The Republic of the Union of Myanmar

FY2016 Ex-Post Evaluation of Japanese Grant Aid Project
"The Project for Urgent Improvement of Communication Networks"

External Evaluator: Tomoko Tamura, Kaihatsu Management Consulting, Inc.

0. Summary

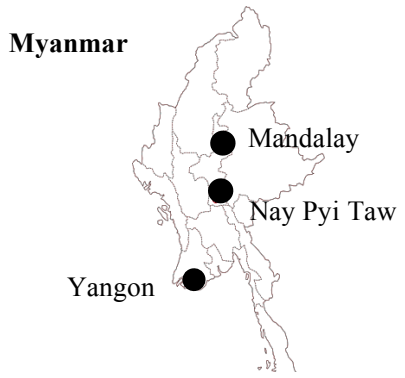
This project was implemented to enhance capacity of communication services, by improving communication networks in and between the three largest cities in Myanmar, and thereby contribute to economic development and improvement of the living condition of people in the country. The project has been highly relevant to the development plan of Myanmar, which aims to drastically increase the population coverage of communication services; to the development needs of the country, including developing communication infrastructure in line with the increase in the number of users and traffic volume of communication services, and fulfilling communication needs of upcoming international events, such as upcoming the South East Asian Game (SEA Games) at the time; and to Japan's ODA policy, which places importance on the development of infrastructure and institutions necessary for sustainable economic development. Therefore, its relevance is high. Procurement of equipment and capacity building program (soft components) was conducted as planned, and both the project cost and project period were within the plan. Therefore, the efficiency of the project is high.

Improved communication speed of the backbone networks and metro networks of the largest three cities of the country, and improved internet access were realized as planned due to the implementation of this project. After completion of the project, Myanma Posts and Telecommunications (hereinafter referred to as "MPT"), the executing agency of the project, continuously enhanced its facility due to the increase in traffic volume and demand by increasing the capacity of the equipment introduced by the project and purchasing additional equipment. The communication service of MPT has been improved and the equipment has been maintained properly. This project supported the operation of the SEA Games and contributed to raising the international presence of the country. The beneficiary survey conducted in the ex-post evaluation found that the users of communication services in the country had benefited in various ways as a result of this project and improvement of communication infrastructure and services realized after the project, such as improvement in communication with people living far away and in workplaces, increased business chances and opportunities for employment and better jobs. Therefore, the effectiveness and impact of the project are high.

There were no problems with the operation and maintenance of the equipment introduced by the project in terms of institutional, technical and financial aspects; most of the equipment is utilized effectively. There is also a prospect of the equipment being effectively utilized in the future. However, currently the equipment for LTE communication is utilized to a limited extent. Therefore, sustainability of the project effects is fair.

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

1. Project Description



Project locations

Equipment installed by the project (Nay Pyi Taw)

1.1 Background

Development of communication infrastructure was delayed in Myanmar due to many years of import and other restrictions during the time of economic sanctions. Communication services were only used to a limited extent in the country because of insufficient communication network capacity, due to the necessary infrastructure not being developed, and high user fees. The penetration rates of fixed telephones, mobile phones and internet in the country were 3 percent, 5 percent and 0.3 percent respectively in 2011.[1]

The Thein Sein administration, established in 2011, was in a process of political and economic reform and had a policy of improving communication services and citizens' lives, and stimulating economic activities, by opening the communication market to private service providers and relaxing regulations. However, in those days there were frequent problems with connectivity and speed of telephone and internet because of inadequate capacity of the communication network and decrepit communication infrastructure, and other reasons. The administration was worried that the communication environment would worsen in future when traffic volume increased. In particular, improving communication capacity in Greater Yangon, the center of the economy and the entrance of the country, Mandalay, the second largest city, and Nay Pyi Taw, the capital city, where local and foreign firms and government institutions would locate their offices in future, was urgent.

Myanmar was planning to hold the SEA Games in December 2013, and the ASEAN conference in November 2014. It was also an urgent task for the country to meet the communication needs of these international events.

1.2 Project Outline

The objective of this project is to enhance capacity of communication services to meet increasing communication demand, by improving the communication networks in and among the cities of Greater Yangon, Mandalay and Nay Pyi Taw in Myanmar, and thereby contribute to the economic development and improvement of the living condition of people in the country.

[1] Source: Summary of the ex-ante evaluation of the Project for Urgent Improvement of Communication Networks.

E/N Grant Limit / Actual Grant Amount	1,710 million yen/ 1,709 million yen
Exchange of Notes Date/ Grant Agreement Date	December 2012/ December 2012
Executing Agency	Myanma Posts and Telecommunications (MPT)
Project Completion	November 2013
Main Contractors	Sumitomo Corporation NTT Communications Corporation, and NEC Corporation consortium
Main Consultants	The Consortium of Yachiyo Engineering Co., Ltd. (Japan), Pantel International Co., Ltd. (Japan) and Nippon Koei Co., Ltd. (Japan)
Basic Design	November 2012 - March 2014[2]
Related Projects	- ODA Loan: Communication Network Improvement Project (L/A signed in 2015) - JICA Long-Term Expert: Advisor for Improvement of Telecommunication Infrastructure (November 2013 - June 2015) - JICA Long-Term Expert: Policy Advisor for Communication and Information Technology (October 2015 -)

2. Outline of the Evaluation Study

2.1 External Evaluator

Tomoko Tamura, Kaihatsu Management Consulting, Inc.

2.2 Duration of Evaluation Study

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

Duration of the Study: July 2016 – July 2017

Duration of the Field Study: October 2nd - 16th, 2016, December 18th - 24th, 2016

2.3 Constraints during the Evaluation Study

Currently MPT is jointly operated with a private company,[3] and does not publicize its

[2] The preparatory study for this project and the ODA loan project of Communication Network Improvement Project was conducted at the same time in "The Preparatory Study on Improvement of Communication Network Projects". The field study for preparation of this project was conducted from December 2012 to January 2013 (the first phase) and in February 2013 (the second phase).

[3] MPT is being operated jointly with KDDI Summit Global Myanmar Co., Ltd. (KSGM) from July 2014. KSGM is owned 50.1 percent by KDDI and 49.9% by Sumitomo Corporation. Staff of MPT and KSGM call the jointly operated firm MPT-JO (JO stands for joint operation). However, MPT and MPT-JO are regarded as the same in this report, and described as MPT, because it is called MPT in public relations material.

financial information. Therefore, financial information of MPT was not provided to the external evaluator for this ex-post evaluation. Sustainability in terms of financial aspects was analyzed based on the result of interviews with senior management of MPT, as quantitative analysis could not be conducted.

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

3.1 Relevance (Rating: ③[5])

3.1.1 Consistency with the Development Plan of Myanmar

At the time of project planning, completion and ex-post evaluation, the political and economic development policy of the government of Myanmar[6] emphasized the need for reform of information and communication technology, and aimed to radically increase penetration rates of fixed telephones, mobile phones and internet. For example, the policy had a target of increasing the penetration rate of mobile phone from 10 percent at that time to 80 percent in 2015.

