Development of Integrated System for Human Resources and Infrastructure Development in Developing Countries

Rajendra Niraula

A dissertation submitted to
Kochi University of Technology
in partial fulfillment of the requirements
for the degree of

Doctor of Philosophy

Special Course for International Students
Department of Engineering
Graduate School of Engineering
Infrastructure System Engineering
Kochi University of Technology
Kochi, Japan

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Advisor: Professor, Dr. Shunji Kusayanagi

Examination Committee: Professor, Dr. Shunji Kusayanagi (Chairman)
Professor, Dr. Masahiro Murakami
Associate Professor, Dr. Tsunemi Watanabe
Professor, Dr. Gota Kano
Professor, Dr. Seigo Nasu

Abstract

The Official Development Assistance is the quite important activity when people think about the stability and peacefulness of the world. Developed countries like USA, UK, France, Germany and Japan are aggressively contributing as donors for ODA activities. The total amount of money spent for ODA within last 20 years was approximately US $ 1 trillion. However, the world has not yet overcome the North-South problem and still been fighting with serious problems like Poverty reduction, Terrorisms and Safe Water etc.

Do the policies and schemes that have been applying in ODA are really appropriate? This must be considered for further development. The author has been working as a governmental staff of the organization that is handling ODA activities in Nepal. The study was made for focusing on the ODA system in Japan as an example from the view point of recipient countries side. It is quite interesting thing that Japan had been the largest donor country in the 1990s and even now second largest donor in the world, but she was one of the least developed countries in the world in the 1960s. The author started to think why and how Japan had been developed by herself, because he thought it must give some of the useful hints to solve the problem related to ODA scheme.

The least developed countries in Asia like Nepal and Cambodia are in need of the basic infrastructure. Further, the access to infrastructure for the poor is extremely limited. In addition, the construction industry of these countries (Nepal and Cambodia) lacks the appropriate human resources and technology in order to develop infrastructure efficiently. The effect of the human resources and the technologies can be observed from the severe delay and quality problems in the infrastructure development projects. The construction engineers lack construction management skills like time, cost and quality management, project management and so forth. Although the tertiary education is the major source of the skilled workforce, the graduates could not acquire the practical skills from the university education. Industry and the universities are working independently. The construction industry did not invest, and engage in human resources and technology development.

Official Development Assistance is the major resource for infrastructure development in the developing countries. Japan's ODA includes the infrastructure as well as human resources development component. Infrastructure development system under ODA usually deployed international contractors/consultants which resulted to the limited use of local resources. Capacity of the local industry has not improved significantly. The human resources development under ODA includes trainings for the people (especially from the clients' organization) and sending experts to

developing countries. However, the quality of the tertiary education was in inattention and remained unchanged. The training for the few clients' people did not improve the performance of the construction industry as there was in flow of hundreds of untrained workforce to the industry every year. Investment through ODA without improving the human resources and technology development capacity of the least developed countries like Nepal and Cambodia made the local construction industry incapable in infrastructure development.

In contrast to the present situation of the least developed countries, Japan in her development stage could fully satisfy the nationwide demands for the human resources in applied education including the civil engineering. The engineering education enabled the Japanese engineers able to absorb, modify, and internalize the western technology in modernizing Japan. The birth of the higher education in engineering in Japan was begun in the Meiji Era. The basic philosophy of the applied education in the beginning was the appropriate combination of theory and practice in the university education. Such education system provided the graduates to study theory and apply in the real work simultaneously during the university education. The production of the graduates in such environments and deployment in the construction helped the Japanese construction industry to develop and innovate the technology required for the nationwide infrastructure development in very short period.

Based on the concept of the "theory and practice" in engineering education adopted in the birth of the higher education in engineering in Japan, the integrated system for human resources and infrastructure development in the developing countries was developed in order to develop human resources and infrastructure efficiently in the least developed countries Nepal and Cambodia. The purpose of the study was to:

- to develop a new ODA system for producing appropriate human resources and technology for infrastructure development in the developing countries,
- to discuss how the Japanese construction industry would be benefited from the proposed system.

Chapter 1: Introduction

The research philosophy and the assumptions made to identify the major issues that caused lack of appropriate infrastructure in the least developed countries Nepal and Cambodia, and to reach at the goal are shown in the chapter 1 in the form of flowcharts. The flowcharts were made on the basis of why/what/how-reasoning.

Chapter 2: Background of the Study

This chapter provides the infrastructure development environments in Nepal and Cambodia. The socio-economic conditions, infrastructure financing and construction industry in Nepal and Cambodia are explained. The situation and problems associated with the infrastructure development are explained to investigate the root cause of the problems associated with infrastructure development in Nepal.

Chapter 3: Human Resources Development

This chapter begins with the brief overview of the economically active human resources in Nepal and Cambodia. As such the civil engineer, more than any other engineers, have more direct impact in the national infrastructure development, the discussion forwards with the human resource development system especially in the civil engineering sector. The quality of civil engineering education and associated problems are explained.

Chapter 4: Official Development Assistance (ODA) and Donor Countries

This chapter provides the history of the official development assistance, major source of funds for infrastructure development in the developing countries, with special focused to the Japan's ODA. The activities and the implementation system as well as the drawbacks of the existing system are explained. This chapter gives how the Japan's ODA could not develop and utilize the local resources efficiently in the developing countries. Further, the issues related to the Japanese construction industry are analyzed in order to find how the proposed system is beneficial to Japan as well.

Chapter 5: Figure out the New Concept of ODA scheme
Integrated System for Human Resources and Infrastructure Development (ISHID)

The Integrated System for Human resource and Infrastructure Development, so call ISHID that was figured out by the author- the major achievement of this study is explained. This chapter provides the background, concept, elements and activities if the ISHID. How the concept of 'theory and practice' which was used in the birth of the engineering education in Japan can be used for appropriate human resource and technology development in the developing countries is explained. The structure of the proposed integrated system with the example of the Cambodian case is explained. The ISHID includes the universities collaboration and the Center of Excellence for Education and Research (COE&R). The universities collaboration aims at enhancing the capacity of the local universities through faculty exchange, advanced studies/research and seed technology transfer to the developing countries. The COE&R concept aims at improving the quality of education, production of special materials, delivering integrated professional services, and bridging university and industry. The knowledge and skill transfer system in the ISHID is discussed.

Chapter 6: Implementation Procedure of the Integrated System for Human Resources and Infrastructure Development (ISHID)

This chapter aims at explaining the implementation procedures of the ISHID. The activities under the universities collaboration and center of excellence for education and research are explained in detail. The relation of the ISHID with the infrastructure development project cycles is presented.

Chapter 7: Analysis of Efficiency of the Proposed System (ISHID)

The efficiency of the existing human resource development under the Japan's ODA especially through the JICA training is explained. The logic model for the proposed system (ISHID) is presented. The existing JICA system is compared to the proposed ISHID system. The skill index system aims to quantify the effects of the ISHID in the construction productivity. The productivity in the Nepalese construction industry is analyzed, and the effect of the ISHID in the construction productivity is forecasted in this chapter.

Chapter 8: Some Knowledge Areas for Improving Efficiency in Infrastructure Delivery and Civil Engineering Curricula Development

This chapter provides some knowledge areas which affect infrastructure and human resource development. Project delivery systems and the appropriate curricula development system are presented. The construction manager as advisor (CMR as Advisor) type construction management project delivery system could be the alternative to the traditional system to improve the performance of the local construction industry. The curricula improvement system through the infrastructure development project by incorporating the industrial as well as academic needs would be appropriate to enhance the civil engineering education is explained.

Chapter 9: Conclusions and Recommendation for Further Study

This chapter provides the conclusions and recommendations for future study.

Acknowledgement

I would like to express my heartfelt gratitude to my advisor Prof. Shunji Kusayanagi for his kind encouragement, valuable and helpful advice throughout this research. I would like to especially thank to his encouragement to have ‘why and how knowledge’ in doing researches. It is very much fortunate to me receiving lectures from Prof. Kusayanagi in the JICA training in 2002 in Tokyo, and being a student under him in pursuing higher studies since 2003 April at Kochi University of Technology (KUT).

Sincere gratitude to Prof. Seigo Nasu for his encouragement to incorporate economic idea in the research, to Prof. Masahiro Murakami for sharing his experiences on ODA, to Dr. Tsunemi Watanabe for his constructive advice and to Prof. Gota Kano for sharing his industry experience. I am extremely grateful to all members of the examination committee—Prof. Murakami, Dr. Watanabe, Prof. Kano and Prof. Nasu for their valuable discussion, constructive comments and suggestions.

I would like express sincere acknowledgement to Kochi University of Technology, Japan for providing me opportunity and scholarship to pursue doctoral studies through Special Scholarship program (SSP).

I sincerely thank to all the respondents from Japan, Nepal, Cambodia, Mongolia and Thailand who kindly cooperated in questionnaire survey and interviews. I would like to thank Dr. K.R. Nielsen and Dr. P.D. Galloway for their useful discussion and valuable suggestions.

I extend my sincere thank to the faculties and staffs of Infrastructure Systems Engineering for their cooperation during my study at KUT. Especial thanks to the members of the International Relation center (IRC) for their kind effort and help during my study.

Many thanks to the seniors, colleagues and juniors in the Construction Management and other laboratories—Dr. Jirapong, Dr. Goso, Ms. Kira, Ms. Chen, Mr. Asato, Mr. Yoneda, Mr. Miyazaki, Mr. Horii, Mr. Yashuda, Mr. Arai, Mr. Sunochi, Mr. Nakamoto, Mr, Ohara, Mr. Ohira and Mr. Muramatsu for their discussion and help. I also thank to all the Japanese and foreign students for their cooperation, and sharing experiences and cultures.

Finally, I would like to dedicate this work to my wife (Pushpa), daughter (Shambhavi), son (Prithul), father (Maya Nath), mother (Toya Kumari) and mother-inlaw (Sita Laxmi) who have been always a source of aspiration to me.

