Review and Suggestions from Official Development Assistance Economic Infrastructure Project Impact, case study on long span bridge projects

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The Japanese Official Development Assistance (ODA) Loan has contributed to many economic and social infrastructure projects in developing countries. However, there is no clear methodology of how to measure the values of the end results of such programs. Just considering the economic rates of return without considering the value of ongoing human relations cannot completely show the successes that are potentially gained. Economic infrastructure in developing countries has stood upon the capacity to foster human relations between counterparts while working under the Japanese ODA Loan. Continuing trust among all the human relationships within the cooperative efforts sponsored between governments is the most precious quality that is not easily quantifiable. It cannot be verified by economic cost benefit analysis. The formation of relationships among the individuals creates a fundamental structure of trust, reliability, and exchange of knowledge within the ongoing development between countries.

This study reviews non-quantifiable values through the ODA Loan of two long span bridge construction projects in the 1980's, and gives several suggestions for further projects.

Key Words : *Official Development Assistance, capacity development, construction process management, MATADI Bridge, second BOSPHORUS Bridge*

1. INTRODUCTION

Construction of long span bridges that cross deep valleys or big rivers has been essential for developing a national transportation network to unify the nation in developing countries. That is reason why the Japanese government has assisted the construction of long span bridges in many developing countries through the Japanese Official Development Assistance (ODA) Loan. Since construction of a long span bridge requires advanced technologies even for Japanese engineers, especially in the 1980's, there were many hardships in transferring related technologies to counterparts. Another key factor to tranfer is maintenance for keeping the bridge in good shape. After completion of an ODA project, daily maintenance should be carried out by counterparts by themselves. Thus, not only technologies for construction and maintenance but also values toward the job such as qualities of discipline, approach, and responsibility must be transferred from Japanese engineers to counterparts.

Based on the experiences of the authors with many ODA projects, it can be said that Japanese engineers worked closely together with their counterparts regardless of occupational distinctions and levels. Professional and personal engagement led the counterparts toward the deepening of personal identification and emotional investment to the people and the project, as well as the respective governments. This can be explained by the strong and trusting relationships built and maintained with Japan, even up until now. Not only the completion but the duration of these bridges beyond the construction period

stands upon the capacity for the development of human relations. This study compares human influences on counterpart's capacity for managing the construction and maintenace of the MATADI Bridge with the second BOSPHORUS Bridge, which were constructed with Japanese ODA.

2.OBJECTIVES

Regarding the MATADI Bridge and the second BOSPHORUS Bridge, the purpose of this study is to investigate:

1) How capacity for competence, e.g., chief engineers, engineers, technician, worker, scaffolding foreman etc., was developed.
2) How the construction schedule was shortened.
3) How the bridges were maintained in good condition.

3.EXPLANATION OF TARGET CASES

The MATADI Bridge (officially called "Pont Marēchale Mobutu Sese Seko") is a suspension bridge; the center span length is 520 meters. It was constructed in the Democratic Republic of Congo (DRC, former Zaire), Africa, with 34.3 billion yen from a Japanese ODA Loan in 1983, five years prior to completion of the KOJIMA-SAKAIDE long bridge route, in Japan. The second example is the BOSPHORUS suspension bridge in Turkey, with a center span length of 1,090 meters, which was completed in 1988, by 61.6 billion yen by Japanese ODA Loan.

4.METHODS

The approach employed in this study is as follows;

JICA has studied "Testimony of the history and lessons learnt on the MATADI Bridge construction project" for two years following 2010. Through this study testimonies were collected from THE EXPERTS who were deeply involved in this project and assigned as JICA engineering experts in the 1980's. They reviewed historical data, documents, materials, and conducted a site visit to hear current conditions directly from the counterparts. Based on the above study, we reviewed and collected supplemental documents and interviewed THE EXPERTS.