Development of communication infrastructure is necessary to achieve these policy objectives. The plan of the communication sector of the country[7] at the time of the ex-post evaluation aimed to increase the population coverage of telephones (mobile and fixed phones), internet and high-speed internet to 90 percent, 85 percent and 50 percent respectively by 2020 by developing communication infrastructure, such as communication networks and international gateways.

Therefore, this project, which aimed to develop communication networks, is highly consistent with the development plan and communication sector plan of the country at the time of planning and ex-post evaluation of the project.

3.1.2 Consistency with the Development Needs of Myanmar

At the time of planning the project, it was expected that the number of users of communication services and traffic volume would increase, and it was urgent to develop communication infrastructure to meet this demand. It was also urgent for the country to develop its communication infrastructure at the time of planning of the project to meet the communication needs of the organizers, participants and media persons of participating countries in international events, such as the SEA Games in December 2013, and the ASEAN conference in November 2014.

After completion of the project, communication services, especially mobile phones, became widely used in the country. According to a survey of the International Telecommunication Union (hereinafter referred to as "ITU"), the subscription rate of mobile phones was 13 percent in 2013 and 77 percent in 2015. In the same way, the penetration rate of individuals using the internet increased from 2 percent to 22 percent (Figure 1). However, these subscription rates for mobile phones and individuals using the internet are still low compared to neighboring South-East Asian countries (Figure 2). There is a high possibility that demand for telephone and

[4] A: Highly satisfactory, B: Satisfactory, C: Partially satisfactory, D: Unsatisfactory
[5] ③: High, ②: Fair, ①: Low
[6] *Framework for Economic and Social Reforms, 2012*
[7] *Myanmar Telecommunication Master Plan, 2015*

internet will also increase in the future, in line with the economic development of the country. The need to develop communication infrastructure to meet this demand remains high at the time of the ex-post evaluation.

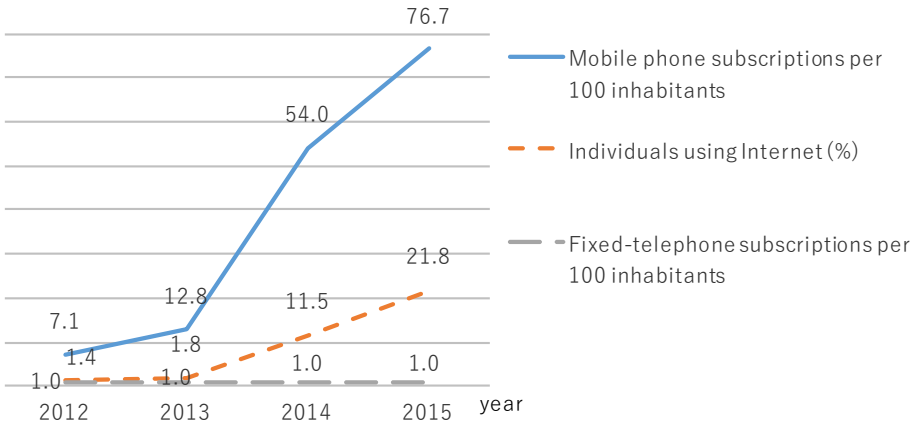


Figure 1 Mobile phone and fixed telephone subscription rates and individuals using the internet in Myanmar in recent years

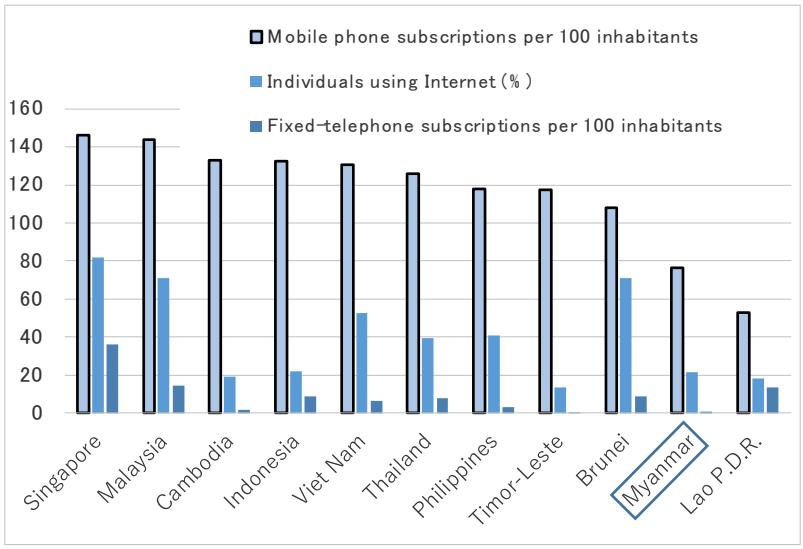


Figure 2 Mobile phone and fixed telephone subscription rates and individuals using internet in South-East Asian countries (2015)

Source: Illustrated by the external evaluator based on the information on the website of ITU (the figures are estimates of ITU)

It was found in the beneficiary survey[8] which was conducted in Yangon, Mandalay and Nay Pyi Taw as part of the ex-post evaluation that users wished to have further improvement of

[8] A street interview survey was conducted in the earlier-mentioned three cities of the users of one of the following communication services - mobile phones, fixed telephones or internet - in October 2016 by using convenience sampling method. The total number of valid responses was 258. The number of city-wide responses was 86, 78 and 94 in Yangon, Mandalay and Nay Pyi Taw respectively. 52 percent were male and 48% were female. 47% were

connectivity of internet and telephone, speed of internet, user fees and others, while they highly appreciated recent improvements in the communication environment (Figure 3). This survey result also shows that the need for further improvement and development of communication infrastructure is high in the country at the time of the ex-post evaluation.

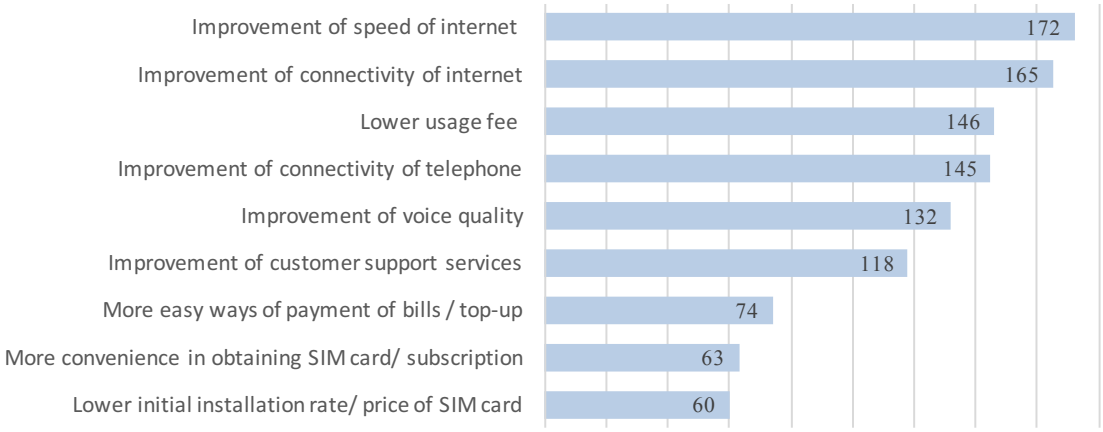


Figure 3 In what kinds of service do you wish to have further improvement in future?
(n=258, multiple answers allowed)

Source: Beneficiary survey

Therefore, this project, which aimed to improve communication infrastructure, was highly consistent with the development needs of the country throughout the period from planning to the ex-post evaluation of the project.

