IMPROVING PERFORMANCE OF THE CONSTRUCTION INDUSTRY IN DEVELOPING COUNTRIES THROUGH INTEGRATED SYSTEM FOR HUMAN RESOURCES AND INFRASTRUCTURE DEVELOPMENT (ISHID)

Rajendra NIRAULA[1] and Shunji KUSAYANAGI[2]

ABSTRACT: This paper based on the Nepalese and Cambodian context has identified the necessity of integration of human resources and infrastructure development systems in order to efficiently develop infrastructure in developing countries. The construction industry in Nepal and Cambodia has not been able to deliver infrastructure development projects within the stipulated resources with required quality. Only several projects were completed within predetermined time and budget. The lack of appropriate human resources and technology development was the major reason investigated and are responsible for the poor performance of the construction industry. The industry and universities are working independently without evident linkage. In addition, the universities lack appropriate faculties and facilities for quality education, research and development. Industry practitioners were complaining the quality of new graduates for not acquiring enough practical skills and knowledge from the university education. Despite large investment of official development assistance (ODA), there was insignificant development in the quality of human resources and technology required for efficient infrastructure development in the low-income developing countries like Nepal and Cambodia. This study has developed an integrated system for human resources and infrastructure development (ISHID) in order to develop appropriate human resources and technology for domestic infrastructure development in developing countries. The proposed system incorporates universities collaboration and center of excellence approach for appropriate human resources and technology development. Higher efficiency and output from the construction industry would be achieved if the ISHID were implemented properly.

KEYWORDS: Developing countries, human resources, infrastructure, ODA, construction industry

1. INTRODUCTION

Poor performance of the construction industry in developing countries is due to lack of technological and managerial capabilities [1-3]. The construction industry in the low-income developing countries still remains in a tiny executers' position. Cost overrun, delay and quality not meeting the standards are common in public works in Nepal and Cambodia. Only several projects were completed within the stipulated budget and time.

Official development assistance (ODA) is the major resource for the socio-economic development in developing countries. Almost all public infrastructure development projects in Nepal and Cambodia have been carried out through ODA and other bilateral assistances. The ODA has been concentrated more on hard infrastructure development rather than appropriate human resources and technology

[1] *Ph.D.,Center of excellence for social management systems, Kochi University of Technology, Kochi, Japan*
[2] *Ph.D, Professor, Infrastructure system Engineering, Kochi University of Technology, Kochi, Japan*

development in developing countries. No significant amount of ODA has been utilized for improving the quality of engineering education and technology development in developing countries especially in the low-income developing countries like Nepal and Cambodia. Despite large investment of official development assistance (ODA), there was insignificant development in the quality of human resources and technology required for efficient infrastructure development in Nepal and Cambodia. This study based on the Nepalese and Cambodian context has developed an integrated system for human resources and infrastructure development in order to develop appropriate human resources and technology domestically in developing countries.

2. INFRASTRUCTURE DEVELOPMENT AND THE CONSTRUCTION INDUSTRY

Like many other developing countries, Nepal and Cambodia are still striving for basic infrastructure. People in these countries are suffering from insufficient and poor quality of infrastructure. Less than 19 percent of the Cambodian and 15 percent of the Nepalese live in urban area. About 16 percent of the Cambodian and 27 percent of the Nepalese do have access to the improved sanitation. Similarly, telephone mainlines per 1000 population in Cambodia and Nepal was 3 and 16 respectively [4]. The road length (in kilometer) per 100 square kilometer of land in Cambodia and Nepal as of 2003 was only 21.4 and 10.8 respectively. In addition, about 25 percent of the whole road network in Cambodia is in good or fair condition, and many of the existing bridges have the load bearing capacity below 10 tons [5]. Many parts of the country remain isolated during the rainy season due to the lack of all weather roads and enough bridges across rivers in Nepal and Cambodia.

