. The universal-designed building was suited for a hospital traffic line to alleviate unwanted congestion caused by patients with various diseases and their families. It was also confirmed that the ICH perceived that it enabled them to accommodate many more patients with various distinctive requirements within the medical practices compared to before the project.

Furthermore, the ICH recognized that the improvement of diagnostic capacities through the procurement of diagnostic medical equipment contributed to the improvement of the quality of basic medical services. The ICH had constituted the Medical Audit Committee, a group of medical officers tasked with rigorously assessing medical records to evaluate the quality of the medical care rendered to patients. Medical records were checked regularly by the committee, to ensure that they indicated a correct diagnosis and to verify whether the warranted medical treatment had been given. Concerned medical officers are made aware of the common issue of the ICH shared through discussions of the committee from many angles. Based on all survey results, including hearings from each department in the given context above, the ICH perceived that their diagnostic performance had notably improved and had enhanced the quality of treatment as it had targeted to accommodate the larger number of patients seen (see data shown in <Impact>).



ER team's motto "No child should die of my ignorance"

It can be inferred that the capacities for medical service provision for patients had improved from various aspects, including the confidence of patients and their families in the ICH, which had increased along with their satisfaction level.

[Improvement of the Education Environment as a Clinical Education Institution]

The project improved the clinical education environment and therefore it was inferred that it also contributed to enhancing the satisfaction of residents, etc. The space for educational purposes (classrooms, etc.) was duly increased and this allowed for a greater capacity to provide even more opportunities for medical students, trainees, and residents to experience hands-on practical experiences of using the newly acquired medical equipment. As an affiliate hospital of the Madras Medical College, the ICH has annually received a considerable number of medical trainees (230 persons), medical students (250 persons), and residents (52 persons) from Madras Medical College for various clinical training before the project; it was perceived that the project enabled them to train effectively in a better educational environment in the hospital. Since 2018, the ICH also started providing Pediatric Emergency Medicine Courses to train medical personnel from district headquarter hospitals and several medical colleges, thereby contributing further to the enhancement of medical education. Moreover, aligned with the state policy to further enhance the healthcare sector, the ICH became capable of receiving more residents from outside hospitals so that they could be exposed to state-of-the-art pediatrics medicine and practice. It admitted over 400 persons during the year 2019.

It is considered that the enhancement in the training and educational environment also contributed to the increased motivation of the medical staff in the ICH. In order to improve medical services, it is essential to develop medical skills and knowledge through human resource development. Therefore, it can be surmised that, especially for the residents and medical students, they were motivated to take advantage of the opportunities provided by the project to obtain more experience in clinical medicine, through an appropriate educational environment and the use of new medical equipment.

<Impact>

It was confirmed that the project had an impact on the improvement in the health status of children in Tamil Nadu and, in a broader sense, in South India, through its contribution to enhancing the diagnostic and therapeutic capacities in the medical service provision of the ICH as a tertiary medical institution.

The ICH was called upon to fulfill its responsibilities as a top referral pediatric hospital in Tamil Nadu and Southern India. The project constructed the outpatient building to renew facilities and procure medical equipment, including clinical testing devices, which then enabled them to perform higher quality diagnoses. In effect, to suggest effective treatment that also includes inpatients, the increasing average cure rate of patients was raised to 97.5% in 2019, along with an inversely decreasing bed occupancy rate, which confirms less crowding compared to the numbers before the project started (Table 3). The improvement in the total quality of the hospital as well as its hygienic environment is illustrated by decreasing numbers of in-hospital mortality, specifically the number of in-hospital deaths within 48 hours and the number of deaths from sepsis at the time of the ex-post evaluation. In 2016, the project completion year, the number of in-hospital deaths within 48 hours was 650 deaths, showed a consistently declining trend to 570 deaths in 2019. By the same token, the number of deaths from sepsis was 315 deaths in 2016, it dropped markedly to 44 deaths in 2019 (Table 4). The ICH thus contributed to the survival and recovery of pediatric patients and it was deemed that with concerted efforts, the medical personnel of the ICH had made it possible to upgrade the quality of the hospital.