3.1.3 Consistency with Japan's ODA Policy

The Country Assistance Policy of Myanmar, which was revised in April 2012 to facilitate democratization, national reconciliation and sustainable development of the country, listed the following as three important areas of assistance: (a) improvement of living conditions of the people, (b) capacity building of individuals and institutions necessary for supporting socio-economic activities, and (c) development of infrastructure and institutions necessary for sustainable economic development. This project, which aimed to develop communication infrastructure, was part of (c) above. Therefore, this project was consistent with Japan's ODA policy.

This project has been highly relevant to the development plan and development needs of Myanmar, as well as Japan's ODA policy. Therefore, its relevance is high.

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younger than 35 years old and 53% were equal or older than 35 years old. Status of usage of the communication services was that 240 persons (93%), 48 persons (19%), 26 persons (10%) and 8 persons (3%) were using smartphones, mobile phones (voice only), fixed telephones at home and internet facility at home respectively (multiple answers allowed).

3.2 Efficiency (Rating: ③)

3.2.1 Project Outputs

The output of procurement of the equipment and soft components were as follows. They were conducted in accordance with the original plan.

＜Procurement and installation of the equipment＞

(1) Enhancement of the backbone network between the three cities

The backbone network transmits all the communication services of MPT, including those for internet, mobile phones (both voice and data), and fixed telephones. The project enhanced the capacity of the backbone network from 10Gbps to 30Gbps (10Gbps×3) by installing wavelength division multiplexing systems, power supply systems for the backbone network and others to the existing fiber optic cables between Greater Yangon, Nay Pyi Taw and Mandalay. The project also installed redundant switching systems for the backup route of the backbone network, so that the entire system would continue functioning if a problem occurred with the backbone network.

(2) Enhancement of the metro network in the three cities

The project installed wavelength division multiplexing systems, digital microwave communication systems, switching systems and power supply systems for the metro networks in the three cities, and formulated metro ring networks, so that MPT can provide high-speed internet services and dedicated-line services to office buildings and business establishments in the three cities by connecting them with fiber optic cables.

(3) High-speed radio broadband access in the three cities

In order to meet communication needs at the time of the SEA Games and the ASEAN conference, an LTE communication system was introduced to make high-speed radio broadband access available in the three cities. The element management system was installed in Nay Pyi Taw, a total of 50 sets of LTE compact radio station systems were installed at the sports grounds and international conference halls in the three cities, and the LTE compact radio station systems were connected to the metro network systems. In addition to these systems, 250 WiFi routers for LTE in total were installed in the three cities, so that internet could be connected through WiFi, which is generally available in these cities.

(4) Improvement of internet access

Equipment such as the core router, firewall servers, load balancers, network address translations, DNS[9] cache machines, bandwidth control device and others, were installed in the existing internet access networks. In addition, internet systems were reconstructed, so equipment was connected to each other and linked with existing networks. By this arrangement, the network became capable of dealing with increasing traffic volume effectively; the situation of the internet not being connected when a problem occurred at any one of the locations in the network was now avoidable.

[9] DNS (Domain Name System) is a system to administrate and operate domain names and IP addresses used for their corresponding host names and e-mails on internet.

(5) Reinforcement of the international gateway

At the time of project planning, there was only one international gateway at Yangon. This project set up another international gateway at Nay Pyi Taw. The project also reconstructed the network system so that these two cities were linked to each other. By this arrangement, when a problem occurred in the international cable connected to Yangon, it would be connected through Nay Pyi Taw; as a result, a system was established whereby the internet connection would never be interrupted. In addition, a DDoS detector[10] was installed at the international gateway at Yangon, so that network attacks from overseas can be detected.