Like in the Japanese construction industry, a few large contractors dominate the construction industry of Nepal and Cambodia, and the majority of the construction firms are small to medium class. Contractors are categorized and selected on the basis of their technical and financial capability. However, experienced and qualified manpower is not generally available even with the highest class of contractors. There are four classes of contractors (A, B, C and D) in Nepal and Cambodia. There were 176 ‘A’, 350 ‘B’, 1500 ‘C’ and about 10,000 ‘D’ class contractors in Nepal [6]. Only about 20 percent of the highest ’A’ class construction firms are being managed by engineers. The total number of registered civil engineers and architect working in Nepal as of July 2002 were 2,758. Almost 90 percent of the civil engineers involved in development works in Nepal were one-degree graduates [7].

2.1 PROJECT DELIVERY

The traditional, Design – Bid – Build (D-B-B), project delivery system has been widely used in public infrastructure development. Most of the medium and large infrastructure development projects have been executed through international contractors and consultants. The local construction industry does not have enough financial, technical as well as managerial capabilities for large infrastructure development projects. Time and cost overrun and inferior quality of works are the major problems in the public infrastructure development in Nepal and Cambodia. The construction industry in Nepal and Cambodia has not been able to deliver infrastructure development projects within the stipulated resources with required quality. Only several projects were completed within predetermined time and budget.

Literature reviews and authors’ questionnaire survey followed by interviews and field visits identified that unfamiliarity of the construction engineers with the appropriate tolls and practices for time, cost and quality management, and lack of appropriate technology were the major reasons for the poor performance of the construction industry. 26 individuals from Cambodia and Nepal were interviewed. The interviewees were consultants, contractors, clients’ engineers, and university teachers. It was found that the Nepalese and Cambodian construction industry did not have appropriate human resources and technology development system. Neither the industry was motivated nor governments had adequately invested at the universities for research and development in order to develop appropriate technology and human resources.

2.2 ENGINEERING EDUCATION AND TECHNOLOGY DEVELOPMENT

Although the tertiary education is the major supplier of the skilled workforce, the universities in Nepal and Cambodia could not provide graduates enough opportunities to acquire enough practical knowledge and skills from the university education. Theoretical knowledge imparting is the domain of education system of many developing countries including Nepal and Cambodia. Lack of appropriate teaching materials, qualified teachers and research facilities are the major problems in all level of education in Nepal and Cambodia. The written examination of theoretical knowledge at the end of the academic year is the only measure of competency of a student. Moreover, the civil engineering education, which is supposed to contribute in improving quality of life, does not emphasize on the application of science and engineering knowledge to societal problem, and could not make graduates creative and adequately prepared for the construction industry.

Unlike in the developed countries, universities in Nepal and Cambodia were not evidently engaged in research and development. The least developed countries including Nepal and Cambodia have invested a little money on education than other middle and higher income developing countries do. The universities lack financial resource and physical facilities for research and development. Moreover, there is no linkage and enough cooperation between the university and industries for appropriate human resources and technology development. As a result, the contribution of the universities in Nepal and Cambodia is limited to produce graduates equipped with theoretical knowledge. Moreover, the construction industry has not invested for human resources and technology development. Neither the universities nor industry has focused in technology development and innovation. As a result, there were no significant improvement in the construction technologies in Nepal and Cambodia. In addition, the civil engineering education did not significantly contribute in the technological development and could not make the industry healthy.

3. OFFICIAL DEVELOPMENT ASSISTANCE (ODA)

Official Development Assistance (ODA) concept was adopted by Development Assistance Committee (DAC) established in 1961 in organization for economic cooperation and development (OECD) separating ODA from "Other Official Flows" (OOF) and identifying as ODA those official transactions which were made with the main objective of promoting the economic and social development of developing countries and the financial terms of which were "intended to be concessional in character".