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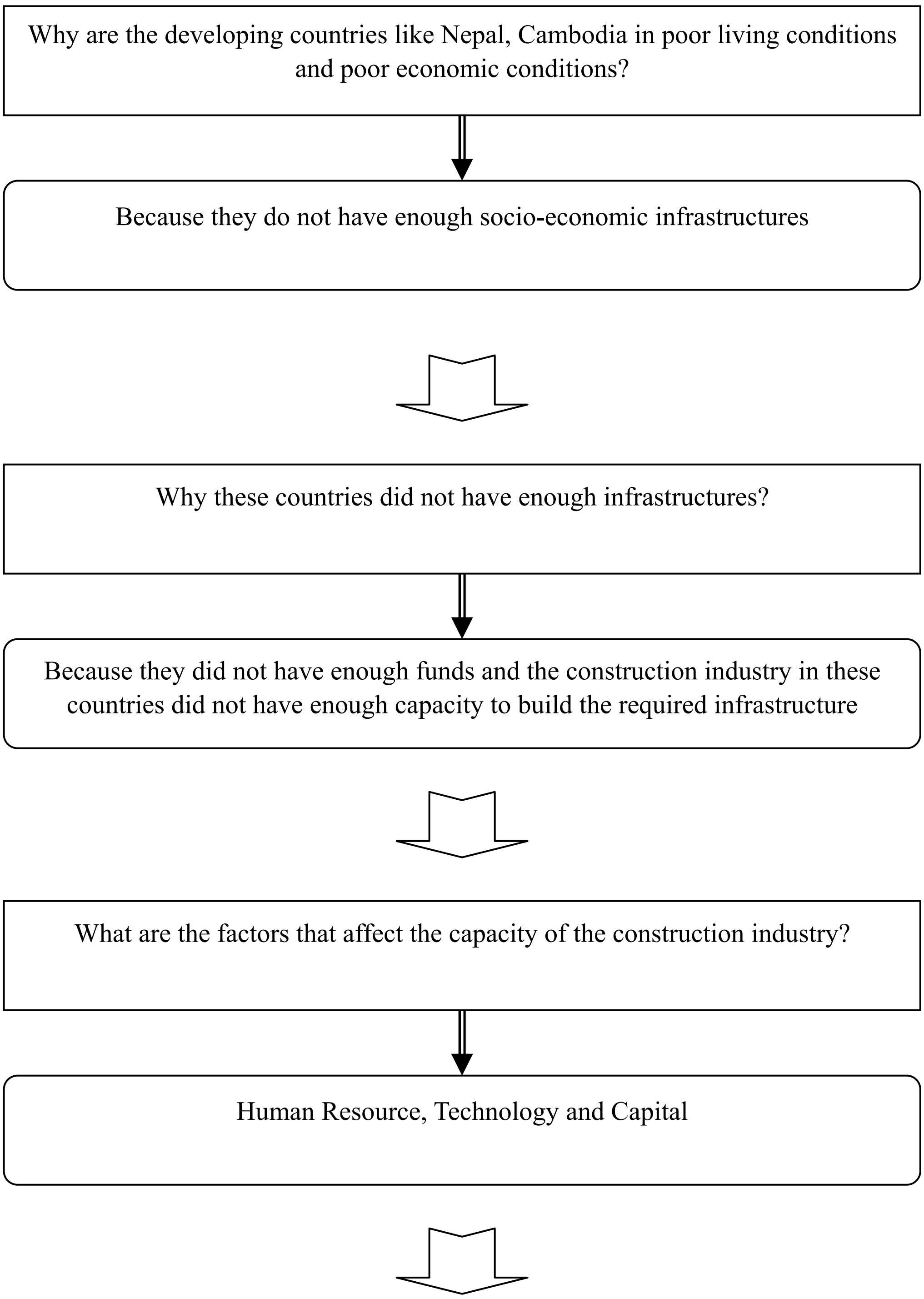
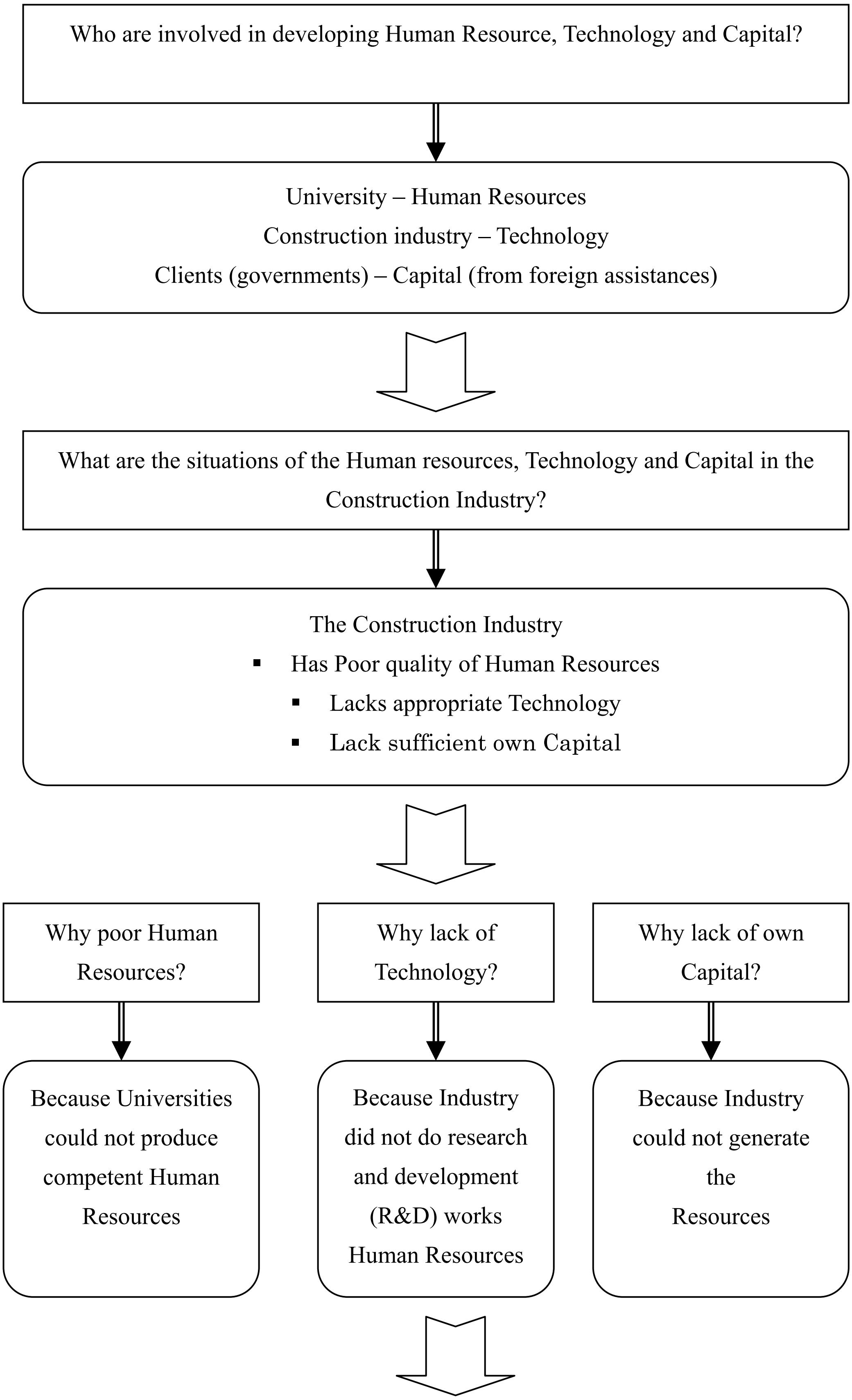
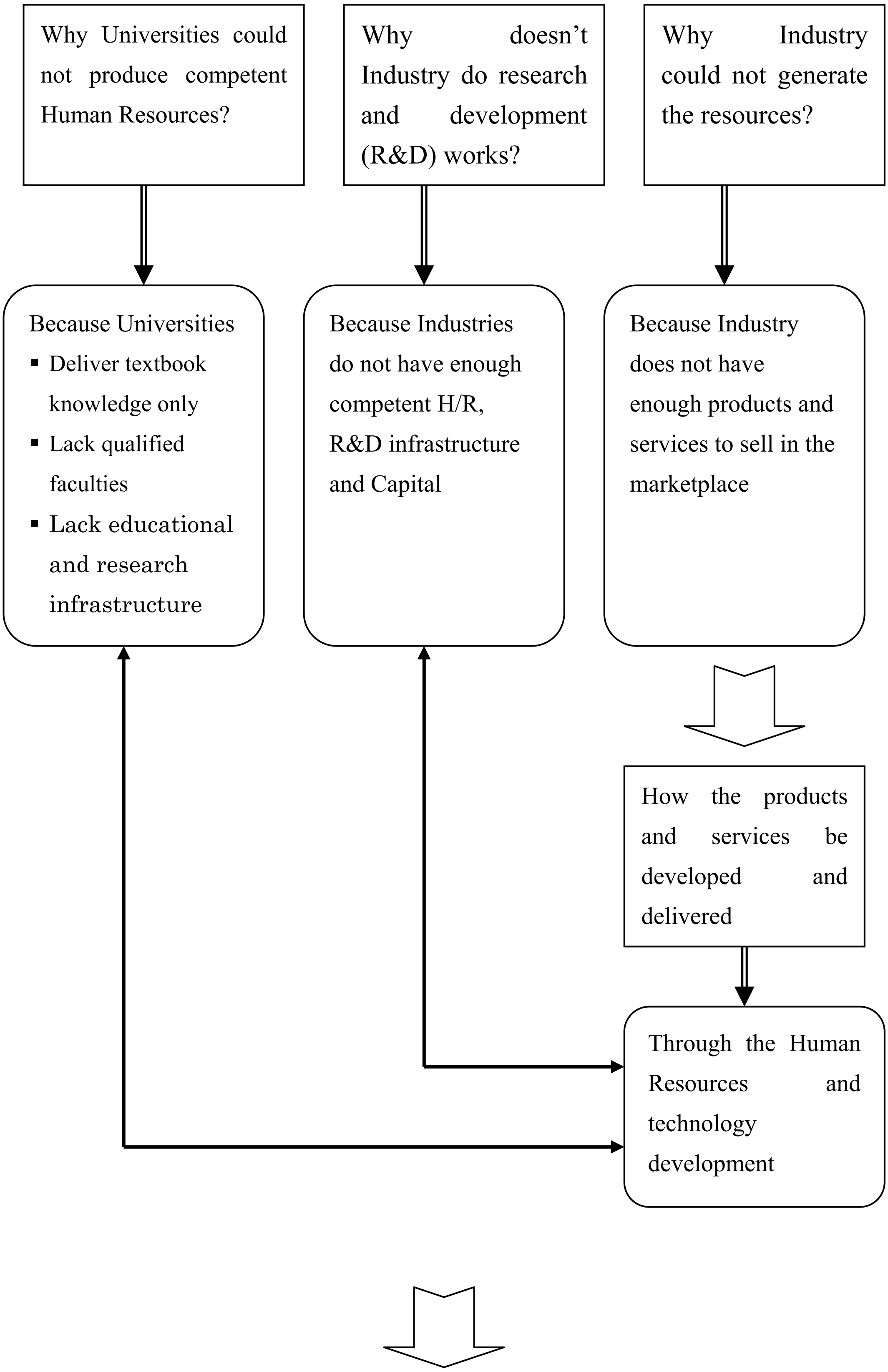
Chapter 1