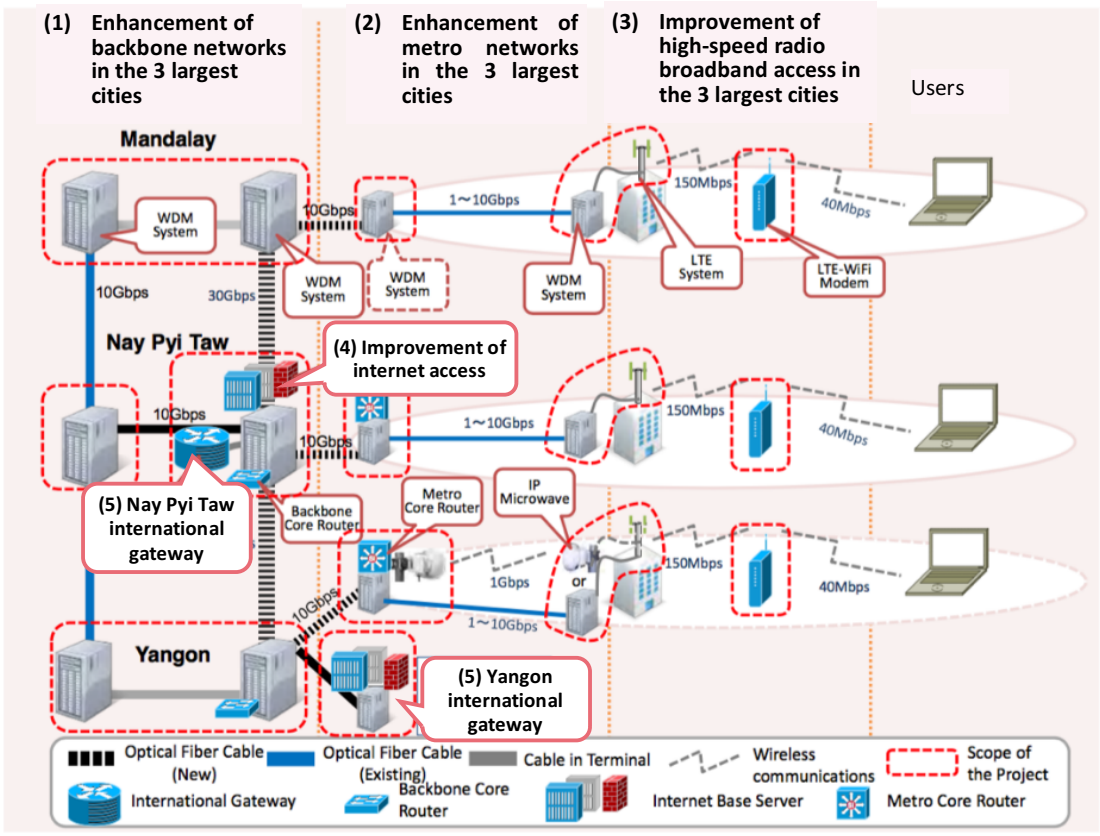


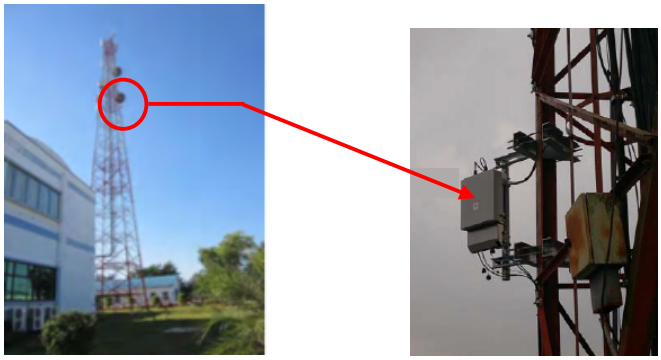
Figure 4 Equipment procured by the project[11]

Redundant switching system for backbone ring network (Nay Pyi Taw)

Redundant switching system for metro ring network (Yangon)

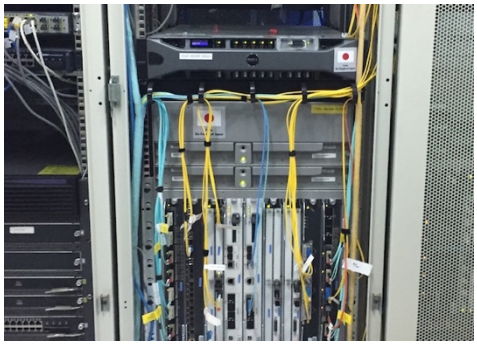
[10] DDoS attack (Distributed Denial of Service attack) is an attack in which multiple computers are used to send requests for connection at the same time, targeting a particular server - this increases load or traffic volume and thereby shuts down the function of the server.

[11] WDM system (Wavelength Division Multiplexing system) is one of the photonic technologies for transmitting a large volume of signals.



Equipment for high-speed radio broadband access in Nay Pyi Taw
(Right: LTE compact radio station system,
Left: a tower where the system is installed)

Equipment for improving internet access in Mandalay



DDoS detector at the international gateway in Yangon

<Soft components>

Lectures, classroom lessons and workshops for strengthening maintenance systems of communication equipment and networks were conducted for the relevant departments of MPT, including departments of fixed telephones, international communication, long distance communication, mobile communication and IT, in the three cities.

3.2.2 Project Inputs

3.2.2.1 Project Cost

The project cost was planned as Japanese yen (JPY) 1,890 million in total, which included JPY 1,710 million from the Japanese side and Myanmar kyat (MMK) 1,957 million, equivalent to around JPY 180 million,[12] from the Myanmar side. Actual cost was JPY 1,771 million, which included JPY 1,709 million and MMK 673 million, equivalent to around JPY 62 million. The actual cost was within the planned cost (94 percent against the plan).

[12] The planned and actual costs from the Myanmar side were converted by applying the exchange rate at the time of project planning (1 kyat = 0.092 yen, the report of the project preparation study in January 2013) because the IMF rate during project implementation was not available.

3.2.2.2 Project Period

The project period was planned as twelve months from March 2013, the commencement of the designing, to February 2014, completion of the installation. It was actually nine months, from March 2013 to November 2013, and was within the planned period (75 percent against the plan). The project was completed earlier than planned as stakeholders in Myanmar and Japan made a collective effort to complete the project in time for the SEA Games, which was scheduled to be held from December 8th, 2013. (See the column on page 15.)

There were some members in the consultancy team and agencies for procurement and installation of the equipment who had worked in the country for a long time, and, therefore, cordial relations were established with MPT; this facilitated efficient implementation of the project. To avoid the risk of project delays due to weather conditions, the project minimized the need for civil construction by utilizing MPT's existing fiber optic cables, buildings of the exchange stations and steel towers for installation of the equipment, as they knew that the time for procurement and installation would be during the rainy season.

Both the project cost and project period were within the plan. Therefore, efficiency of the project is high.

3.3 Effectiveness[13] (Rating: ③)

3.3.1 Quantitative Effects (Operation and Effect Indicators)

＜Operation Indicators＞

At the time of planning, proposed operation indicators of the project were improved communication speeds of the backbone network between the three cities, the metro networks and radio broadband. The external evaluator studied these indicators and found that all of them had improved at the time of the ex-post evaluation.

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

Table 1 Operation Indicators

Items	Baseline	Target	Actual			
	2012	2016	Nov. 2013	Dec. 2014	Dec. 2015	Oct. 2016
	Planned Year	3 Years After Completion of the Project	Completion Year	1 Year After Completion of the Project	2 Years After Completion of the Project	3 Years After Completion the Project
(1) Improvement of the speed of the backbone network	Around **10Gbps**/ without backup	**30Gbps**/ with backup of 10Gbps	**30Gbps**/ with backup of 10Gbps	**100Gbps**/ with backup of 10Gbps	**200Gbps**/ with backup of 200Gbps	**300Gbps**/ with backup of 200Gbps
(2) Improvement of the speed of the metro networks	**1 -10Gbps**	**10Gbps**	**10Gbps.** Redundancy was improved. Expansion of usage.	**10Gbps**. Redundancy was maintained. Further expansion of the usage.	**10Gbps**. Redundancy was maintained. Further expansion of the usage.	**10Gbps**. Redundancy was maintained. Further expansion of the usage.
(3) Improvement of the speed of the radio broadband	Wi-Max : Max. transmission speed of **2Mbps**	LTE: Max. transmission speed of **100Mbps**	LTE: Max. transmission speed of **100Mbps**	LTE: Max. transmission speed of **100Mbps**	LTE: Max. transmission speed of **100Mbps**	LTE: Max. transmission speed of **100Mbps**

Source: The baseline and target figures were from the report of the preparatory study of this project; the actual figures were submitted by MPT.

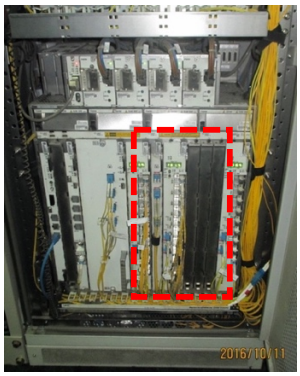
Note: Improvement in indicators of (1) and (2) after completion of the project were realized as a result of MPT purchasing additional equipment and installing them in the equipment procured by the project 2014 onwards.