ODA since its adoption has become a major resource for the socio-economic development of developing countries. Different donors have been involved in different areas of socio-economic

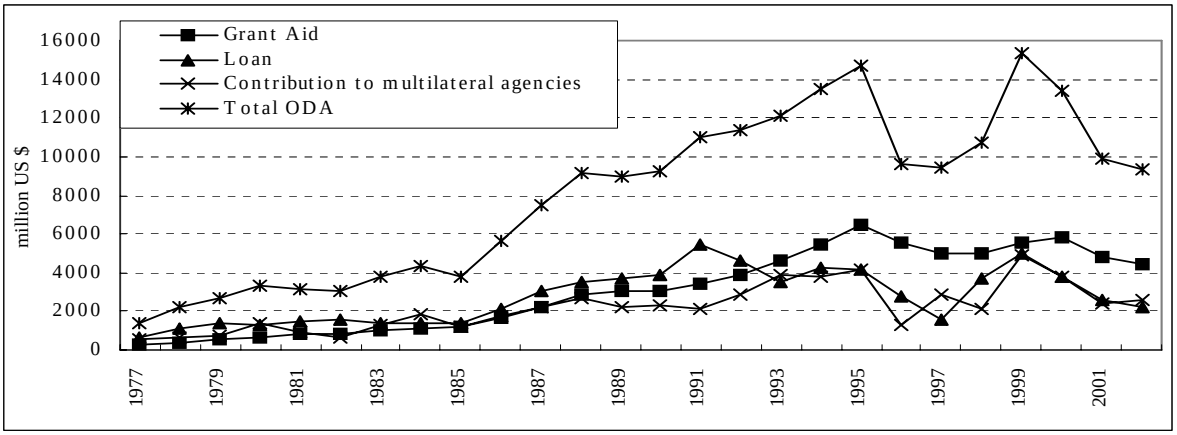

Figure 1: Japan's ODA (1977-2002)

development in developing countries. Among others the USA and Japan are the largest donors to developing countries. However, this paper is focused on Japan's ODA, as it occupies the largest amount of assistance in some Asian and African countries including Nepal and Cambodia. Moreover, Japan's ODA to the least developed countries (LDCs) contains considerable amount of grants aid inclusive of technical cooperation as shown in Figure 1 [8]. Like many other developing countries, Nepal and Cambodia have been very much benefited from Japan's ODA and Japan is the largest donor to these countries. However, the main activities of Japan's ODA seemed to be hard infrastructure development along with inefficient human resource development. For instance, all grant aids excluding technical cooperation under Japan's ODA in 1994-2001 to Nepal was used in hard infrastructure development in which as much as 3 percent was utilized in educational infrastructure related activities-- materials and equipment for the construction of primary schools. Similarly, less than 1 percent of the grant aids to Cambodia in the same period was used in human resource development scholarship [9]. Further, all grant aid projects have been executed by donor's own consultants and contractors. Human resource development and technology transfer were not the major elements in grant aid projects. Acceptance of trainees mostly from executing agencies of developing countries and dispatch of the Japanese experts in technical cooperation scheme were the only means for human resource development program in ODA. However, Japan's ODA had not been utilized to improve the quality of higher education and technology development in these countries.

3.1 HUMAN RESOURCES AND TECHNOLOGY DEVELOPMENT UNDER JAPAN'S ODA

Human resources and technology development under Japan's ODA consists of the dispatch of the Japanese experts and volunteers, acceptance of the trainees from developing countries, providing equipment and materials to facilitate technology transfer. Human resource development cost under the Japan's ODA was very high compared to the government expenditure on education in the least developed countries. Typically, it was found that the training cost per trainee under Japan's ODA was 140 times higher than that of the government expenditure per student in higher education in Nepal. Only few people had opportunities to be trained. The training for a few people from the clients' organization could not improve the overall skill level of the construction engineers due to the inflow of hundreds of untrained engineers in the construction industry. There is no horizontal flow of human resources and diffusion of technology across the implementing and executing agencies in the existing bureaucratic system. Human resource if trained and technology if developed in an agency is limited within its own boundary and vertically flowed down if not died out. In addition, there were no evident activities for technology development in the recipient countries. In order to efficiently utilize ODA to produce appropriate human resources and technologies for infrastructure development in the recipient (ODA receiving) countries, an integrated system has been developed which is described below.

4. INTEGRATED SYSTEM FOR HUMAN RESOURCES AND INFRASTRUCTURE DEVELOPMENT

Integrated human resources and infrastructure development system developed in this study incorporates research and development functions of university in cooperation with lending agencies (donors) and university/industry from the donors' countries to produce appropriate human resource and technology required for infrastructure development in the recipient countries. This system consists of universities collaboration and center of excellence approaches. The schematic diagram of the integrated system is shown in Figure 2.