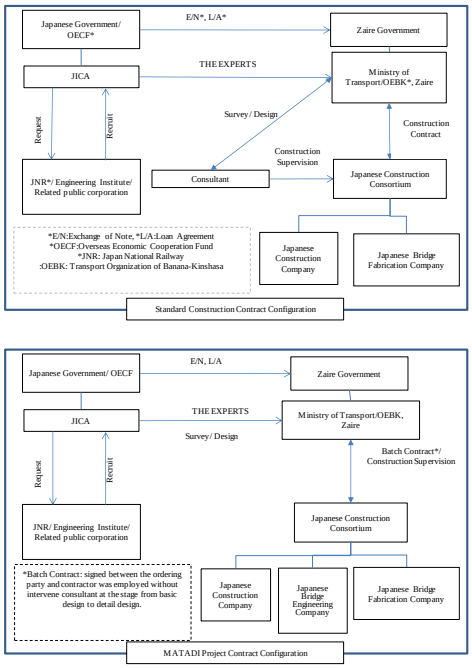
For the second BOSPHORUS bridge project, we collected testimonies directly from the Project Managers fully involved in this project.

5.STUDY REVIEW

ASHINO, et al. examined counterparts capacity development contribution to themselves and their organization through transport sector development studies in Thailand conducted by JICA. They concluded that it was mostly capacity development which was achived not only by couterparts themselves, but by their organization. Furthermore, they expanded their personal networks and contributed in promoting each other's career paths.

TAKAMATSU examined the wide range of his longstanding experiences on the MATADI Bridge project, and concluded several main reasons for the shortening of the construction period, which were as follows:

1) Package contract, which was signed between the ordering party and contractor. This was employed without intervening consultation from the stages of basic design to detail design. On the other hand, standard bridge construction contracts are signed with three parties, i.e., neutral consultant, contractor, and ordering party. Usually, standard contracts take one year extra after completion of basic design; however, the package contract could be shortened because construction started in parallel with detail design (Refer Fig. 1).



This chart is reffered from TAKAMATSU

Fig.1 The MATADI Bridge Project Contract Configuration

2) Design modification contingency and physical contingency were included in the construction contract, and in case of high inflation this contract could be applied flexibly, because all related ministries and Overseas Economic Cooperation Fund (OECF: JICA former organization responsible to Japanese ODA Loan) have close relations with this project.

TAKIZAWA examined with his long experience on the second BOSPHORUS Bridge project, and concluded that the shortening of the construction period was due to the following:

1) THE ENGINEER's judgment was precise and quick,
2) Japanese construction consortium offered a variety of design concepts and flexible construction management process which was applied to the local construction standards and practices.

The project contract configuration is shown in Fig.2.

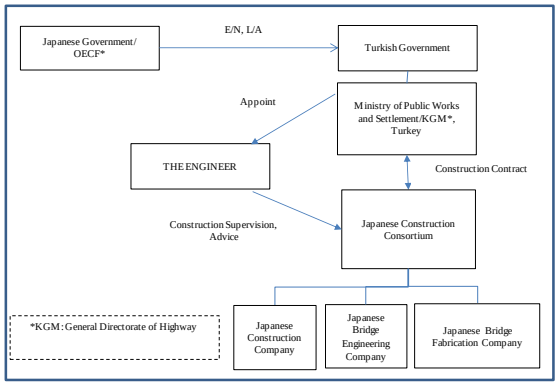


Fig.2 The Second BOSPHORUS Bridge Project Contract Configuration

The above mentioned information seemed to be of value to future overseas bridge construction contracts and construction management.

6.SCOPE OF STUDY

The question we have to ask here is firstly whether the capacity development is effective to sustain the project in the ODA Loan.

We can define capacity development as three comprehensive perspectives for counterpart organization as follows:

1) Individual capacity such as techniques, particular knowledge, skills.
2) Management capability such as attitude, leadership.
3) Society / environment / culture such as policy frameworks, legal systems, market economy, language, customs.

The second point that requires clarification is how both bridge construction periods were shortened, minimizing the economic / physical contingency risk. Construction period of the MATADI Bridge project was shortened fourteen months earlier than planned, while the second BOSPHORUS Bridge was completed six months earlier.

The third point that requires clarification is how both bridges are still being maintained in good condition. Although thirty years have passed since completion of the MATADI Bridge, its structural condition is so good that it is even better than what was expected by THE EXPERTS, who could not be assigned to the location afterward due to the unstable political conditions within the DRC government in the 1990's and 2000's.

7.FINDINGS

Firstly, considering the implications of capacity development of each bridge project, we would like to focus attention on the following:

Through package contract, THE EXPERTS managed institutional capacity building for each level of staff members in OEBK, Transport Organization of Banana-Kinshasa, a counterpart of organization in Zaire. In parallel, the Japanese construction companies achieved technical transfer to the local contractors.