The speed of the backbone network was approximately 10Gbps and 30Gbps at the time of planning and completion of the project respectively, which was the expected figure. To further enhance the backbone network, MPT increased the speed of the network in stages to 100Gbps, 200Gbps and 300Gbps, by purchasing some additional equipment (transponders[14]) after the completion of the project; MPT installed them into the wavelength division multiplexing systems so that they could meet the increasing needs of communication (see photos).

This project also ensured redundancy of the systems by improving the backup route of the backbone networks. MPT also increased the speed of the backup route up to 200Gbps by purchasing and installing some new equipment after the completion of the project, because the backup route, also, needed to be upgraded in accordance with the enhancement of the backbone networks.

[14] Transponder is a collective term for equipment responding to incoming signals, such as relay transmission of electric signals received and mutual exchange of electric signals and optical signals. It is a composite word from transmitter and responder.

At the time of completion of the project



At the time of ex-post evaluation

The main router for the backbone network at the Mayangone International Transmission Maintenance Center Exchange in Yangon. Two transponders (marked by a red dotted line) had been added by the time of the ex-post evaluation.

The speed of the metro networks was 1 - 10Gbps and 10Gbps at the time of planning and completion of the project respectively. This was the expected figure. In addition to this, as the project constructed the ring network, the network connection would be maintained through a detour at any time even if an accident or problem occurred in the network: therefore, redundancy of the system was ensured. Before the project, MPT used to provide a service called "fiber internet access" to business entities and government institutions, with a speed of 1Mbps - 100Mbps. After the project, MPT had started a high-speed internet service called "B2B plan" in Yangon, using the metro networks developed by the project, with an aim of offering a communication service both faster in speed and larger in capacity. This is a service offering communication capacity of 400MB - 10GB; the main customers are office buildings and business entities. In addition to this, MPT started a dedicated network service by using IP-VPN technology in Yangon and Mandalay using the metro networks from 2016.[15] This is a high security service which links specific places; the main customers are financial institutions and others.[16] MPT had purchased additional equipment for several exchange centers in Yangon, which have higher demand, and installed them to the metro networks when needed; this had expanded the services. In this way, the metro networks have been actively utilized for providing faster and larger communication services to business entities and government institutions in Yangon and Mandalay, the economic centers in the country.

As for radio broadband communication, Wi-Max of 2Mbps was available at the time of project planning; after the introduction of LTE communication, a speed of 100Mbps has become available at the time of completion and ex-post evaluation. This, too, was exactly expected as an effect of the project.

[15] IP-VPN is one of the virtual private networks, which are developed and operated by each network operator in a closed manner. It has superior security and quality control.

[16] The number of subscribers of B2B and dedicated network service are shown in the chapter on "impact" in this report.

＜Effect Indicators＞

At the time of planning, proposed effect indicators of the project were quality, connectivity and stability of transmission of the internet in the three cities. The information shown in Figures 5 - 8 was provided by MPT for the ex-post evaluation to show improvement in these items, such as quality, and its background.

Figure 5 shows total traffic capacity and traffic usage in the three cities. The traffic usage has increased year by year. This is the result of a rapid increase in the number of users of mobile phones and internet communication, which happened after introduction of the policy to open the market for mobile communication services. As a consequence of the fact that two private communication operators came into the market from August 2014, a competitive environment was created, the price of SIM cards and usage fees of these operators became much lower,[17] and advertising campaigns and sales networks expanded. Figure 5 also shows that MPT increased traffic capacity year by year according to the increase of the usage. This was realized because MPT continuously enhanced the facility by re-structuring the configuration or design of equipment procured by the project, and purchased additional or new equipment after enhancement of the facility conducted by the project. The equipment introduced by the project served as a foundation for the continuous enhancement made after completion of the project.
Figures 6 and 7 show improvement of upload and download speed of the networks. Figure 8 shows improvement or maintenance of the Ping result, which shows speed of response of the networks.

Accordingly, the communication services of MPT have been improved or maintained as a result of this project; further enhancement of the facility was conducted in accordance with the increasing traffic volume after the project.

[17] According to interviews with staff at JICA (Japan International Cooperation Agency) Myanmar office conducted at the time of the ex-post evaluation, the official price of a SIM card was around 200,000~1,500,000 kyat (around 20,000~160,000 JPY at the exchange rate then) and from one to four million kyat (110,000~420,000 JPY) in market price prior to August 2014. Furthermore, one could not purchase a SIM card until winning a lottery. The price of a SIM card was reduced to 1500 kyat (around 150 JPY) from August 2014 onward (it was the same price, 1500 kyat, at the time of the ex-post evaluation). Usage fees for telephone and data have also been reduced.

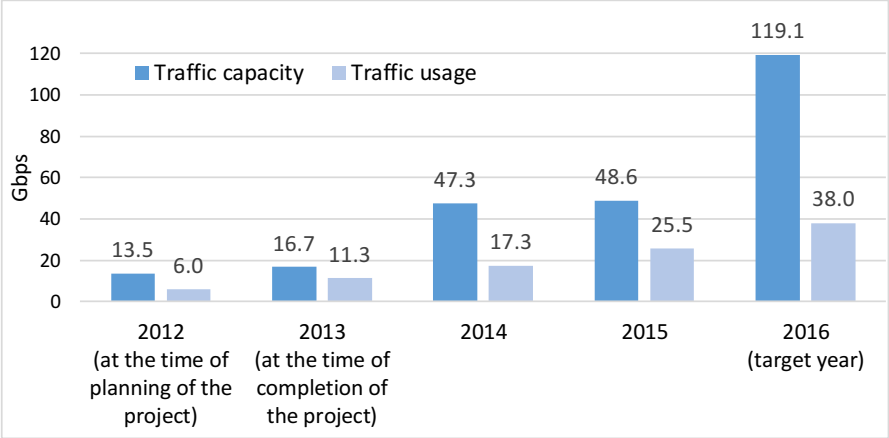
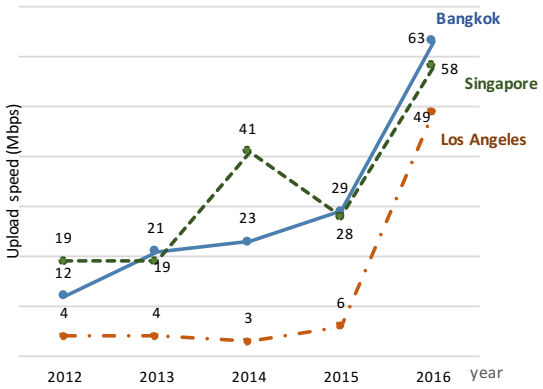


Figure 5 Traffic capacity and traffic usage of MPT (total of the three cities)

Note: Figures are those at the end of December every year. The figure for 2016 was for the end of September.
Traffic capacity is the maximum information-carrying capacity of a network. In the above figure, it is the transmission speed the internet attained when connected to the server of the networks which link the three cities, according to communication theory. Traffic usage was the speed which was actually attained when information was carried by the network.