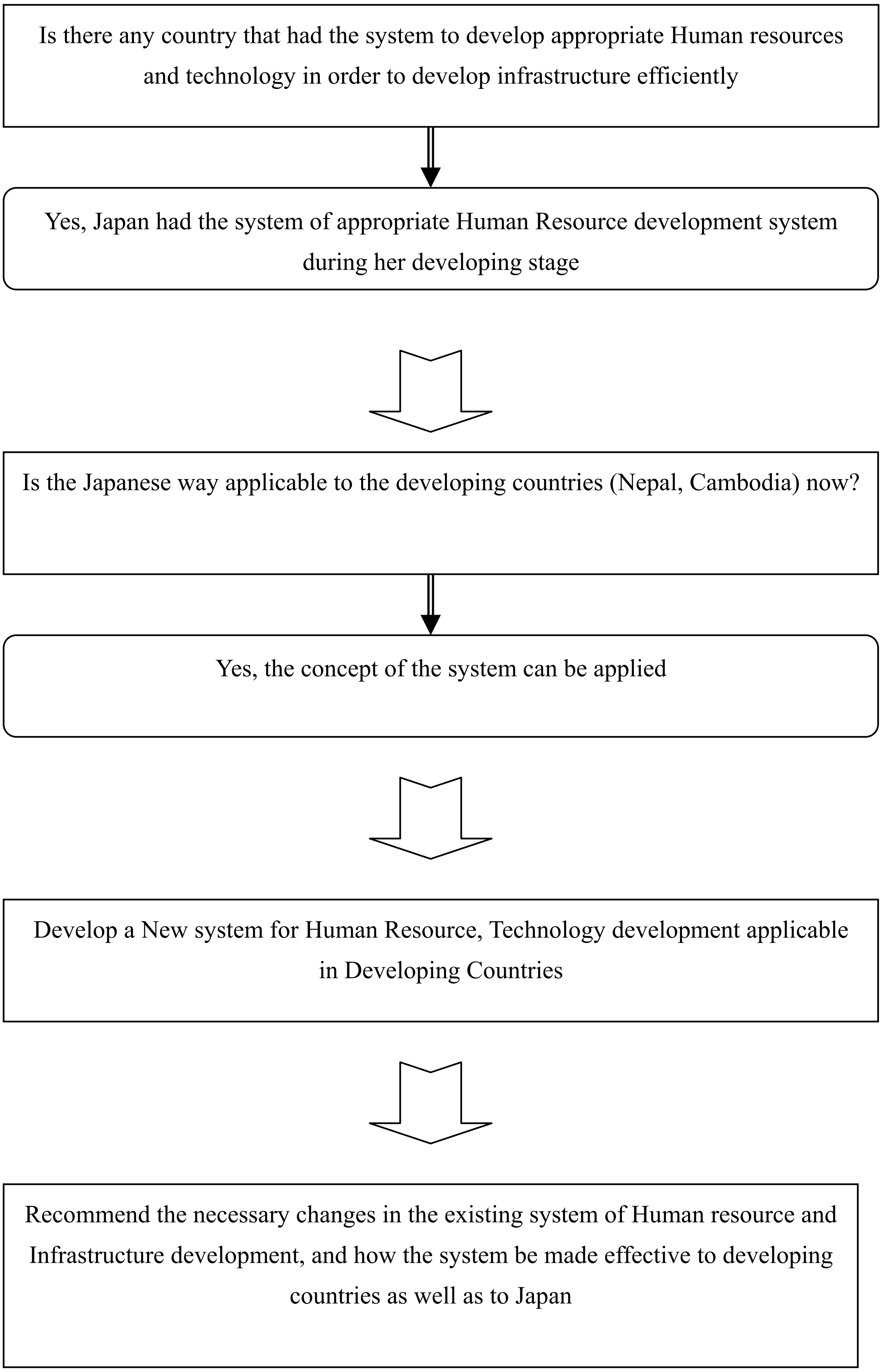
1. Introduction

For clarifying the research philosophy and setting up the study flow, following steps of Questions and Answers were made.




Who are involved in developing Human Resource, Technology and Capital?
University – Human Resources
Construction industry – Technology
Clients (governments) – Capital (from foreign assistances)
What are the situations of the Human resources, Technology and Capital in the Construction Industry?
The Construction Industry
Has Poor quality of Human Resources
Lacks appropriate Technology
Lack sufficient own Capital
Why poor Human Resources?
Why lack of Technology?
Why lack of own Capital?
Because Universities could not produce competent Human Resources
Because Industry did not do research and development (R&D) works Human Resources
Because Industry could not generate the Resources


Why Universities could not produce competent Human Resources?
Why doesn't Industry do research and development (R&D) works?
Why Industry could not generate the resources?
Because Universities
Deliver textbook knowledge only
Lack qualified faculties
Lack educational and research infrastructure
Because Industries do not have enough competent H/R, R&D infrastructure and Capital
Because Industry does not have enough products and services to sell in the marketplace
How the products and services be developed and delivered
Through the Human Resources and technology development


Is there any country that had the system to develop appropriate Human resources and technology in order to develop infrastructure efficiently
Yes, Japan had the system of appropriate Human Resource development system during her developing stage
Is the Japanese way applicable to the developing countries (Nepal, Cambodia) now?
Yes, the concept of the system can be applied
Develop a New system for Human Resource, Technology development applicable in Developing Countries
Recommend the necessary changes in the existing system of Human resource and Infrastructure development, and how the system be made effective to developing countries as well as to Japan

1.1 Research Methodology and Flow

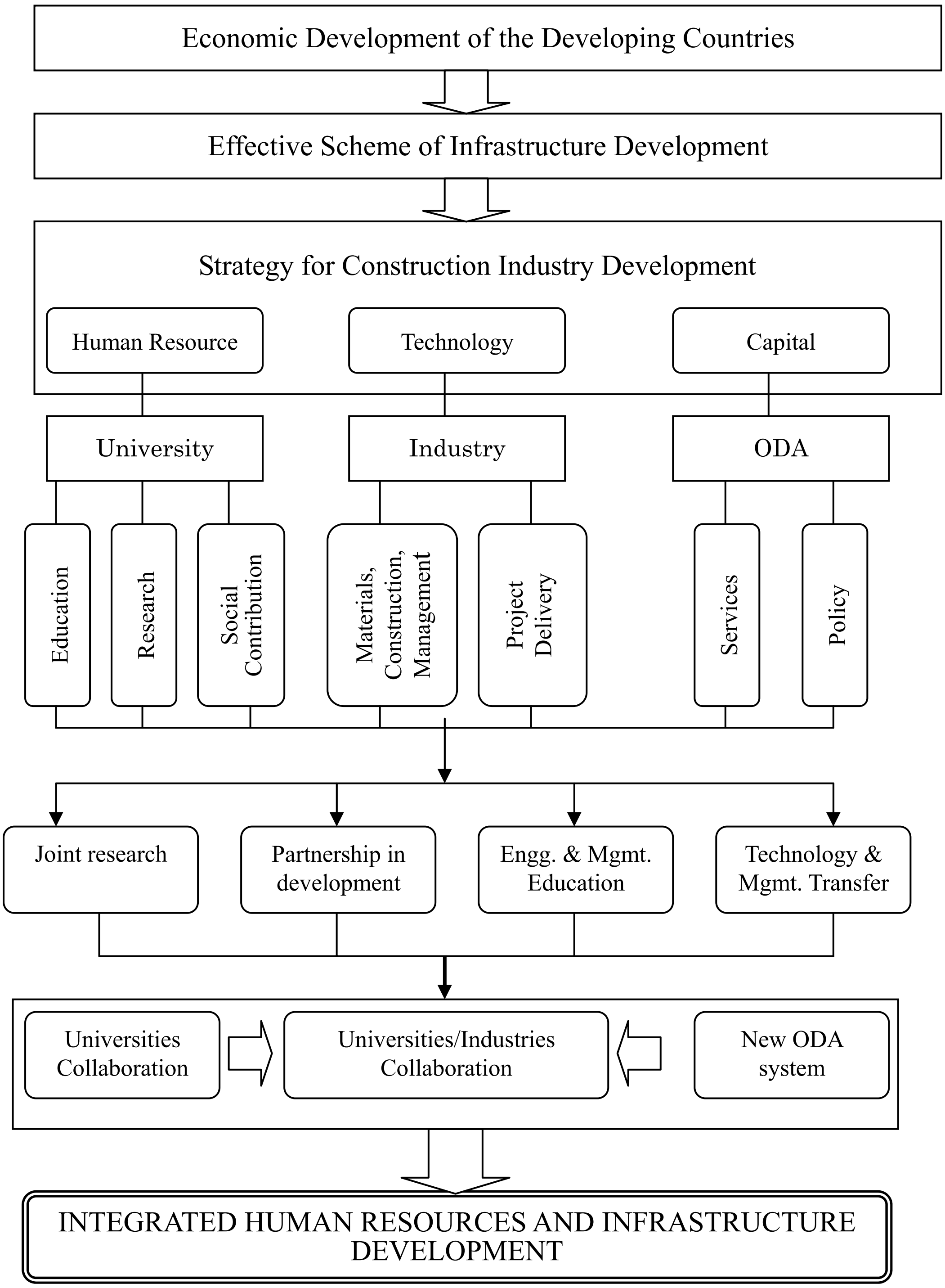


Figure 1.1: Research Methodology and Flow

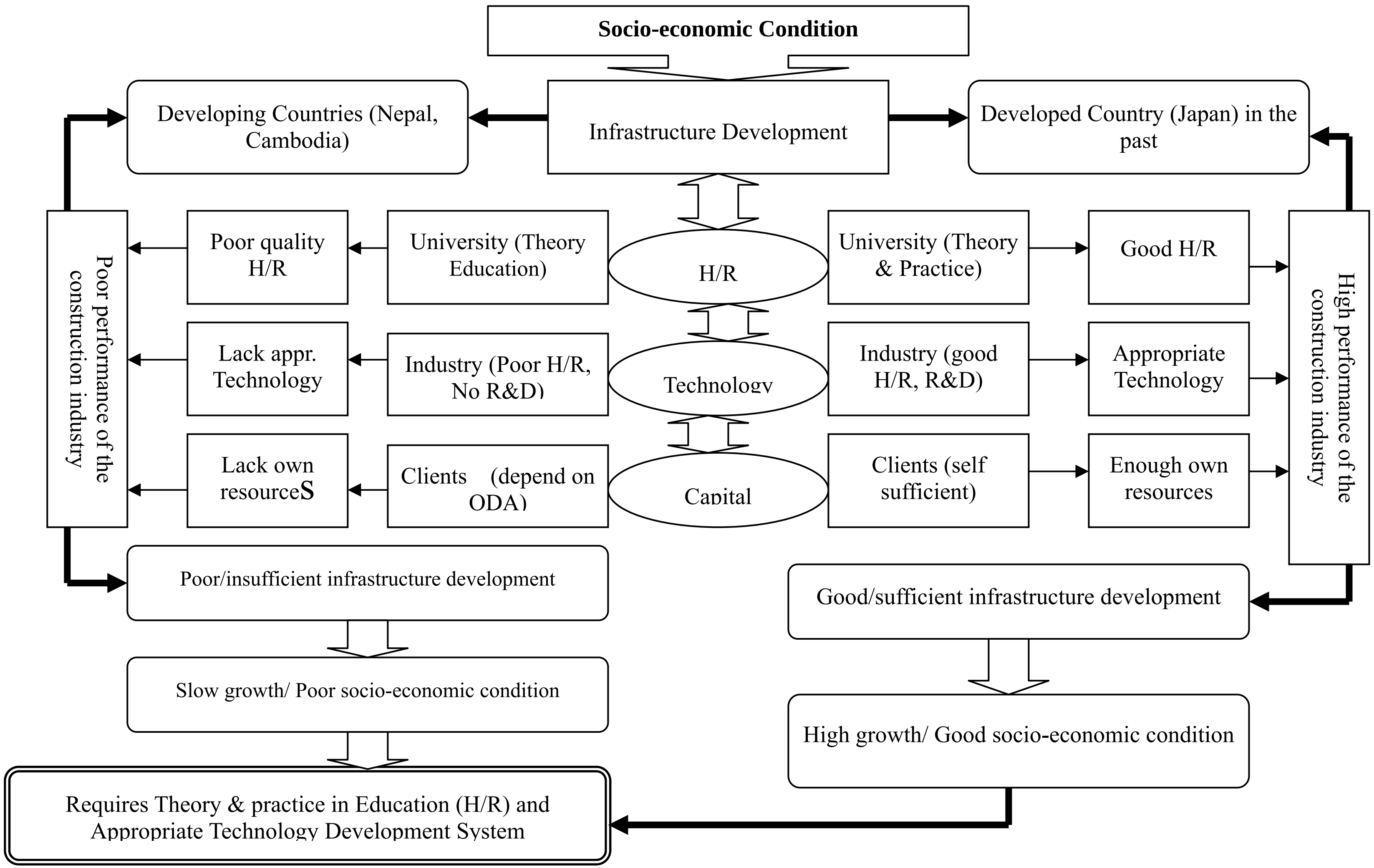


Figure1.2: Comparison of Infrastructure Development factor in developing and Japan in the past