At the construction site, Japanese scaffolding foremen, technicians, and engineers worked closely together with their counterparts. This cooperation formed between them and their counterparts brought a sense of unity / friendship with Japanese. After completion of the MATADI Bridge project, some Japanese scaffolding workers were involved in the KOJIMA-SAKAIDE route project in Japan, as well as in the second BOSPHORUS Bridge project. In this way, the above mentioned Japanses technologies were inherited from the MATADI Bridge project by the second BOSPHORUS Bridge project.

In Japan, "the MATADI Bridge project engineering committee" was newly established in the Japan Society of Civil Engineers. It supported and advised for structural engineering, construction methods, and installation method and design modifications. OECF applied flexible contract payments for design modification and physical contingencies. JICA arranged a counterpart training program for related visiting institutions in Japan, to remind and inspire them by showing that not only THE EXPERTS, those who are implementing at the project site, but all related institutions, ministries, and organizations in Japan supported the project (Refer

Fig.3).

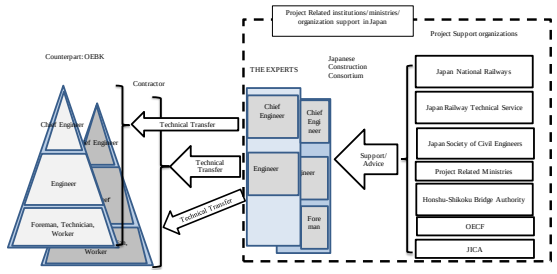


Fig. 3 The MATADI Bridge Construction Project Capacity Development Stakeholders Configuration

In the second BOSPHORUS Bridge project, Japanese construction consortium was involved in construction under management of a British THE ENGINEER, because basic design was completed by a foreign consultant company. However, some Japanese scaffolding foremen, engineers, and technicians who were involved in the MATADI Bridge project transferred each technology to the Turkish counterparts regardless of occupational levels (Refer to Fig.4).

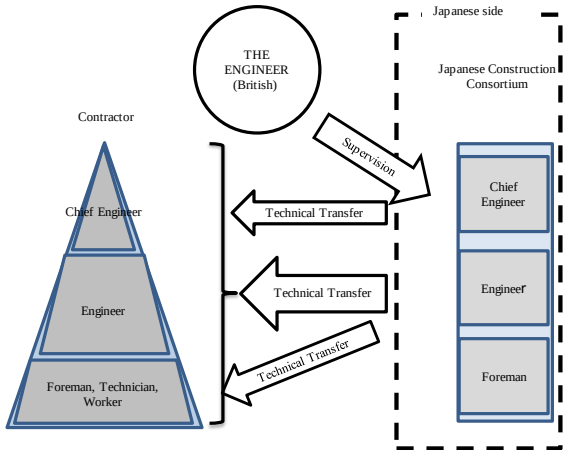


Fig.4 The Second BOSPHORUS Bridge Construction Project Stakeholders Configuration

The common lessons learnt from both projects are as follows:

1) Individual capacity: Following the Japanese culture of giving professional advice, emphasis was placed upon engaging within the field and gaining practical experience. Japanese engineers and technicians spent significant time with their counterparts at the construction site, and even shared their time off together to establish personal connections, making friends with others regardless of occupational positions.
2) Management capacity: The counterpart management shifted its organizational system to be more in line with the suggestions and rules given from the Japanese management. The counterpart organization shifted its attitude to be punctual and precise, and gradually they tackled foreseeable troubles.
3) Society / Environment / Culture: Japanese and counterparts worked together smoothly even though the differences of languages were barriers to understandings at the initial stage. However, at the latter half of the project the mentioned barriers had cleared because local counterparts had formed trusting relationships with THE EXPERTS and Japanese contractors.

Secondly, about the shortening of the construction period, we would like to focus attention on the following:

In the MATADI Bridge project, the related institutions, ministries, and organizations in Japan accepted the package contract, comprehensive procurement contract, and flexible contingency contract, from a contract document point of view. And the authority of the decision to pay was transferred to THE EXPERTS, effectively shortening the implementation of the project and construction period. From a technical point of view, suspension bridge engineering technology was under experimentation during the 1980's in Japan; however, all related technical and engineering institutions supported and advised engineering problems and promoted the process management steady and quickly, which finally led to a shortening of the construction period.