Source: Illustrated by the external evaluator based on the document submitted by MPT



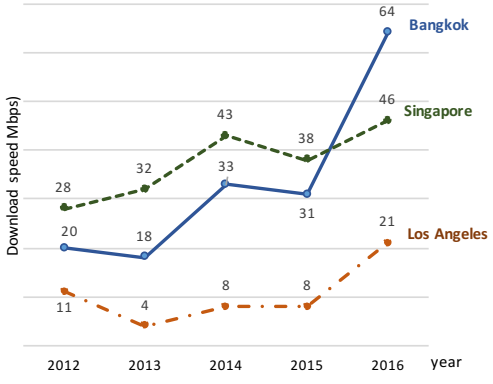


Figure 6 Result of upload speed tests

Figure 7 Result of download speed tests

Note: The download and upload speed is the speed of a computer in a particular location to obtain or send data from other computers in other locations through the internet. The larger the value, the faster the speed. The tests were conducted by using an application for testing speed on the last day of December every year at the MPT Hantharwaddy Exchange in Yangon. The speeds for obtaining and sending data from the computers in Bangkok, Singapore and Los Angeles were tested. (Year 2016 shows the test result on the last day of September 2016.)

Source: Illustrated by the external evaluator based on the document submitted by MPT

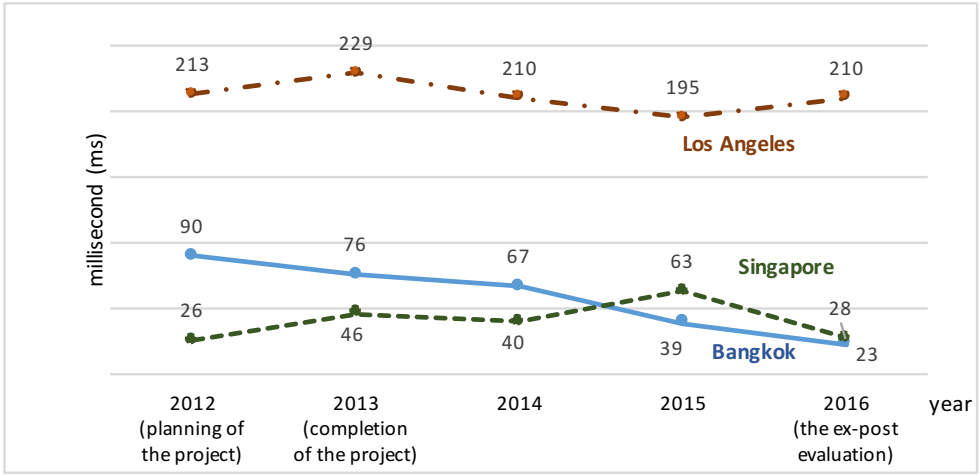


Figure 8 Ping results (measured at the MPT Hantharwaddy Exchange in Yangon)

Note: Ping is the time a computer takes from the time it requests another computer to send data until it is sent accordingly. It shows response speed of the communication network. The unit is millisecond (ms). The smaller the value, the faster the response speed. The values in the Figure are those measured on the last day of December every year. (Figure of 2016 was measured at the end of September.)

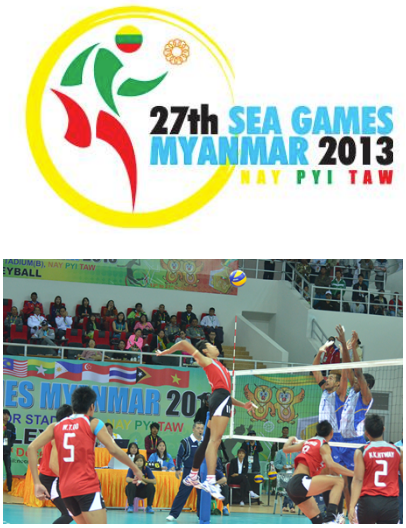
Source: Illustrated by the external evaluator based on the document submitted by MPT

3.3.2 Qualitative Effects (Other Effects)

This project was a timely assistance for the liberalization of the telecommunication market in the country and the SEA Games held in December 2013. The following column explains that this project supported the operation of the SEA Games and contributed to raising the international presence of the country.

<Column: The timely completion of the Project contributed to fulfilling communication needs in the SEA Games >

The SEA Games started in 1959. One South-East Asian country hosts the event in turn every two years. It was after 44 years that Myanmar hosted the event in 2013 - Myanmar had not hosted the event since 1969. The events had become to be at a higher level in terms of facility, opening and closing ceremonies and operation in those days. Therefore, the Myanmar government also aimed to host the event up to the level of expectation of others, with national pride at stake.



Logo and a picture of the SEA Games (Source: Official Facebook)

The city of Nay Pyi Taw, the main venue of the event, became the capital of the country instead of Yangon in 2006. At the time of project planning, there was very little facility of WiFi communication in the city, and the internet speed was slow. Therefore, the project planned to introduce high-speed WiFi communication

through LTE, improve internet connectivity and fulfil the communication needs for the event.

To realize this plan, it was necessary for the project to be completed before the opening of the event. According to stakeholders of the project, the top management and ministers of the relevant ministries and departments of the country visited project sites many times to ensure progress with installation of equipment on holidays and other available days. It is true that top officials in the country pinned their hope on this project. The staff on the Japanese side did their best to complete the project early by carrying out designing, manufacturing and transport of equipment efficiently, and providing necessary advice in advance to the relevant departments of the country so that the project would not be stagnated due to a delay in custom clearance and payment of taxes. The efforts made by the two countries yielded results. Installation of all the equipment was completed in November 2013. The project team conducted test operations and technical transfer during a few weeks before the opening of the event. Everybody was fully ready for the event.

The SEA Games received approximately 4,700 athletes from 11 countries. The 28 different sporting events were carried out smoothly. The operation of the event was carried out extremely well. The equipment installed by the project functioned without any problem, and met the communication needs of the event. The LTE facility was widely utilized as a communication tool among the different groups of people who were undertaking operation of the event, for data transmission of the result of various sport events to be displayed on sign boards at the sports grounds, for media personal from different countries to send results of events to the broadcasting stations of their respective countries, and other purposes. The athletes from different countries and visitors were able to use the high-speed WiFi service free of charge on their smartphones. According to senior officials of MPT, the communication services introduced by the project were very much appreciated by the stakeholders of the event; there were no problems or complaints.

Myanmar won 233 medals, including 86 golds at the event. This was the second highest after Thailand, and the event brought great pleasure to the people in the country. The SEA Games was a symbolic event for the country in its effort for democratization. The success of the event contributed to raising the international presence of the country. Furthermore, the communication equipment introduced by the project functioned without a problem at the ASEAN summit conference held in May and November of 2014 at Nay Pyi Taw, and fulfilled the communication needs at the conference.