Chapter 2

2. Background of the Study

2.1. Developing Countries

Organization for Economic Co-operation and Development (OECD) Developemnt assistance Committee (DAC) classifies developing countries for the purpose of Official Development Assistance. It classifies developing countries in to 5 categorries as follows:

1) Least developed countries
2) other low income developing countries (per capita GNI <$ 745 in 2001)
3) Lower middle income countries (per capita GNI $746-$2975 in 2001)
4) Upper middle income countries (per capita GNI $2976-$9205 in 2001)
5) High income countries (per capita GNI >$9206 in 2001).

Approxmatory 50 countries are listed by DAC as the least developed countries (OECD-Aid recipient countries). As of 1 May 2001, those are:

1) **Asia (east-south):** Bangladesh, Bhutan, Cambodia, Laos, Maldives, Myanmar, Nepal
2) **Middle East:** Afghanistan, Sudan, Yemen
3) **Oceania:** Kiribati, Samoa, Solomon Islands, Tuvalu, Vanuatu
4) **Africa:** Angola, Benin, Burkina Faso, Burundi, Cape Verde, Central African Republic, Chad, Comoros, Congo Dem.Rep., Djibouti, Equatorial Guinea, Eritrea, Ethiopia, Gambia, Guinea, Guinea-Bissau, Lesotho, Liberia, Madagascar, Malawi, Mali, Mauritania, Mozambique, Niger, Rwanda, Sao Tome and Principe, Senegal, Sierra Leone, Somalia, Tanzania, Togo, Uganda and Zambia
5) **Latin America:** Haiti

On the other hand, the World Bank classifies developing countries in to 4 categories as follows;

1) Low income (per capita GNI $825 or less),
2) lower middle income (per capita GNI $826 - $3,255),
3) Upper middle income ((per capita GNI $3256 - $10,065)
4) High income (per capita GNI $10,088 or more).

Nepal get per capita GNI $240 in 2001 and Cambodia get per capita GNI $280 in 2001. These two countries fall under the Least developed countries of DAC and low income countries of the World Bank. In this study, the author chose these two countries as the main study fields of figuring out new scheme of ODA with two resons. One is the author he himself come to Japan for studying this interesting theme from Nepal. The other is that the Department Infrastrucutre System Engineering in Kochi University of Technology has already developed relationships with universities in Nepal and Cambodia. This circumstance of the study made the author to do much realistic and practicable resurch for finding out the new ODA system. He could spend his time for having the discussion with the peoples, finding out real situations and valuable informations in Nepal and Cambodia. The author also visited in China, because China was the other valuable fields to observe developing countries situation. Moreover, the author spent his time for finding out real situations and valuable informations from Mongolia, Indonesia and Thailand as well.

2.2 Problems existing in the Least Developed Countries: Poverty and Low development of Infrastructures

The poverty line is the consumption level that is required to achieve the minimum acceptable standard of living in a society. The most common international definition of peoples in extreme poverty is those who live on less than $1 a day (to be more precise 1.08 US$ per day in 1993). In the year 2002 there were 690 million people in the Asia were in the extreme poverty. Using a more "generous" poverty threshold of $2 a day, 1.9 billion Asians were poor that year. Further, 50% of the world's population is living on the equivalent of less than one dollar a day (ADB 2004).

Table 2.1: Human Development Index of some Least Developed Countries
Asian (Cambodia, Nepal) and African (Burkina Faso, Uganda, Zambia)

Indicator	Cambodia	Nepal	Burkina Faso	Uganda	Zambia
Population Living below $1/day (%), 1990-2003	34.1	37.7	44.9	--	63.7
Population Living below $2/day (%), 1990-2003	77.7	82.5	81	--	87.4
Population below national poverty line (%)1990-2002	36.1	42	45.3	55	72.9
Urban population (% of the total), 2003	18.6	15	17.8	12.3	35.9
Population with sustainable access to improved sanitation, 2002	16	27	12	41	45
Population with sustainable access to improved water source (%), 2002	34	84	51	56	55
Telephone mainlines (per 1000 people), 2003	3	16	5	2	8
Internet user (per 1000 people), 2003	2	3.4*	4	5	6
GDP per capita (US$) 2003	315	237	345	249	417

Road length per 100 square kilometer (in kilometer) 2003	21.4	10.8	--	--	--

--: Not available

* 2002 data

Source: Human Development Report 2004; Ministry of Physical Planning and Works, Nepal; Ministry of Public Works and Transport, Cambodia.

Regarding the importance of infrastructure industries the World Bank has noted the following

> *" Infrastructure industries and services are crucial for generating economic growth, alleviating povery, and increasing international competitiveness. Safe water is essential for life and health. Reliable electricity saves business and consumers from having to invest in expensive backup systems or more costly alternatives, and keeps rural women and children from having to spend long hours fetching firewood. Widely available and affordable telecommunications and transportation services can foster grassroots entrepreneurship and so are critical to generating employment and advancing economic development."(Kessides, I.N. 2004)*

It is the major challenge to the least developed countries to provide the poor people access to the infrastructure to improve the socio-economic conditions. As we can see in the history of development in developed countries, the construction industy shall be strong enough in these countries and the industry need to develop efficient infrastructure that could provide the access for the poor. For this the industry needs appropriate human resources, technology and capital in order to build efficient infrastructure. However, the least developed countries, as discussed below, are not yet able to develop appropriate human resources, technologies, and generate own resources for infrastructure development. The problems of the least developed countries are discussed below through the example of infrastructure development, human resource development and official development assistace in Nepal and Cambodia.

2.3 Infrastructure Development

2.3.1 Introduction

Nepal has 147,181km^2 land, and the population is 23.15 million in 2001 Infrastructure development in Nepal started taking shape from the first plan period (1956-1961), which envisaged an investment of NRs. 330 million in public sector. In 1951, Nepal had 276 km of motor-able roads, 6,200 hectares of irrigated land, 1.1 MW of electricity, 2 hospitals, 300 schools and 25 telephone lines (Mihaly, 2002).

After 51 years, the road network had reached 16,000 km, power generation had gone up to 549 MW and irrigated land had extended to 1.128 million hectares. Similarly, the number of hospitals had increased to 83, schools numbered 39,000 and there were about 394,000 telephone lines (Economic Survey of Nepal).

Much of this achievement had been possible through foreign aid. However, the situation of infrastructure is not satisfactory. The road density of 10.8 km per 100 square km of land area is among the lowest in the Asia. Out of total 75 districts, still 17 district headquarters are not connected with motor-able roads. Moreover, only 49 percent of total village development committees (VDCs), the lowest unit of government for administration of one or more villages, have access to telephone service. Furthermore, much of the existing infrastructure is concentrated in the capital city, Kathmandu.

2.3.2 Project Financing

Due to limited internal resources, only small-scaled infrastructure development project are supported through internal revenue. The projects like small irrigation, water supply and village access roads projects are supported through internal revenue and peoples' participation in either cash or volunteer works. All the medium and large-scale infrastructure development projects are financed through bilateral / multilateral grants and loans.

During the 104-year rule of Ranas (the ruler) until 1951, Nepal had been kept in isolation form from rest of the world. Many Ranas had used their own money to hire the services of foreigners, mainly from the British, to establish hydroelectric schemes, drinking water networks, irrigation systems and to construct palatial buildings and to manage the Terai-based *Sal* forests. The first foreign aid to Nepal was a sum of US$ 2000 provided by the United States to the Rana government in January 1951, just a month before the Rana regime collapse (Mihaly, E.B. 2002). The Figure 2.1 and 2.2 show that acute dependency to foreign aid of Nepal's national budget as well as development budget (Mihaly, E.B. 2002, Economic Survey of Nepal 2003-04). The situation is also similar in Cambodia where more than 75 percent of capital formation in infrastructure development had been supported through foreign aid as shown in Figure 2.3 (Kaneko, A. et al 2000).

The main providers of aid to Nepal in the 1950s were the US and India. In the 1960s, the UK, Switzerland, China and the United Nations came to support Nepal. In 1970s, the West German and Japan provided large volume of aid, and the Soviet Union also kept on providing supports. India was the largest donor in 1980s but Japan became the biggest donor to Nepal in 1990s. Likewise in 1990s, Denmark, the Netherlands, Finland, Norway and the multilateral agencies such as the Asian

Development Bank (ADB) and the World Bank (WB) also provided significant amount of aid to Nepal in Infrastructure development. Moreover, Japan is also the largest donor to Cambodia since middle of the 1990s.