The second BOSHPHORUS Bridge project, the following issues shortened the construction period:

1) THE ENGINEER (British with long experience in bridge construction) judgments that were precise and made with quick decision.
2) Under requirements of shortening the construction schedule by THE ENGINEER, the Japanese construction consortium offered a variety of design concepts and flexible construction management styles, which which were applied to the local standards and practices, such as the superstructure anchorage cable fixing work that was done in parallel with substructure construction at the abutment (Refer to Fig.5).

Fig.5 Superstructure Anchorage cable fixing work

Considering both projects, the MATADI Bridge project mobilized the best technology in the 1980's with the support from related institutions, ministries, and organizations in Japan, and simplified the package contract, which shortened the construction period by fourteen months earlier than planned. In the second BOSPHORUS Bridge project, the Japanese construction consortium introduced flexible construction management styles, which were applied to the local standards and practices, and shortened the project by six months earlier than planned.

It is critical that a flexible approach, as applied to local standards and practices, alongside competent coordination of the many construction processes, can lead to a shortening of the construction period while maintaining construction quality. Even though certain compromises may be made in the way bridges are built, there should be no trade-off in quality assurance.

Thirdly, for bridge maintenance, we would like to focus attention on the following:

Due to the unstable political conditions within the DRC in the 1990's and 2000's, THE EXPERTS could not cover the MATADI Bridge project maintenance procedures; however, the bridge is in good condition even after thirty years passed since its completion. The reason why it is still in good condition seems to be from the counterparts' deepened emotional attachment to this project. For example, they made such efforts as collecting bridge tolls to spend on maintenance expenses such as painting. Moreover, the counterparts were faithful to the execution of daily procedures written in the maintenance manuals which THE EXPERTS created in the 1980's. These maintenance manuals contain the form and frequency of the inspection of each structural part of the bridge, with very detailed descriptions that take into consideration the specific local conditions. The maintenance manuals are one of the outputs of the technical transfer from THE EXPERTS. It is important to note that such detailed manuals are not created under multilateral donors.

The second BOSPHORUS Bridge could withstand the great MARMARA earthquake that hit near Istanbul in 1999. This raised awareness of the importance of seismic reinforcement for pubic citizens in Turkey. Japan's seismic reinforcement technology developed through much experience was highly evaluated and trusted by the Turkish government. In 2002, "Seismic Reinforcement Project for Large Scale Bridges in Istanbul" with a Japanese ODA Loan was bid by a Japanese construction consortium. In 2004 the "BOSPHORUS Straight Underground Railway Tunnel Project" with Japanese ODA Loan, was successfully bid by a Japanese construction consortium. Recently, the Turkish government tendered the IZMIT long span bridge project by international competitive bidding in 2011, and a Japanese construction consortium successfully bid the tender (Refer to Fig.6).

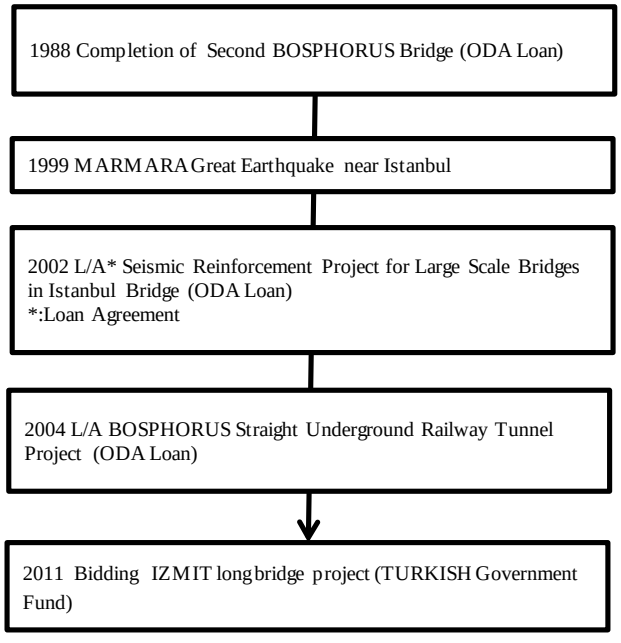


Fig.6 Timeframe of Japanese Construction Consortium for Civil Engineering Structure Project in Turkey

From lessons learnt in both projects, it can be summarized that:

1) The maintenance manuals created by THE EXPERTS are one of outputs of Japanese technical transfer. Such manuals are not created under multilateral donors, and if proper maintenance is carried out, the bridge will last for thirty years. On the other hand, if an unexpected event happens, a grant aid/ loan for supplemental ODA technical cooperation might be necessary for retrofitting.