From the perspective of the Sustainable Development Goals (SDGs), the health status of children of Tamil Nadu was verified as a target area. According to the Sample Registration System (SRS) Data 2017, there was a significant reduction in infant mortality rate (IMR) from 24 per 1,000 live births in 2010 to 16 in 2017. This number is notably low against the National IMR of 33. Furthermore, the under-five mortality rate in Tamil Nadu was 23 per 1,000 live births in 2015. This number dropped to 19 in 2017 showing improvement during this period, having already achieved the national target of 34. The improvements in child mortality in Tamil Nadu had been a trend even before the implementation of the project, so it was difficult to verify the project's specific contribution with statistically significant data. However, since it contributed to the improvement of the quality of medical services such as the reduction of mortality and the improvement of cure rate, etc., it can be inferred that, to a certain extent, the project contributed to the improvement of the health status of children in Tamil Nadu.

Based on the above, it was concluded that the project contributed to the improvement of the health status of children in the region as the ICH was positioned to treat seriously-ill patients not only in Tamil Nadu but also from neighboring states in southern India.

On the other points of concern, there was no resettlement and land acquisition caused by the project, and thus there were no ramifications to do with them. Also, there were no unintended negative impacts observed at the time of the ex-post evaluation.

<Evaluation Result>

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



An ambulance transporting a patient to the ER in the outpatient building

<Quantitative Effects>

Table 1: The Annual Number of Examinations (Operation Indicators of the Project)

Indicators	Baseline	Target	Actual			
	The average of 2011 and 2012	2019 3 Years after Completion	2016 Completion Year	2017 1 Year after Completion	2018 2 Years after Completion	2019 3 Years after Completion
Ultrasonographic examinations	18,728	20,600	30,873	30,052	29,303	35,834
X-ray examinations	37,088	40,800	69,000	69,760	79,800	82,292

Source: The ICH

<Qualitative Effects>

Table 2: The Annual Number of Patients of the ICH

Indicator	Actual							
	2012	2013	2014	2015	2016 (Project Completion)	2017	2018	2019
Outpatients	614,361	561,511	534,180	594,760	594,337	609,816	612,025	639,225
Inpatients	35,905	34,389	36,688	39,325	37,582	40,406	42,530	50,609
Critical care patients (emergency case)	-	-	7,232	10,253	12,628	14,688	12,927	17,496

Sources: The ICH

<Impact>

Table 3: Indicators of Inpatients

Indicator	Actual							
	2012	2013	2014	2015	2016	2017	2018	2019
The average cure rate (%)	95.1	95.3	95.6	95.8	96.5	96.6	97.1	97.5
Bed occupancy rate (%)	99	98	100	74	70	69	77	85

Source: The ICH

Note1: the standard definition of hospital discharge in ICH: since the ICH is a top referral hospital, admitted children get discharged when they have sufficiently recovered from the illness.

Note 2: the number of beds: 837

Table 4: In-Hospital Mortality in the ICH

Indicator	Actual							
	2012	2013	2014	2015	2016	2017	2018	2019
In-hospital deaths within 48 hours	822	751	617	859	650	647	490	570
Deaths from sepsis	438	414	559	370	315	380	329	44

Sources: The ICH

3 Efficiency (Rating: ② Fair)

The output of the project was mostly produced as planned (construction of a new outpatient building, procurement of medical equipment (Ultrasound scanner, Endoscopes, Digital X-ray unit, Transport incubator, EMG, etc. for a total of 65 items)). There were changes in the layout of the building, addition of facilities, and changes in procured items based on the actual situation of ICH; however, these changes did not substantially influence the intended project effect.

The planned project cost was a total of 1,528 million yen (Japanese portion: 1,495 million yen, Indian portion: 33 million yen). The actual cost of the Japanese portion was 1,049 million yen, which was within the plan (71% of the plan). In the survey, ICH reported that the Indian portion was disbursed as planned, but it was not possible to collate the details of the planned amount and the expenditure record. Therefore, the cost-efficiency of the project was determined using only the Japanese portion of the project cost.