However, the economic performance despite the large amount of foreign assistance in Nepal is very insignificant. The nominal GDP growth and the outstanding foreign loans are increasing in parallel. The repayment of the loan is negligible (Economic Survey of Nepal 2003-04). The nominal GDP,

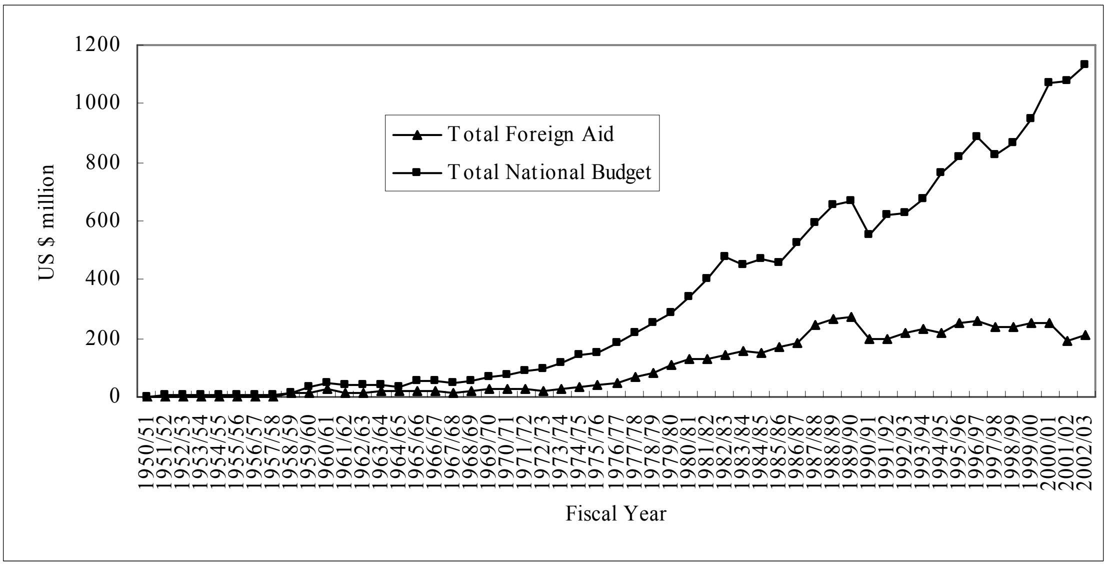


Fig. 2.1: Nepal's national budget and Foreign Aid

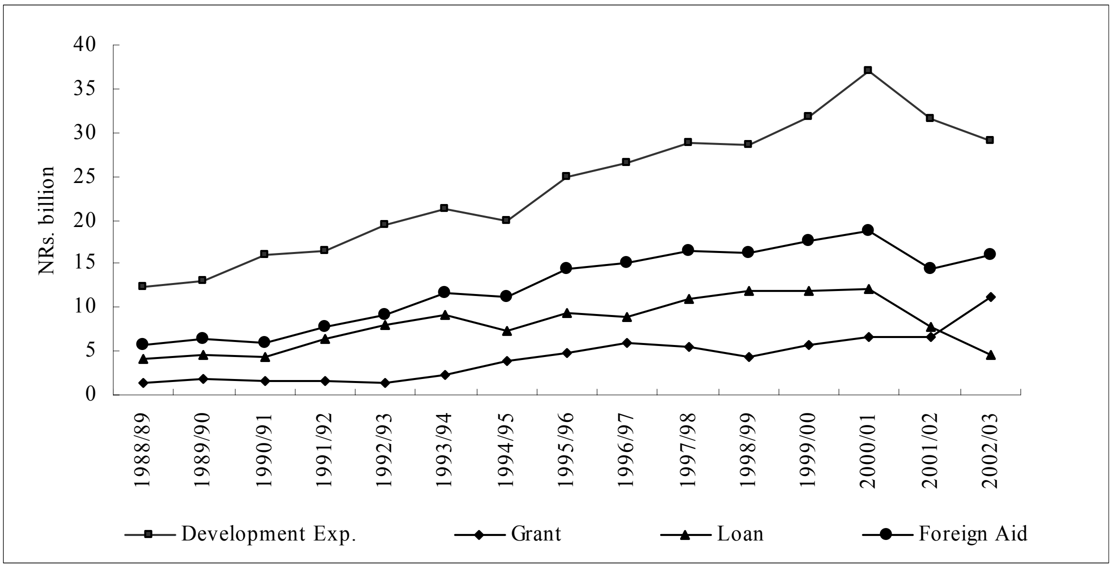


Fig 2.2: Nepal's development expenditure and Foreign Aid (Grants and Loans)

the outstanding loan and repayment are shown in Figure 2.4.

2.3.3 Construction Investment

The development expenditure of 12.3 billion NRs. in 1988/89 had reached to 29.00 billion NRs. (equivalent 372.6 million US$) in 2002/03. The development expenditure covers all the expenses for the development works. The construction investment amounts were drawn from the annual audit reports prepared by the Auditor's General Office (AGO), Nepal. Although all the audit reports were not available, the average of the expenditure in the fiscal year 1999/00, 2001/02 and 2002/03 was taken for to derive the construction expenditure. It was found that 41.6 percent of the whole development expenditure was used for the construction of infrastructures. The development expenditure at nominal value was reached to the highest value of 37.1 billion NRs. in the year 2000/01 and the corresponding construction investment was about 15 billion NRs.

In this study, it was intended to derive the productivity of the civil engineers in terms of construction investment. The number of the civil engineer was taken from the database of the

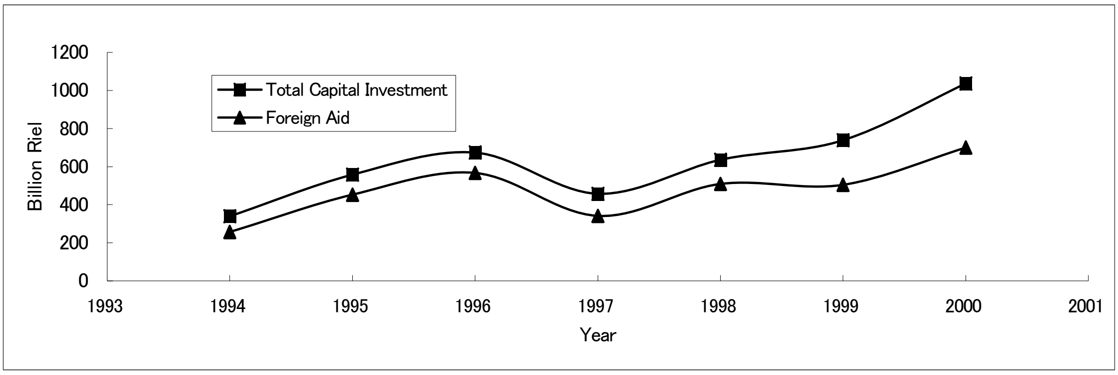


Fig 2.3: Total capital investment and foreign aid in Cambodia

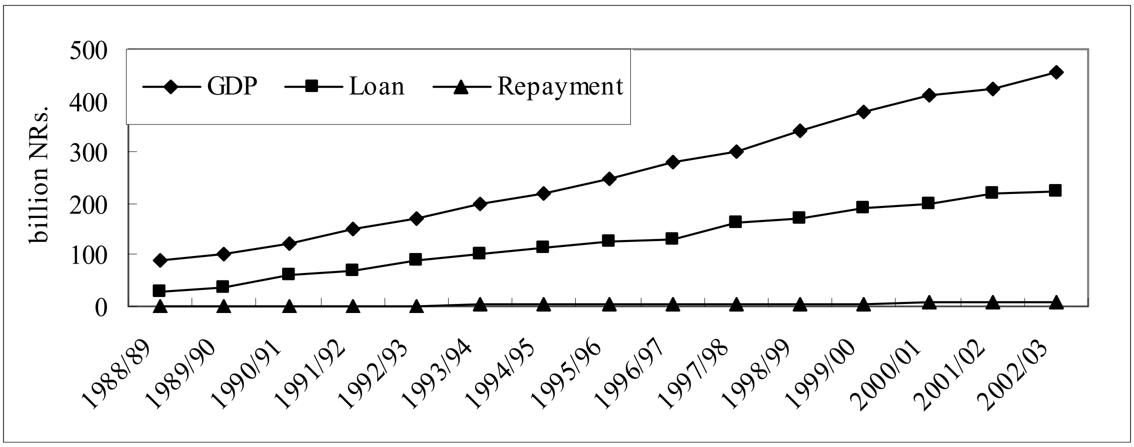


Fig 2.4: GDP, Foreign Loan and Repayment of Loan in Nepal

Nepal Engineering Council (NEC). The Nepal Engineering Council is the central governing body which registers and issues license for engineers to deliver professional services. As of 2004, there were 2758 civil engineers were registered at the NEC. Based on the registration and the graduation year of the engineers, year wise number of the civil engineers was drawn. The derived construction investment was divided by the number of registered engineer to get the investment per civil engineer. It was found that the average investment per civil engineer in Nepal at 1994/95 constant prices was 5.26 million per year. The actual investment per civil engineer may be still lower than the above value as there might be the unregistered engineer for the support services. The growth of the construction investment at 1994/95 constant price and the numbers of the civil engineers in Nepal is shown in the Figure 2.5.

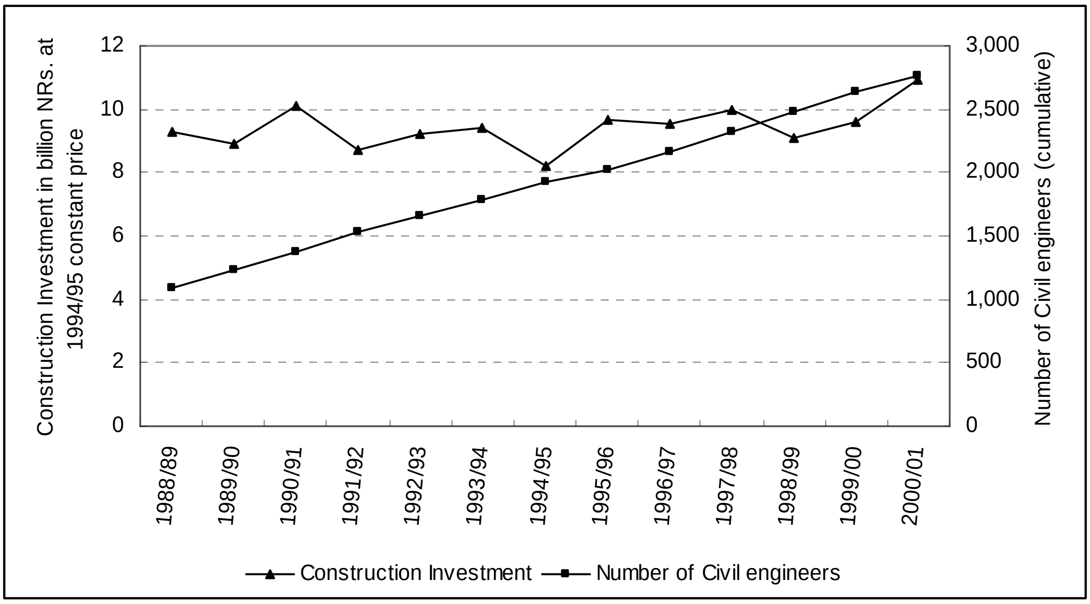


Fig 2.5: Construction Investment and numbers of Civil engineers in Nepal

2.3.4 Development Projects and Organizations

Figure 2.6 is showing the development organization in Nepal. Infrastructure development environments in Nepal and Cambodia are very fragmented and in dismal situation. Many implementing and executing agencies are involved in infrastructure development with duplicating activities without appropriate coordination. For example, ministry of works and transport and ministry of rural development in Cambodia have duplicating activities in road development. One under-secretary for the ministry of rural development in a seminar in Pnom Penh in Novemeber 2004 had demanded to clearly define the authorities of ministry of public works and transport and ministry of rural development in order to develop and maintain roads efficiently in Cambodia. In similar way, ministry of physical planning and works, ministry of water resources and ministry of local development in Nepal has duplicating responsibility in developing and maintaining rural roads and bridges.