3.4 Impact

3.4.1 Intended Impacts

This project stimulated the infrastructure development of MPT, and helped them to deal with a rapid increase in communication demand after completion of the project. Therefore, this ex-post evaluation studies expansion of usage of the communication services of MPT, because

this was considered an impact of both this project and further enhancement of the infrastructure after the project.[18]

Table 2 shows the trend in number of subscribers to communication services of MPT. It shows a drastic increase in the number of subscribers for mobile internet and ADSL services year by year, and introduction of new services, such as B2B internet and dedicated network. It clearly shows that MPT was expanding the number of subscribers and the kinds of services.

Table 2 Number of subscribers to the internet and network communication services of MPT in recent years

Items	2012	2013	2014	2015	2016
Mobile internet	743,824	2,105,628	4,060,631	14,129,218	19,405,080
ADSL	5,241	7,905	11,899	15,632	18,370
B2B internet	-	-	-	202	651
Dedicated network service	-	-	-	-	11,527

Note: Figures are those at the end of December every year. (Figure for 2016 was measured at the end of October.)
Source: Document submitted by MPT

The beneficiary survey conducted in the ex-post evaluation (see footnote 8) studied the opinion of people in the three cities about improvement of communication services in recent years (about last three years). All the respondents were appreciative of the improvement in communication services and communication environment, and mentioned improvement in services for mobile phones and internet, for example. The lower price of SIM cards, and improved availability of SIM cards, convenience in payment of user fees, telephone connectivity, voice quality, customer care services, speed of internet, were also mentioned, as shown in Figure 9.

[18] Contributing to the economic development of the three cities benefitted by the project was expected as an impact of the project at the time of planning. It was difficult to identify the impact of this project on the economy as economic development was largely influenced by other matters, such as trend of investment and business operations, in addition to improvement in the environment of communication; the economy of the country was continuously developing, and GDP growth rates in recent years were 7.2% - 8.7%.

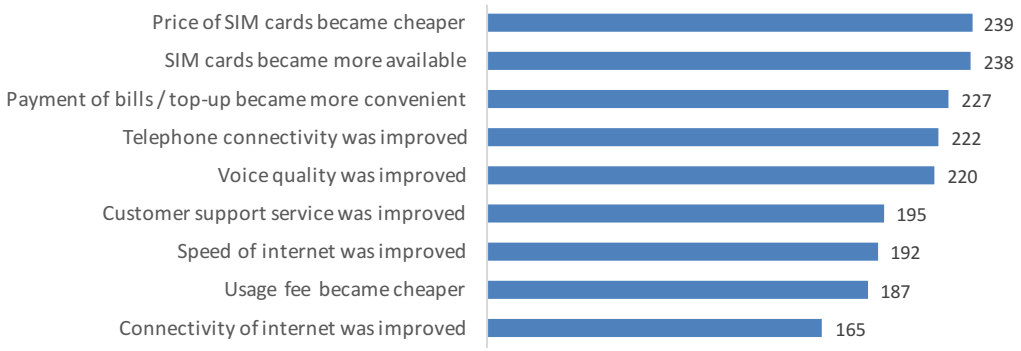


Figure 9 What kind of improvement do you think was there in recent years relating to mobile phones and internet services

（n=258, multiple answers allowed）

Source: Beneficiary survey

Ninety percent of respondents answered that "There was a positive impact due to the improvement of communication services". Improvement in communication with people living far away and in workplaces, and increased business chances and opportunities for better jobs, were the most frequent answers for examples of positive impacts (Figure 10).

Figure 10 In what ways has the change in the communication environment been positive?

（n=244, multiple answers allowed）

Source: Beneficiary survey

In summary, it was found that the users were highly enjoying improvements in communication services that happened in recent years, and these had brought various positive impacts to their daily life and working environment.

3.4.2 Other Positive and Negative Impacts

There was no impact on the natural environment, land acquisition or resettlement by the project.

This project has achieved its objectives. Therefore, effectiveness and impact of the project are high.

3.5 Sustainability (Rating: ②)

3.5.1 Institutional Aspects of Operation and Maintenance

MPT is responsible for operation and maintenance of the facility and equipment introduced by the project, which has not changed from the time of planning the project. Organizational structure and place of responsibilities in MPT at the time of the ex-post evaluation are clear. MPT has the necessary staff in each division, and there are no vacancies in important posts. The Operation Unit under the Technical Division is in charge of the operation and maintenance of the equipment and facility.

MPT has been in a competitive environment since private companies participated in the market in 2014. MPT has been making a keen effort to enhance competitive strength and improve services, by absorbing marketing and service know-how from the joint operation partner of KSGM, having renewed its brand logo, established wholly-owned outlets, implemented public relations activities actively and enhanced network facility in stages in recent years. MPT has been conducting operation and maintenance of the equipment efficiently, utilizing external professional agents as needed.

As mentioned above, institutional arrangements of MPT for the operation and maintenance are well established, and will facilitate sustainability of the project effect.

3.5.2 Technical Aspects of Operation and Maintenance

There have been no technical problems with regard to the operation and maintenance of the equipment procured by the project to date. Daily maintenance of the facility and equipment is conducted mainly by the staff of MPT. MPT conducts maintenance work efficiently, outsourcing repair and other work when necessary. As mentioned earlier, traffic volume and demand has increased rapidly after completion of the project as a result of the policy of liberalization of the market and others, followed by the participation of private telecommunication operators. MPT obtained timely advice from the Japanese engineers of KSGM, which is the joint operation partner of MPT, and managed the rapid increase in traffic volume by effectively utilizing the equipment procured by the project.

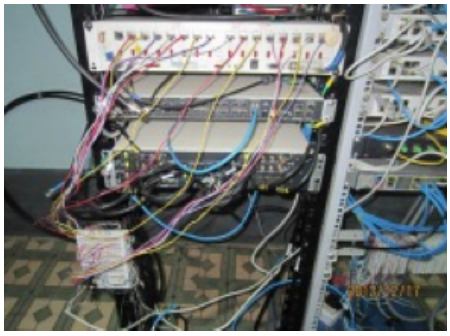
There have been no large-scale repairs or problems for the equipment of the project so far. MPT plans to manage these by obtaining advice from KSGM or local agencies of the manufacturer of the equipment, should any such problem occurs in future.

MPT analyzes training needs and sets targets for each staff member, and compiles these into a training master plan every year. MPT is carrying out capacity development of staff according to

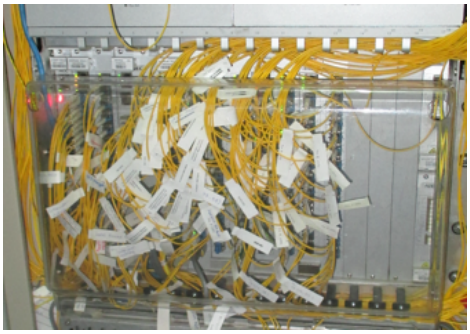
the training master plan. MPT is actively implementing capacity development of soft skills, such as English language, in addition to technical skills.

There is an example of an improvement that was realized following advice provided to MPT technical staff by the Japanese technical staff during the time of project implementation; this was still taking place at the time of the ex-post evaluation (see photos below).