The actual period for the project was 29 months, which exceeded the planned period (126% of the plan). Project completion was delayed due to the time required for tender preparation that then put on hold the construction work of the water supply and drainage facilities. This was originally borne by the Indian side. This situation made it difficult to start the facility construction, and in response to India's request to reopen the medical practices in the new outpatient building with the least delay, the Japanese side completed the additional work by taking over. This eventually resulted in a delay of 6 months.

Although the project cost was within the plan, the project period exceeded the plan. Therefore, the efficiency of the project is fair.

4 Sustainability (Rating: ③ High)

<Institutional Aspect>

The Policy Note (2019-2020) issued by the Health and Family Welfare Department (HFWD) of the State Government of Tamil Nadu addressed the medical/healthcare field in its main policy, as several renowned medical schools (e.g. MMC) and a large portion of institutions/hospitals have traditionally been located in Chennai. Such accumulated knowledge and resources in the industry are deemed to be essential capital assets that need to be reinforced. Tamil Nadu emerged prominently as a model State in the country in providing quality health care services: it achieved health-related MDGs and also Sustainable Development Goals (SDGs), far ahead of most other Indian States. For this reason, the State Government of Tamil Nadu retained a twin role of ensuring effective and accessible tertiary care for the

treatment of diseases and provision of health services, and of creating adequate human resources for this sector.

In the policy framework indicated above, the administration, regulation, and budgetary control of O&M of medical facilities of all public medical institutes in Tamil Nadu have fallen under the HFWD; whereas, the execution and supervision of maintenance for all the public medical facilities have been under the Public Works Department (PWD). As indicated in Table 5, in terms of the O&M of medical equipment of tertiary medical institutions, the Directorate of Medical Education (DME) has been in charge of standard control and supervision, implementation, and budgetary and disbursement control. Tamil Nadu Medical Services Corporation Ltd. (TNMSC)³ a specialized public corporation under the supervision of DME in Tamil Nadu has been assigned to execute all the maintenance and procurement of medical materials and equipment of tertiary public institutions. Having deployed approximately 320 members in total, the ICH has been rightly in charge of O&M of medical equipment through proper usage and cleaning on a daily basis. Therefore, the O&M system has remained institutionally unchanged in the foreseeable future.

Furthermore, from the ICH's point of view as an end-user, the O&M has been sufficiently managed and executed from the perspective of deployment of manpower. It was reported by the ICH that DME mechanics were officially dispatched to check on the equipment regularly, but that they had been capable of handling minor malfunctions.

Table 5: Role and Responsibility of the O&M of Tertiary Medical Institutions in Tamil Nadu

Organization	<O&M of medical facilities>				<O&M of medical equipment>			
	Standard control	Regulation	Execution	Budgetary & disbursement control	Standard control	Regulation	Execution	Budgetary & disbursement control
HFWD	✓	✓		✓		✓		
PWD			✓					
DME/TNMSC					✓		✓	✓
ICH (incl. other tertiary medical institutions)							✓	

Source: The ICH

<Technical Aspect>

As described above, there was an institutional mechanism in place for the O&M of the public hospitals in Tamil Nadu and related activities have been systematically carried out as per the established standard of operation even before the project. No major problems were reported regarding technical capabilities for the O&M of precision medical equipment, which required sophisticated maintenance. Regular inspections were performed by medical equipment engineers dispatched by the DME and it was reported that, to date, the medical equipment procured by the project was utilized without any technical problems. It should be noted, however, that this might be because many of the devices were still under warranty at the time of the ex-post evaluation. There was some concern expressed by the ICH regarding the maintenance of some clinical laboratory devices after the expiration of the warranty. Yet, regarding the operation of the newly acquired medical equipment as part of the project there were no major technical issues reported by the ICH. Therefore, it is judged that they have been trained methodically through hands-on experience and have acquired a sufficient skillset for the use and maintenance of the equipment.

<Financial Aspect>

Although there is no data available for the balance of payment including the budget amount allocated for the ICH, the O&M costs have been fully covered by the state budget. At the time of the ex-post evaluation, there had not been any serious issues that occurred in the ICH. According to the available records, all the relevant O&M costs of the ICH have been steadily disbursed; this was approximately 350 million Indian Rupee (Rp.) in 2016, 333 million Rp. in 2017, and 387 million Rp. in 2018 (Table 6). It appears that there have been no problems in securing and maintaining the O&M costs by the State Government. On the other hand, the ICH has faced structural impediments in the prompt procurement of consumables such as reagents utilized in lab tests.