The principal agencies involved in public infrastructure implementation in Nepal are sectoral ministry, sectoral department, National Planning Commission, Ministry of Finance. Public infrastructure development works have been implementing mainly through three ministries namely Ministry of Physical Planning and Works (MoPPW), Ministry of Water Resources (MoWR) and Ministry of Local Development (MoLD).

Ministry of Physical Planning and Works, which the author used be working for, holds major responsibility in public infrastructure development. It is responsible for the development and management of Roads network, Water Supply and Sanitation, and Urban Development and Building Construction. Ministry of Water Resources is concerned in Irrigation, Hydropower and Water induced disaster control. And, Ministry of Local Development is responsible for the development of rural Roads. All these ministries have following type organization. The National Planning Commission approves the program and project proposal, and Ministry of Finance provides the budget for the implementation of approved projects.

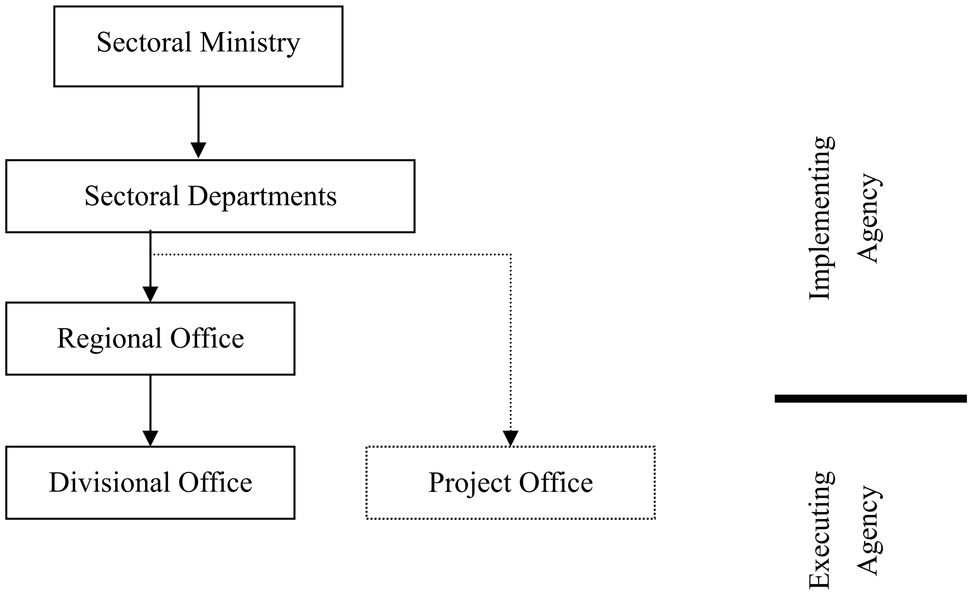


Fig 2.6: Development organization in Nepal

2.3.5 Project Delivery and Contracting System

2.3.5.1 Introduction

Infrastructure development projects in Nepal until 1950 were executed departmentally in which the government procured construction materials and equipment locally or from India and Britain. Project planner and designers were also brought from India on the recommendations of Indian Rajas and Princes. The designers also brought in skilled tradesmen and craftsmen for the execution of a project (Vaid, K.N. 1999). The unskilled labors of rural Nepal as well as India were employed during the execution.

The new era of the construction industry in Nepal started in 1951. However, the construction activities remained at low as the government was busy in reorganizing the administrative mechanism, promulgation of new laws and framing of the First Five-year Development plan. A large number of Indian experts were seconded to His Majesty's of Government of Nepal for the purpose. The construction industry system was revamped. (Vaid, K.N. 1999)

The ministry of works and transport was established in 1951/52 as a nodal ministry for all construction works in the country. The Industrial Policy Resolution, 1957 adopted by the HMG of Nepal recognized the construction as the 'priority sector' industry. As the priority sector, construction firms enjoyed income tax holiday along with other tax concessions for seven years from the date of incorporation, a more liberal depreciation rate, capitalization of pre-investment expenditure, provision of foreign exchange facilities, etc.

The Industrial Enterprises Act, 1974 defined a contractor as a person who takes contracts for supply of rations, collection of revenues, etc., besides the construction activity. Later, in 1988 a construction firm was defined as ' an enterprise established for the construction of roads, bridges, tunnels, ropeways, flyovers, bridges, trolley buses and commercial and residential complexes' (ibid).

2.3.5.2 Contractors Classification in Nepal and Cambodia

Industrial Enterprises Act 1974 has made a provision for the registration and classification of contractors in Nepal. Contractors in Nepal are classified under four categories depending upon their overall financial and technical capability. The law has also stated the contract size in which the different class of contractors can participate. The class, number of contractors and limited bidding amount are shown in the Table 2.2.

Table 2.2: Types, numbers and Range of Bidding Amount for various classes of Contractors in Nepal

Class of Contractor	Numbers of Contractors	Bidding Amount Limited to	
		in NRs.	(eqv. US$)**
A	176	> 20 million	(>254,777)
B	350	>6 million < 30 million	(>76,433 < 382,166)
C	1500	>2 million < 10 million	(>25,478 <127,389)
D	10000*	<3 million	(<38,217)

* Estimate only: No actual data available as they are registered in district offices.

** 1 US $ equivalent to 78.5 NRs.

*** Source: MoPPW, Nepal

Similarly, the Prakas on the Governance over the Consultants and Construction Companies-1999 classifies the contractors in Cambodia into four categories: Category I, II, III and IV. (Ministry of Land Management, Urban planning and Construction, Cambodia)

2.3.5.3 Minimum Requirements for various classes of Contractors in Nepal and Cambodia

Although the minimum requirement for various classes of contractors were stipulated as shown in table 2.3, there were no availability of human resources, plant and equipment even with the highest class of contractors in Nepal. The contractors usually show the documents for stipulated items at the time of registration, however they do not continue to own the same for the long term. Further, there are no monitoring and evaluation system for the contractors performances in Nepal.

Similarly, Cambodia has also stipulated as shown in table 2.4, the minimum requirements for various classes of contractors. The Cambodian classification requires larger number of human resources compared to the Nepalese classification, however there is also no mechanism to monitor the ownership and performance of the contractors. Further, there is no any program for contractor performance improvement in Nepal and Cambodia. Thus, the contractors in Nepal and Cambodia are not encouraged to improve the performance. In addition, these countries do not have the policy to develop specialized contractors as in Japan.

Table 2.3: Minimum Requirements for various classes of Contractors in Nepal

Minimum Requirement for Various Classes of Contractors in Nepal				
Particulars	Class of Contractors			
	A	**B**	**C**	**D**
Registration	In department of Industry	In department of Industry	In department of Industry	In department of Industry
Financial				
Paid up Capital (Minimum)	2.5 Mln. NRs.	1.5 Mln. NRs.	0.5 Mln. NRs.	50,000 NRs.
Technical Manpower				
Civil Engineer	2 nos. (Full time)	1 no. (Full time)	Having Service agreement with at least **1** Civil Engineer OR **1** Civil overseer with more than 10 years experience.	Having Service agreement with at least **1** Civil overseer OR any Engineering consulting firm.
Civil Overseer	4 nos. (Full time)	2 nos. (Full time)		
Plant and Equipment	Possessing equipment and machinery of current value of 10 mln. NRs. With minimum of following equipment.	Possessing equipment and machinery of current value of 5 mln. NRs. With minimum of following equipment.	Possessing equipment and machinery of current value of 2.5 mln. NRs. With minimum of following equipment.	Possessing equipment and machinery of current value of 0.1 mln. NRs. With minimum of following equipment.
Theodolite	1	1	-	-
Level	4	3	1	1
Dump Truck	4	2	1	-
Loader	1	1	-	-
Dozer/Excavator/ Earth Removing m/c	1	-	-	-
Road Roller	1	-	-	-
Water Pumps (Heavy)	3	2	-	1
Concrete Mixer	2	2	1	1
Vibrators	5	4	2	1
Water Tanker	1	-	-	-
Experience	Having successfully completed at least 4 projects of current value more than 7.5 mln. NRs. OR 1 project of 40 mln. NRs.	Having successfully completed at least 4 projects of current value more than 4.0 mln. NRs. OR 1 project of 20 mln. NRs.	Having successfully completed at least 4 projects of current value more than 0.5 mln. NRs. OR 1 project of 4.0 mln. NRs.	Not Required
Bidding Capacity	More than 20 million NRs.	>6 mln. <30 mln. NRs.	>2 mln. <10 mln. NRs.	Up to 3 Million NRs.

Table 2.4: Minimum Requirements for various classes of Contractors in Cambodia

Minimum Requirement for Various Classes of Contractors in Cambodia				
Particulars	Categories of Contractors			
	Category I	**Category II**	**Category III**	**Category IV**
Registration	In Ministry of land management, Urban Planning	In Ministry of land management, Urban Planning	In Ministry of land management, Urban Planning	In Ministry of land management, Urban Planning
Financial				
Capital (Minimum	400 million. Riels.	120 million. Riels.	20 million. Riels.	Not Required
Technical Manpower	1. 2 civil engineers and 2 architects having at least 10 years of professional experience, amongst them, a civil engineer and an architect to be technical Director and Project manager respectively;	1. 1 civil engineer and 1 architect having at least 8 years of professional experience, to be technical Director and Project manager respectively;	1. 1 civil engineer having at least 5 years of professional experience, to be technical Director of the company;	1. 1 skilled worker having at least 10 years of work experience
	2. At least 6 engineers in charge of various activities such as mechanic and electricity, plumbing, geology, topography, etc.	2. At least 4 engineers in charge of various activities such as mechanic and electricity, plumbing, geology, topography, etc.	2. At least 2 engineers in charge of various activities	2. An appropriate number of skilled workers
Experience	Previous experience in construction works with a minimum total value of 20,000,000,000 Riels.	Previous experience in construction works with a minimum total value of 4,000,000,000 Riels.	Not Required	Not Required

Source: Prakas on the Governance over the Consultants and Construction Companies, Ministry of Land Management, Urban planning and Construction, Cambodia

2.3.5.4 Design-Bid-Build (D-B-B) Project Delivery System

Design-Bid-Build (DBB), the traditional project delivery system in which the client makes contracts separately with a consultant/designer and general contractor, consists of three linear phases of the work. Client creates a project plan and the designer prepares the necessary construction documents. Fixed-price bids are then requested from qualified contractors based on lowest responsive bid through competitive bidding to execute the work. The client then makes a contract with a contractor to execute the work in accordance with the plans and specifications.

Design-Bid-Build is the principal project delivery system in Nepal and Cambodia. All public infrastructure development projects in Nepal and Cambodia have been implemented through multiple contracting under DBB system irrespective of the sources of funds and clients' experiences. Despite the long experience of the clients in the Design-Bid-Build project delivery system, only several projects have been completed within stipulated time and budget in Nepal (AGR-1999-2000).