Since universities/colleges/institutes from Nepal and Cambodia were lack of competent faculties and facilities, universities collaboration in the proposed system (ISHID) is intended to provide the opportunities for the faculties from the recipient countries to pursue higher studies and advanced research in order to address the industrial needs. For instance, Institute of Technology of Cambodia (ITC) could not deliver enough education/training on concrete technology and management due to the lack of faculties. In addition, the Cambodian construction industry was also deprived of enough human

resources in concrete technology and management for efficient execution and technology development. Universities collaboration between Kochi University of Technology (KUT), Japan and ITC, Cambodia designed and implemented under this study provided 2 faculties from ITC to pursue doctoral study on concrete technology and management. The KUT-ITC collaboration also includes the transfer of seed technology for high strength prestressed concrete product development to the ITC. Further to the educational/research opportunities and transfer of the seed technology at ITC, the collaboration will continue, as designed in the ISHID model, to establish a center of excellence for education and research (COE&R), a non-profit making entity, for appropriate construction engineers and technology development in Cambodia. The center will be engaged in providing training for practitioners,

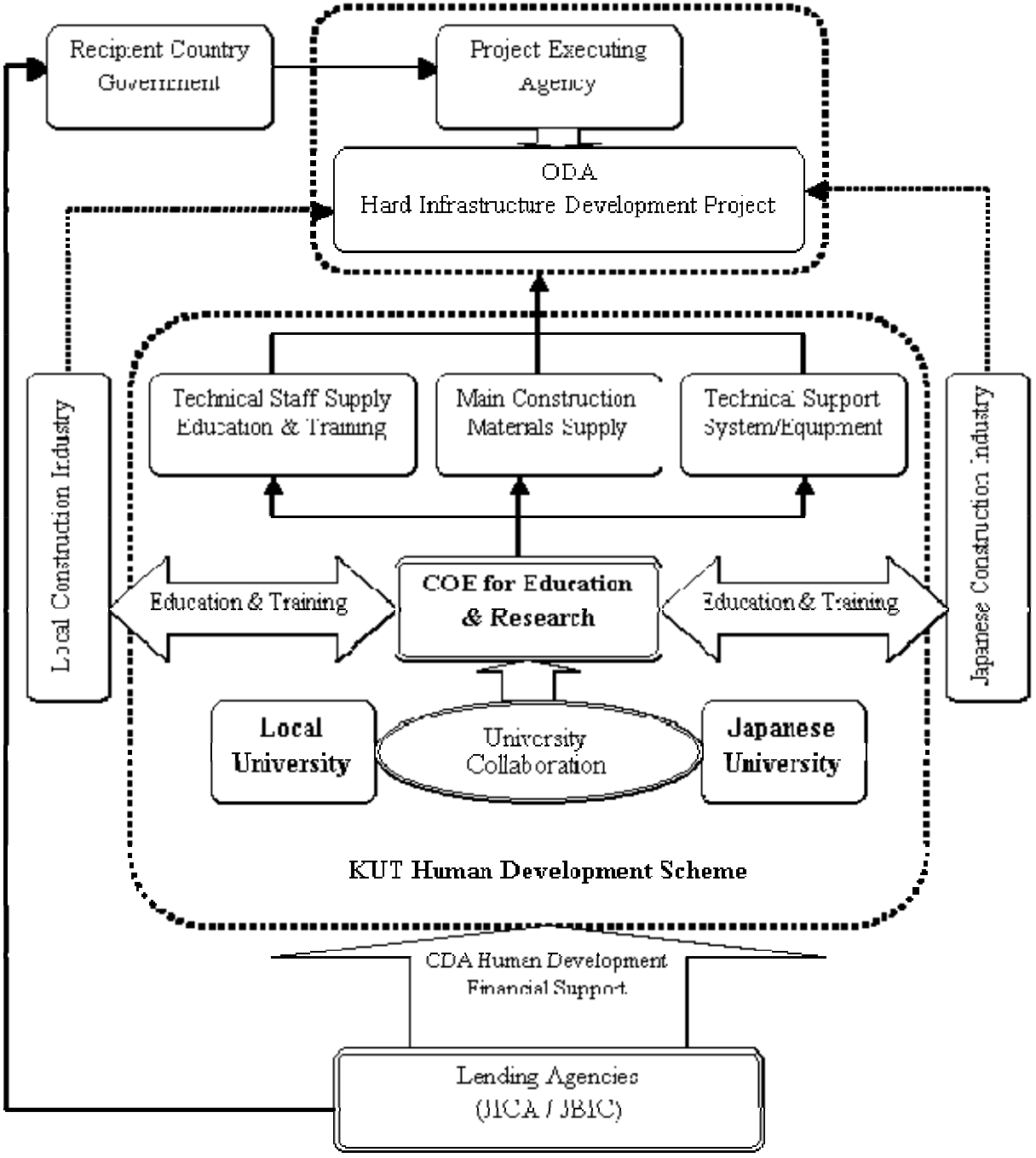

Figure 2. Model of Integrated System for Human Resources and Infrastructure Development

internship for graduates, and developing technology and/or products to the development projects. Consequently, the present KUT-ITC collaboration will enable ITC able to improve the quality of education in concrete technology and management, and to develop high strength prestressed concrete technology to facilitate the bridge rehabilitation projects in Cambodia. The income/saving from the professional service, and supply of the technology and product would enable universities be self-financed and able to continue to deliver quality education and develop technology at reasonable cost.

It was calculated that at least 10 times more people could be trained with the same resources currently using in Japan's ODA if the local faculties were trained and provided opportunities to participate in the industrial activities. The increase in the quality of education and training for more engineers/technicians would continuously improve the overall skill level of the construction engineers. For instance, with the equal resources, the new system (ISHID) would increase skill level of the Nepalese civil engineers in 2010 by 0.5% more than that of the existing Japan's ODA system. The increase in skill level of the