It was confirmed in the field survey that the 3-year warranty period of some of the devices used for the clinical tests would expire soon. Therefore, it was deemed necessary to review and evaluate the operation status and to carry out a re-estimation of costs on a timely manner, which would allow for a proper heads-up for all concerned institutions, particularly the entities of budget control (DME and TNMSC), in order to avoid any interruptions in the use of these devices even after the warranty period expires.

Table 6: Disbursement of O&M for medical equipment and facilities of the ICH

unit: Rp

Item	Actual				
	2016	2017	2018	2019 Up to October	
Medical equipment					
Operation cost					
Personal expenses	288,684,000	287,467,000	335,220,000	231,867,000	
Medical care activities	Transportation, Library	599,409	700,000	700,000	55,448
	Medicine	6,999,182	6,998,000	8,998,000	4,411,00
	Consumables	1,261,754	4,700,000	4,700,000	4,700,000
	Meals	4,834,511	4,611,000	5,304,000	4,411,000

³ TNMSC was incorporated under the Companies Act, 1956 on July 1, 1994 and has commenced its function since January 1995. <https://tnmsc.tn.gov.in/index.php> (accessed June 2020)

Item	Actual			
	2016	2017	2018	2019 Up to October
Maintenance cost				
Maintenance (equipment)	14,000,000	--	--	8,312,534
Equipment purchase	1,515,934	1,950,000	7,397,000	0
Others				
Office supplies	271,203	201,000	202,000	4,035,900
Miscellaneous (including linens)	425,677	129,000	237,000	0
Subtotal	318,591,670	302,056,000	358,058,000	289,415,980
Facilities				
Electricity	17,528,775	18,863,000	21,691,000	12,625,540
Fuel for emergency generator	285,033	253,000	50,000	45,223
Communication	134,485	118,000	101,000	54,161
City water	1,132,236	1,775,000	7,700,000	2,847,355
Medical gas	12,872,071	10,775,000	4,370,375	9,433,284
Subtotal	31,952,600	31,784,000	29,542,000	15,572,279
Total	350,544,270	333,840,000	387,600,000	304,988,259

Source: The ICH

<Current Status of Operation and Maintenance>

No major issues were found in the status of medical equipment and facilities, the outpatient building, and facilities were found to be well-maintained and regularly cleaned at the time of the ex-post evaluation. A wide range of procured equipment performed in a generally good condition. As stated in the institutional aspect above, the O&M was carried out by a multilayered mechanism, which covered all public medical institutions. Thus, the management of any public hospitals in Tamil Nadu proceeded through concerted efforts involving multiple organizations. Further, public hospitals funded by the State Government have not been able to charge a medical fee to diagnose patients to cover the real cost of services, however expensive it may be.

As stated above, some delays were reported in the purchase of consumables essential for some clinical laboratory devices procured by the project. For diseases such as metabolic idiosyncrasy and disorders, it is indispensable that the appropriate medical treatment should be administered on time, based on a special and unavoidable set of clinical testing and prescription. To do so, consumables such as specific reagents for clinical testing are quite essential. As a tertiary medical institution, the ICH needed to treat a relatively large number of severely ill patients; however, in some cases, a thorough examination was not always possible because the necessary consumables could not be purchased due to budgetary allowance restrictions within the budgetary framework. It is deemed that there were situations where it was difficult to make a timely diagnosis.

<Evaluation Result>

Therefore, the sustainability of the project effect is high.