The history of irrigation and roads development in Nepal showed that only several projects were completed in time and within budget. It was found that the intents of traditional delivery system like complete plan, design and fixed price contract had not been achieved in Nepal. Further, the clients could not prepare complete design drawing and practical schedule and cost before execution, and did not have enough construction management skills to control time, cost and quality. Those clients were typical among infrastructure development organizations and represent the performance of the whole industry as similar organizational structure and contracting methods have been using in other development projects.

The majority of the reasons listed in 2.3.7, for the delays and variations, reported and identified through survey questionnaire and interviews could be grouped under construction management. These were lack of project management, design change, design defect, delay in contract award, lack of coordination, and no trained manpower in constructions. The lack of funds was the dominating factor for delay in internally financed project; however, poor construction management had resulted to delay and variations even in foreign assisted projects. The details are discussed later.

The author had investigated the characteristics of the stakeholders involved in project implementation which have influenced the efficiency of project delivery system and performance of the construction industry in the least developed countries. The characteristics of the owner (government) and the contractors had greatly affected the efficiency of the traditional project deliver in the Nepal and Cambodia.

(1) The Owner

Government in the least developed country is the largest purchaser of the construction product. All public infrastructures have been implemented through governmental organizations. The clients' performance in a project delivery in Nepal and Cambodia is mainly influenced by the following factors.

a) Weak political and legal environment

Although an implementing agency holds sufficient engineers and support staffs, any change in political environment also affects the key post for project implementation. Political influences in deciding project engineers are common in Nepal and Cambodia. A project manager in such a country, therefore, not only involves in the technical management of a project, but also engages in making favorable political environment. Frequent change in the project personnel during execution and less devotion of the key personnel for the technical management of project had greatly affected the decision-making and the quality control in the implementation of a project.

Moreover, Nepal and Cambodia have not enforced construction and procurement laws. Administrative financial regulations have been following in construction also. Further, these countries have not established their own standards for design and construction of infrastructure. Lack of own national standards and codes for design and construction in Nepal and Cambodia require technical manpower to be familiar with many other countries' standards and codes which demands foreign consultants/contractors which has influenced the efficiency in project design. Further, the lack of appropriate laws and regulations in procurements and construction has made difficult to ensure consistency in decision-making and quality control.

b) Lack of motivation for working

Amos and Sarchet (1981) define motivation as "a force or drive causing some action, behavior or result". Further, Maslow's hierarchy of human needs to explain how persons are motivated to an action suggested that the lowest motivational factor is related to physiological needs: food, water, sex, shelter and clothing (the survival needs required to maintain life). The hierarchy goes upwards to safety needs, social needs, esteem needs and self-actualization needs (Bennett, F.L. 1996). However, existing incentive system and opportunity provided to the employees in Nepal and Cambodia have not even satisfied the lowest needs of the human beings as categorized by Maslow. The employees, therefore, are naturally not motivated and may not show integrity at work. The human resources involved in project implementation in Nepal and Cambodia are ever seeking other sources to fulfill the cost of livelihood rather than efficient delivery of a project. Lack of motivation to the employees is the major problems in the in the construction as well as service industries of Nepal and Cambodia, which has also affected the efficiency of project delivery system.

c) Lack of appropriate human resources development system

Government is the largest employer of the technical manpower in Nepal and Cambodia. However, human resources development system is not well established to improve the efficiency of the services it delivers. Governments in Nepal and Cambodia do not have established appropriate training system compatible with the job requirements. For instance, an employer does not provide training in administration, design and construction management for fresh-recruited technicians before sending him/her to the construction site. Further, the civil engineering education has not incorporated necessary knowledge area and skills of the construction management. Thus, the performance of a technicians is solely depends upon his own ability and how cooperative and experienced the other team members are. Therefore, involvement of untrained technical and managerial manpower in project implementation is more likely in these countries which is the main reason for inefficiency in infrastructure development and poor performance of the construction industry.

d) Lack of checks and balances

Consultants services are sought only in large, complex project and when donors' guidelines demands for. A client in Nepal and Cambodia often plans, designs and prepares construction documents for small and medium scale infrastructure development project. Further, supervision and inspection are done by the client itself, and the client has full domination in all stages of a project cycle. There is less opportunity for the involvement of the other party to check the performance of the client and, thus, hiding of any faults of the client is more likely in such construction environment.

e) Inefficient decision making system

Responsibility avoiding in decision-making process in bureaucracy is seen in Nepal due to political influence and weak legal environment. The layers of supervision used in the traditional D-B-B project delivery system further influence the decision making in a project execution. A client in Nepal and Cambodia usually sets up design and supervising team for small to medium size project sets under the project manager which consists of engineers and technicians – support staffs. The client usually hire designer for the design of large projects. The figure 2.7 shows the decision-making system in the traditional project delivery system where designer is hired for the design and the client himself supervises the project.

Technicians are supposed to oversee the daily work progress of the contractors and visit construction site often, if not stayed at the site. Engineers are engaged in design, in issuing the drawings and solving technical problems. Any problems encountered by the contractor at the site are first reported to the engineer through the technicians who then reported to the project manager. The project manager may consult the designer and instructs the engineers regarding the problems. The engineer further instructs the technicians, and finally the contractors receive the project manager's decision through the technicians. Such reporting from site to project office and decision dissemination from project office to the site usually takes considerable time, and there is more likely for responsibility transferring among the supervising members which slows down the work progress and often create adversarial environment at the construction site.

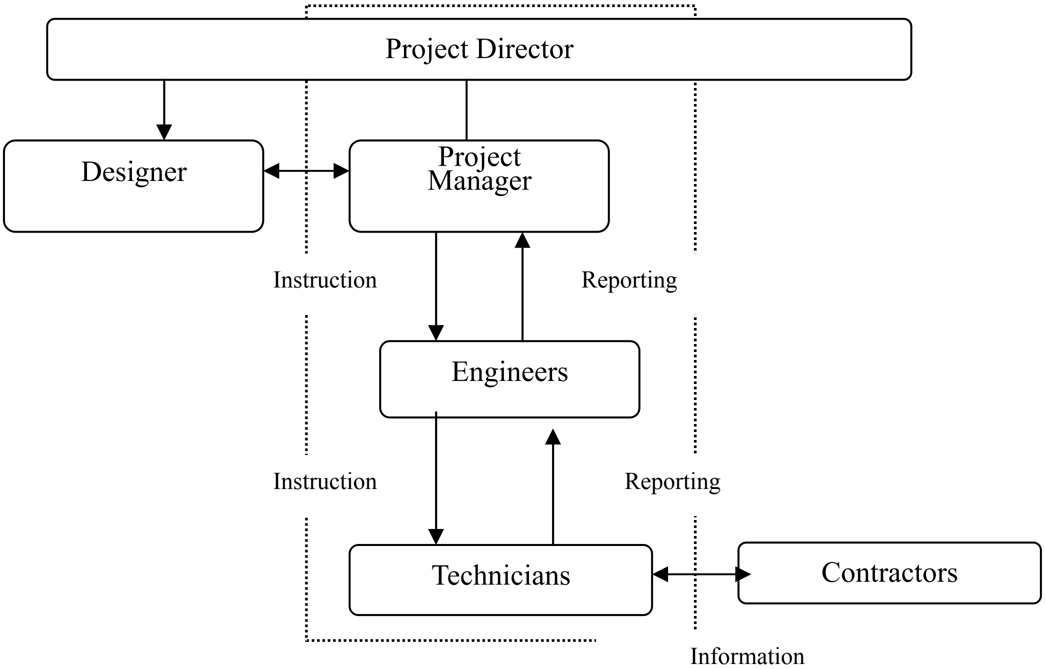


Fig 2.7: Decision Making in client supervised traditional project execution method

(2) The characteristics of the Construction Industry

Like in the developed countries, 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. As stated earlier, there are four classes of contractors (A, B, C and D) in Nepal and Cambodia. Only about 20 percent of the highest 'A' class construction firms in Nepal are being managed by engineers. The total number of 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 are one-degree graduates (NEC 2004).

Authors' questionnaire survey followed by interviews and field visit identified that most of the contractors from Nepal and Cambodia were not familiar with appropriate time, cost and quality management tools and practice. There were no appropriate training systems for the construction engineers and technicians in the construction industry. Further, no contractors have established and invested for human resources development. The contractors in project execution were dependent on the clients' engineers for technical support, as they could not hold sufficient engineers themselves. Such client dominated traditional project delivery system could not enhance the performance of the construction industry in Nepal and Cambodia due to no incorporation of professional construction management. Further, the lowest bid principle of the traditional project delivery system forced contractor to bid the lowest possible to get a work. The practice of the lowest bid in the traditional D-B-B system has made contractors to employ inexperienced and untrained technical manpower at low incentive, and to seek shortcuts during construction.

2.3.5.5 Tendering System

The executing agency usually performs feasibility study, detailed engineering design, cost estimation and preparation of tender documents of all small to medium scale development projects whereas consultants are involved in large-scale infrastructure development projects. There is no separate law for construction procurement however the Financial Administration Regulation (FAR) provides some provisions for procurement of works, goods and services. The law dictates that pre-qualification of the contractors should be done for the construction of a project that costs more than 10 million NRs. The common bidding systems that have been in practice are i) pre-qualification, ii) two-envelope system (post-qualification) and iii) direct bidding. Donors' procurement guidelines have been following for the implementation of donor-assisted projects.

For pre-qualification, the technical proposals are invited for the proposed project. The executing agency evaluates the formally received technical proposals. Then successful bidders are requested to submit the financial proposals. The contract is awarded to the contractors who offers lowest bid. On the other hand, the technical and financial proposals are invited at the same time in two-envelope system. There are two types of evaluation procedure; the first one in which technical proposals are evaluated first and the financial proposals of successful bidders only are opened and the contract is awarded to the contractors who offers the lowest bid. The financial proposals of unsuccessful bidder are returned unopened. In the second method (post-qualification), the financial proposals are evaluated first and then technical proposal of lowest bidder is evaluated, the contract is awarded to the lowest bidder if the lowest bidder is successful in technical examination. If not, the technical proposal of second lowest bidder is evaluated and so on, and the contract is awarded accordingly. In direct bidding, financial proposals are only invited and the contract is awarded to the bidder who offers the lowest bid.

The pre-qualification is mostly used in ADB assisted and some of internally financed projects. Two-envelop system has been using in internally financed projects and donor assisted projects. The post-qualification is widely used in WB funded projects. Direct bidding is used in small-scale work only.

2.3.6 Situation of Project Delivery

Literatures survey, interviews with the clients, contractors and consultants, and field visit have shown that infrastructure development projects in Cambodia and Nepal are characterized by delay, variations and poor quality of works. The construction industry partners—clients, contractors and consultants in these countries think that the delay and variation are not the special problems of the industry since long ago, as the delay and variation are encountered in almost every project. One interviewee engineer told the author that he had no experience within last 10 years of any project that was completed within the contract amount and time stipulated at the time of contract signing. The clients and contractor were adapted in such situation, and never investigated the reasons for delay and variation. In effect, the clients were reluctant to do any research to investigate the solutions for the delays and overrun, and had not taken any measures to improve the situation.