construction engineers and availability of technology in the local industry would significantly increase the output from the construction industry. This can be shown from the Cobb-douglas production function. Thus, enhancing the capacity of the faculties and improving the facilities at the universities would enable recipient countries to produce industrial need oriented human resources and technology domestically. Thus the proposed integrated system would improve the performance of the construction industry by improving the skill level of the construction engineers and making available the required technologies for the infrastructure development.

5. CONCLUSION

The construction industry in Nepal and Cambodia could not deliver projects on time with required quality due to lack of appropriate human resources and technologies. The universities and industry were working independently without evident linkage and cooperation. In addition, ODA is more concentrated on hard infrastructure development rather than human resources and technology development in recipient countries.

The industrial need oriented universities collaboration and center of excellence approaches would enable local universities in developing countries able to contribute the industry to appropriate human resources and technology development. Integrated system proposed in this study would utilize ODA more efficiently than the existing system does. At least 10 times more people could be trained and required technology for construction, management and material production could be developed locally if the proposed integrated system for human resources and infrastructure development were implemented. The rise in skill level of the construction engineers and technological development for construction, management and materials production would improve the performance of the construction industry, and consequently higher output could be expected.

6. REFERENCES

1. Ofori, G., "Programmes for improving the performance of contracting firms in developing countries". *Construction Management and Economics*, pp 19-38, 1991.
2. Adams, O., "Contractor development in Nigeria: perceptions of contractors and professionals". *Construction Management and Economics*, pp 95-108, 1997.
3. Simkoko, E.E., "Managing international construction projects for competence development within local firms". *Int. J. Project Management*, pp 12-22, 1992.
4. Human Development Report 2004
5. Chanphal N. (2004) 'Rural Infrastructure and Poverty Reduction, The Case of Cambodia'.
6. Ministry of Physical Planning and Works (MoPPW), HMG Nepal, Internal Database, 2002.
7. Nepal Engineering Council: Database, 2002.
8. Japan Bank for International Cooperation, Kokusai Kyouryoku Binran, 2004 (in Japanese).
9. Japan's ODA: Annual report 1999, White paper 2002.