2) From the Turkish case study, it can be shown that the long established history with seismic resistance technology can be used in promoting competitive bids from Japan for bridges to be built in other earthquake-prone countries.

8.SUGGESTIONS

The KOJIMA-SAKAIDE long bridges route started construction in 1978, while in the early 1980's long span bridge technologies were under increasing development. The MATADI Bridge project completed in 1983 was the first Japanese ODA long span bridge project. The government of Japan initiated and committed the project, and then related institutions, ministries, and organizations in Japan supported and applied their technologies to the MATADI Bridge project. Although thirty years passed since the MATADI Bridge completion, the government of the DRC relies upon the government of Japan to assist in maintaining and retrofitting this bridge, and Japan is always ready for it, due to the trusting and strong interpersonal relationships established during the construction of the bridge.

On the other hand, with the second BOSPHORUS Bridge project in 1988, long span bridge technologies had been considerably established, and the Japanese construction consortium could manage this project without any support / advise from related institutions in Japan. The Japanese construction consortium implemented a flexible construction management style that was applied to the local standards and practices.

Based upon the above mentioned facts, a picture of the timeframe in establishing long span bridge technologies and all related institute / ministries / organization support in Japan is shown in Fig.7.

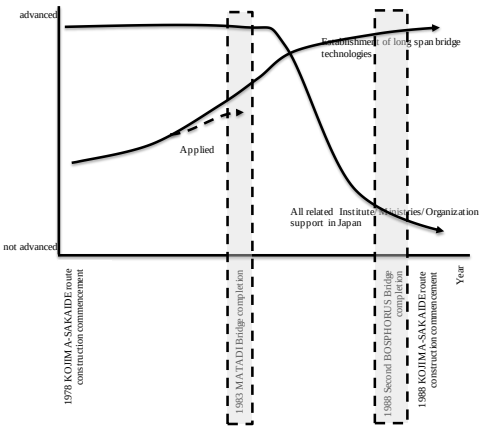


Fig.7 Timeframe of Establishment of long span bridge technologies and All related Institute/ Ministries/ Organization support in Japan

To summarize, several suggestions for further ODA long span bridge projects are given as follows:

1) Japanese technical transfer stands upon the capacity for the development of human relations. Professional and personal engagement led the counterparts toward the deepening of personal identification and emotional investment to the people and the project, as well as the government. This can account for the building of strong and trusting relationships with Japan even up until now. While teaching technical know-how can lead to a well-built bridge, it is the transfer of the qualities of discipline, method, and responsibility that sustain the life of the bridge.
2) For smooth and effective project implementation, a strong initiative and commitment from the government of Japan is a first priority, and then all related institutions, ministries, and organizations in Japan should fully back up not only engineering / technical aspects but contract aspects, such as integrated procurement contract and flexible contingency contract payment.
3) Recently, there has been advancement of contractors emerging from other countries, such as China. Japan has become significantly disadvantaged in terms of cost. It is therefore critical that a flexible approach, as applied to local standards and practices, alongside competent coordination of the many construction processes, can lead to a shortening of the construction period while maintaining construction quality. Even though certain compromises may be made in the way bridges are built, there should be no trade-off in quality assurance.
4) Periodic ODA maintenance support and minimum provision of necessary equipment is at a milestone, and Japanese long established and forefront technologies of seismic resistance is important for bidding in earthquake-prone countries.
5) When Japan begins to build bridges in another country, the first project should bring the highest possible impression of Japan's technological strengths and capacity for development. The Japanese government initiative and support from all Japanese related institutions, ministries, and organizations is important. The first project may then gain the country's advantage of confidence and trust in Japanese technologies and capacities to develop and construct bridges, which may lead

to successive bids of tender.

6) Individual construction and installation management technologies are established and are increasing in Japan; however, it is important to develop Japanese THE ENGINEER with integrated and globalized capacities who can manage situations such as FIDIC, language barriers, overseas experiences, negotiation, coordination, etc.
7) Results cannot be generalizable because this study covers only two projects. More lessons learnt should be collected for further study on long span bridge construction projects.

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