As explained above, there is no problem of sustainability in terms of technical aspects.



At project planning: It was difficult to find the destination of cables as there were no labels and the cables drooped. (The photo was taken from a document provided by JICA)



At the ex-post evaluation: Destinations of the cables can be identified easily as there are labels and the cables are bundled as needed. (The photo was taken by the external evaluator)

3.5.3 Financial Aspects of Operation and Maintenance

As mentioned in "2.3 Constraints during the Evaluation Study" of this report, MPT does not make its financial information available to the public at this moment; therefore, the external evaluator could not obtain financial information, such as a profit and loss statement. Hence, a quantitative analysis of the financial status of MPT could not be carried out.

According to the Managing Director and General Manager (Technical) of MPT, the financial status of MPT is positive. Business income has been increasing at a satisfactory pace, and they have good prospects in future regarding their financial status. As mentioned in the chapter on "effectiveness" in this report, MPT has been making new investments in their communication infrastructure in positive manner, to meet the increasing demand. It was mentioned that necessary and adequate budget has been allocated for the operation and maintenance of the facility and equipment they own, including that procured by the project, as they place the highest priority on network stability.

There have been no problems in terms of finance in the operation and maintenance of the facility and equipment provided by the project. Their financial status seems to be positive as no problem was found.

3.5.4 Current Status of Operation and Maintenance

It was found that almost all the equipment procured by the project, except a few, has been effectively utilized continuously, and that we can expect continuous utilization in future. It was

also found that the status of operation and maintenance was satisfactory.

The capacity or function of some equipment was expanded after the project. The capacity of the equipment for backbone networks between the three cities was enhanced as a result of MPT purchasing supplementary equipment and installing it into the original equipment. MPT installed additional equipment to the equipment for the network within the city of Yangon, and, therefore, MPT's services were expanded. MPT expanded the capacity of the equipment to improve internet access, and was using this continuously - this expansion was possible because the technical specification of the equipment allowed for adjustments in corresponding to increase in traffic volume. Additional equipment was connected to the equipment for the international gateway in Yangon to meet increasing communication needs.

Some equipment for the backup route for the backbone network between the three cities is currently not utilized, as its capacity became insufficient as per the enhancement of capacity of the backbone network. MPT plans to utilize it by relocating it to appropriate locations by coordinating with the on-going ODA Loan project and ensuring integrity of the equipment.

The equipment for LTE communication is still utilized currently as a communication tool when there are international conferences or sports events. It is also used in some offices of MPT, offices for ministries and the airport in Nay Pyi Taw. However, around half of the 50 sets are not utilized. They are mainly those installed in and around the smaller sports grounds. They are not utilized because international public events, which require large-scale data communication services, have not been held in these places after the SEA Games. The frequency band used by this equipment was allocated to MPT by the Department of Post and Telecommunications, which is under the purview of the Ministry of Transport and Communication, with a condition that it will be used for international public events. Therefore, it is currently difficult for MPT to use this equipment for other purposes. MPT was of the opinion that the Ministry of Transport and Communication and Department of Posts and Communication would have to be involved when considering re-utilization of this equipment.

As explained, there was no problem with the operation and maintenance of the equipment introduced by the project in terms of institutional, technical and financial aspects; most of the equipment is utilized effectively. There is a prospect that the equipment will be effectively utilized in future, too. However, currently, the LTE equipment is utilized to a limited extent. Therefore, sustainability of the project effects is fair.

4. Conclusion, Lessons Learned and Recommendations

4.1 Conclusion

This project was implemented to enhance capacity of communication services, by improving communication networks in and between the three largest cities in Myanmar, and thereby contribute to economic development and improvement of the living condition of people in the country. The project has been highly relevant to the development plan of Myanmar, which aims to drastically increase the population coverage of communication services; to the development needs of the country, including developing communication infrastructure in line with the

increase in the number of users and traffic volume of communication services, and fulfilling communication needs of upcoming international events, such as the SEA Games at the time; and to Japan's ODA policy, which places importance on the development of infrastructure and institutions necessary for sustainable economic development. Therefore, its relevance is high. Procurement of equipment and capacity building program (soft components) was conducted as planned, and both the project cost and project period were within the plan. Therefore, the efficiency of the project is high.

Improved communication speed of the backbone networks and metro networks of the largest three cities of the country, and improved internet access were realized as planned due to the implementation of this project. After completion of the project, MPT enhanced its facility continuously due to the increase in traffic volume and demand by increasing the capacity of the equipment introduced by the project and purchasing additional equipment. The communication service of MPT has been improved and the equipment has been maintained properly. This project supported the operation of the SEA Games and contributed to raising the international presence of the country. The beneficiary survey conducted in the ex-post evaluation found that the users of communication services in the country had benefitted in various ways as a result of this project and improvement of communication infrastructure and services realized after the project, such as improvement in communication with people living far away and in workplaces, increased business chances and opportunities for employment and better jobs. Therefore, the effectiveness and impact of the project are high.

There were no problems with the operation and maintenance of the equipment introduced by the project in terms of institutional, technical and financial aspects; most of the equipment is utilized effectively. There is also a prospect of the equipment being effectively utilized in the future. However, currently the equipment for LTE communication is utilized to a limited extent. Therefore, sustainability of the project effects is fair.

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

4.2 Recommendations

4.2.1 Recommendations to the Executing Agency

Around half of the equipment for LTE communication was not utilized at the time of the ex-post evaluation due to restrictions on the unique frequency band and purpose of usage for the equipment allocated and instructed from the Department of Posts and Telecommunications. It is advisable that MPT cooperate with the Ministry of Transport and Communications in formulating a policy and plan, and in implementing a measure for effective usage of this equipment.

4.2.2 Recommendations to JICA

It is recommended that JICA cooperate and provide advice to the relevant institutions, particularly the Ministry of Transport and Telecommunications, and monitor progress of the above-mentioned process for the effective utilization of the equipment for LTE

communications.

4.3 Lessons Learned

Procurement of equipment with a technical specification that is compatible for increased volume of traffic, and providing necessary advice after completion of the project, are effective for the equipment to be actively utilized continuously.

Usage of mobile phones rapidly became popular in Myanmar after market liberalization, and traffic volume increased drastically after the completion of the project. MPT implemented measures to respond to this trend, such as increasing the capacity of equipment procured by the project, purchasing additional equipment to be installed into the equipment and others, by obtaining advice from the Japanese engineers of their joint operation partner and staff of the manufacturers of the equipment. As a result, there has been a drastic increase in the number of users of the services of MPT, an improvement in the services and the continuous and active utilization of the equipment introduced by the project.

In a project for enhancement of communication infrastructure in a country where rapid increase in communication demand is expected, it is important to make the predicted increase in traffic volume after completion of the project as accurate as possible, to make technical specifications of the equipment able to respond to the increase, and to ensure an arrangement to provide advice on effective utilization of the equipment when needed, for continuous and effective utilization of equipment to be procured by the project.