III. Recommendations & Lessons Learned

Recommendations to Executing Agency:

To the Ministry of Health and Family Welfare, The State Government of Tamil Nadu

Introduction of a management system for the purchase of consumables and spare parts for medical equipment

As a public hospital, the ICH ensured equal access to medical services by not charging any fees of patients as an ingrained rule and policy. This, arguably, had a downside as the ICH faced the burden of costs embedded in an institutional mechanism that occasionally failed to cover, on time, some of the real cost of services, such as delays in the purchase of necessary consumables for clinical testing. This potentially could become a much bigger issue with an impact on the larger healthcare system, since the project procured several types of precision machinery to upgrade the pediatrics services of the ICH as a tertiary medical institution responsible for treating a larger population of sick children. Also, the actual status of the use of equipment must be thoroughly checked, reviewed, and projected to balance the allocation of costs. Moreover, to strengthen clinical testing in what is considered the top referral medical institution that admits seriously-ill patients, some of whom have rare diseases, it is a prerequisite to have an adequate level of allowance available in the budget to avoid any on-hold situation of medical equipment.

Therefore, in order to optimize the budget, it is highly desirable to construct and introduce an online platform that can facilitate the processing of real-time medical data of individual patients needed for the cost schedule. In addition, the online platform would allow for closer monitoring of the classification of patients in each tertiary medical institution. This could also facilitate balancing public spending more transparently. It would show the status of all medical equipment connected to each hospital, and TNMSC would be able to carry out evidence-based real-time procurement. It would support the decision-making process of the State Government and strengthen the system of using financial resources to further enhance the quality of medical services.

Recommendations to JICA:

Assistance to design/set up the workable management system

As stated above, since there are other tertiary medical institutions under the DME, it may be desirable to construct an overarching cost management mechanism that would cover detailed cost schedules and monitor closely the classification of patients in each hospital (e.g. electronic billing and reporting connected to TNMSC to reduce any human-induced administrative costs and delays). This would enhance the quality of each medical institution. Because the underlying issue of the burden of health care costs and management is deeply

associated with the sustainability of the overall healthcare system in Tamil Nadu, it may be desirable to discuss with the executing agency how best to introduce the system upon request.

Lessons Learned for JICA:

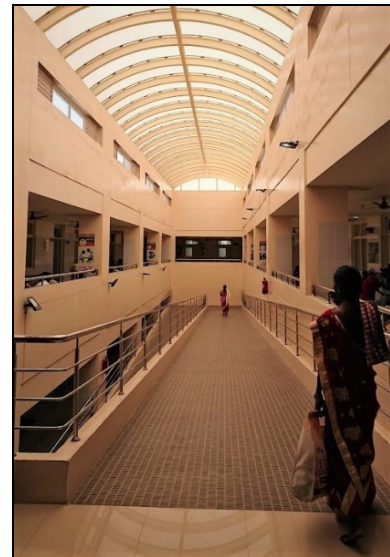
Support to build a mechanism necessary to ensure the timely procurement of medical consumables and spare parts

The ICH was concerned about what would happen to the budget for operation and management costs of medical equipment after the expiration of the warranty period. The particular concerns revolved around issues of how to coordinate the financial gap, as well as how to balance the spending to secure smooth medical operations on demand. Given the multilayered mechanism in place for running the public healthcare system in the state of Tamil Nadu, which included TNMSC, a public hospital such as the ICH did not earn revenue and had no/little financial control over the costs incurred in connection with the delivery of medical services within its facility.

It was thus essential to minimize this uncertainty in a systematic manner. This sort of structural problem could have been foreseen in the planning stage from the perspective of the end-user. Moreover, the fact that necessary consumables were not immediately available to run testing on urgent diagnostic needs of individual patients, meant that diagnosis and treatment could be further delayed. If identified earlier, the ICH and DME/TNMSC could have been notified and made aware of this, and a proposal made in advance for a built-in mechanism on how to cope with the costs and schedule. Although it was agreed with the executing agency on a rough indication of cost by device/equipment according to the estimated frequency of use included in the preparatory survey report, that was hardly reflected and allocated to the budget of the ICH in real terms to secure financial resources in the time after the expiration of the warranty period. Measures related to costs incurred after the warranty period for medical devices/equipment which are not manufactured in the partner country should be deliberately discussed with all stakeholders to secure resources for that matter. This is especially true for a grant aid project involving a public hospital, which is solely run on public funding (free of charge), or with low co-payment rates, which has no authentic and independent financial resources under the given budgetary system.



ER in the outpatient building



Vaulted ceiling and the slope to the top floor of the outpatient building