The irrigation, roads and bridge development projects delivery efficiencies in Nepal are shown in the Table 2.5.

2.3.7 Causes of Delay and Cost Overrun in Irrigation Development Projects in Nepal

The cause of delay and cost overrun in irrigation project delivery as investigated from literature review, experience of the author, and interviews with project personals are listed below.

1) Project name: Sunsari–Morang irrigation project

- Design defect
- Lack of matching fund
- Inadequate interaction with beneficiaries
- Shortage of materials
- Natural calamities
- Lack of access for material management

2) Sunsari-Morang irrigation Project II

- Additional work

3) Sunsari-Morang Head Works project

- Lack of coordination among contractors
- Design change
- Equipment supply delay
- High flood
- Longer rainy season
- Lack of required quantity of materials
- Lack of qualified technical manpower

4) Bagmati Irrigation project

- Lack of matching fund
- Incompetent contractors
- No trained manpower were involved in the execution of work
- Scattered site
- Frequent change of project personnel
- Lack of project management
- Inadequate interaction with beneficiaries

5) Rajapur Irrigation Project

- Delay in contract award
- Lack of matching fund
- No consideration of weather report
- No trained manpower in construction
- Lack of efficient project management team
- Delay in custom clearance

6) Chitwan Lift irrigation project

- Design defect
- Lack of coordination with other stakeholders
- Lack of matching fund
- No trained manpower available in construction
- Frequent change of project manager
- Lack of efficient project management team

7) Bhairawa-Lumbini Ground Water project, III Stage

- Design defect
- Delay in contract award
- Lack of coordination among stakeholders
- Delay in equipment supply
- Change in scope of work
- Frequent change of project manager
- Lack of trained manpower in construction
- Lack of coordination among contractors and stakeholders
- Late decision of consultants

It can be said that the above projects were delayed and undergone to cost overrun because of the any or all of the problem related to i) financial, ii) construction and project management, iii) technological, iv) human resources v) political vi) legal, and vii) others. Lack of matching fund and delay in equipment supply are caused due to insufficient financial resources. Inadequate interaction with beneficiaries, Lack of coordination among contractors, incompetent contractors, scattered site, lack of project management, inadequate interaction with beneficiaries, delay in contract award, no consideration of weather report, lack of efficient project management team, lack of coordination with other stakeholders, Change in scope of work and late decision of consultants are due to the lack of appropriate construction and project management in the implementation of the projects. Similarly, shortage of materials are due to the lack of appropriate technology for materials production, and design defect was arose due to the improper investigation and study resulted from lack of appropriate technology for investigation and design of at the project. The lack of trained manpower in construction, incompetent contractors and the design defect are due to the inadequate education and training including university education, as discussed in following chapters, for human resources development. Political influence in the project implementation usually caused the frequent change of the project manager and delay in contract award. Like wise, the delay in equipment supply and delay in custom clearance are due to the inappropriate legal and bureaucratic system. Among these, financial, the construction and project management, technological and human resources had influenced the most of the project.

2.4. Conclusions

Nepal and Cambodia are dependent on foreign assistances. Almost all medium and large-scale infrastructure development projects were dependent on foreign resources.

The performance of the construction industry in terms of project delivery was very poor. Only several projects were completed within the planned resources. Design-Bid-Build system did not perform well, and alternative project delivery system should be sought.

Financial, construction and project management, and quality of human resources affected the project delivery.

The construction industry could not develop appropriate human resources in order to develop infrastructure efficiently.

Appropriate human resources and infrastructure development system should be established in order to develop infrastructure efficiently. The integrated system developed in this study would help improve the situation.

2.5 Annex

Table 2.5: Efficiency in Irrigation Development Projects in Nepal

Project Name	Start Date	Target date of Completio	Actual date of completio	Delayed (Yrs)	Estimated Cost (mUS$)	Actual Cost (mUS$)
Sunsari Morang IP						
CCP	Oct-64	Nov-72	Nov-75	3 (37%)	3	7.25 (142%)
SMIP I	Feb-78	Feb-82	Feb-85	3 (75%)	37.5	40 (7%)
SMIP II	Apr-87	Apr-94	Apr-94	-	45	49.9 (11%)
SMHP	Jan-91	Dec-95	Dec-97	2 (41%)	29.68	25.02 (-16%)
P 1	Apr-93	Dec-95	Dec-97	2 (75%)	11.67	16.85 (44%)
P 2	Oct-93	Dec-95	Dec-97	2 (92%)	3.36	3.32 (-1%)
P 3	Feb-93	Oct-95	Jul-96	0.67 (25%)	na	na
Bagmati IP						
CAD 7	May-96	May-98	Jul-99	1.16 (58%)	0.43	0.38 (-12%)
CAD 15	Apr-98	Jul-00	Jul-00	-	0.88	0.93 (6%)
CAD 2	May-96	May-98	Aug-98	0.25 (13%)	0.39	0.38 (-3%)
Rajapur IP						
ICB 1	Feb-96	May-98	May-00	2 (89%)	1.29	1.48 (15%)
ICB 2	Nov-96	Aug-98	Aug-00	2 (114%)	5.37	5.37 (0%)
ICB 3	Jun-97	Jun-00	Jun-00	-	5.51	5.51 (0%)
ICB 4	Sep-97	Sep-99	Sep-99	-	1.15	1.15 (0%)
IP	Feb-78	Feb-85	Feb-87	2 (29%)	19.5	24.05 (23%)
BLGWP						
Stage I	Nov-76	Oct-83	Oct-85	2 (29%)	13.7	na
Stage II (ph 1)	Oct-83	Oct-88	Nov-90	2 (40%)	19.4	na
Stage II (ph 2)	Nov-90	Dec-95	Dec-95	-	na	na
Stage III	Feb-91	Dec-98	Jun-95	0.5 (6%)	52.69	59.43 (13%)

Table 2.6: Delay in Road maintenance and Rehabilitation Project in Nepal, Source: AGR 2055

Roads Maintenance and Rehabilitation Project	Contract Amount (NRs)	Intended Execution period (Months)	Delayed by (Months)
Butwal - Tansen	136,032,000	24	24
Thankot - Naubise	157,235,000	18	24
Marsyangdi - Khaireni tar	230,030,000	24	18
Gaddachauki - Chaudhahar	55,460,000	12	21
Naubise - Simbhanjyang	138,893,000	24	3

Table 2.7: Progress and Time elapsed in Bridge Project in Nepal,

Source: AGR 2056

Bridge projects	Time Ellapsed	Progress
Sindhiya Bridge	100%	51.17%
Budhikhola Bridge	50%	5.88%
Keshliya Bridge	100%	27.92%
Sunsari Bridge	100%	11.21%

Table 2.8: Cost Overrun in major Road development Project in Nepal,

Source: AGR 2055

Road Projects	No. of contract	Agreement Amount (NRs.)	Variation (Cost Overrun) (%)
Second Road Improvement Project	6	1,221,606,000	40.13
Third Road Improvement Project	7	483,376,000	53.80
RMRP	3	348,327,000	49.34
Dumre Besisahar	2	105,729,000	114.52
Butwal Tansen		136,000,000	189.90

Chapter 3

3. Human Resources Development

3.1 Human Resources: Occupational Distribution

Nepal's population stood at 23.15 million in 2001. The annual growth rate of population averaged 2.25 percent in 1991-01. The labor force (economically active population 10 years of age and over) of 7.3 million in 1991 was reached to 10.6 million in 2001 (Population Monograph of Nepal-2003). The occupational breakdown of labor force in 2001 showed that around 4 percent of the labor force in Nepal was involved in professional and technical activities while majority of the labor force still engaged in subsistence agriculture. The distribution of labor force in Nepal in 2001 is shown in Table 3.1 below.

Table 3.1: Economically active population (10 years and above) by major occupation groups, Nepal 2001.

Occupation	% of Total
Professional and technical	4.18
Administration and related	0.57
Clerical	2.03
Sales	7.89
Services	9.26
Agriculture	59.61
Production	1.43
Others	14.95
Not stated	0.08

Total may not add up to 100 because of rounding.

Source: Population Monograph of Nepal-2003, pp. 360

Similarly, the labor force in Cambodia had reached to 6,359.2 thousand in 2001. The occupational distribution of the labor force, according to the labor force survey showed that 3 percent of the total labor force is involved in the professional and technical occupation. The labor force distribution in Cambodia is shown in Table 3.2**.**

Table 3.2: Economically active population (10 years and above) by major occupation groups, Cambodia 2001.

Occupation	% of Total
Armed Forces	0.6
Legislators, Senior Officials and Managers	0.7
Professionals	1.1
Technicians and Associates Professionals	1.9
Clerks	0.4
Service and shop and market sales workers	10.1
Skilled Agricultural and fishery workers	67.0
Craft and related trades workers	7.8
Plant and Machine operators and Assemblers	3.3
Elementary Occupations	7.1

Total may not add up to 100 because of rounding.

Source: LF-National Institute of Statistics (NIS), Phnom Penh - Cambodia

3.1.1 Educational Attainment

A country's development depends very much on having available a pool of skilled workforce on which to draw for the jobs that need to be done. Skills are imparted through the education system, and also through further formal training which may be specifically related to the requirements of the job. However, the labor force survey could not measure and incorporate the training in the survey. The survey revealed that more than 80 percent of the whole workforce had attained up to primary level education with as many as 60 percent had never attended any education. The educational attainment of the labor force as revealed by the latest labor force survey (1998/99) in Nepal is shown in Table 3.3.

Likewise, Table 3.4 shows the distribution of labor force participants by highest educational attainment in Cambodia. As shown, the bulk (56.4 percent) of the labor force participants attained primary level (Class 1-6); 18.9 percent not attended school or had not completed class 1 or not reported/unknown; 18.4 percent reached secondary level (Class 7-9); and 4.6 percent attained at least high school. The remaining 1.4 percent had either attained vocational BST/OS graduate /undergraduate or a postgraduate degree holder.

Table 3.3: Educational attainment by the population aged 15 and over in Nepal (1998/99)

Completed Education Level	% of Total
Never attended	60.3
Less than primary	9.7
Primary (class 1-5)	11.8
Lower secondary (class 6-8)	9.3
Secondary (class 9-10)	5.6
Higher secondary (Class 11-12)	1.9
Degree level	1.1
Others	0.2
Not stated	0.0

Source: Labor Force Survey (1998/99), central Bureau of Statistics, Nepal

Table 3.4: Distribution of the Labor Force Participants by Highest Educational Attainment, Cambodia: 2001

Completed Education Level	% of Total
Not attended school /no class completed	18.9
Primary (1-6)	56.4
Secondary (7-9)	18.4
High school (10-secondary diploma)	4.6
Vocational/ BST/ OS graduate & undergraduate	1.0
Graduate or higher	0.4
Not reported	0.3

Source: LF-National Institute of Statistics (NIS), Phnom Penh - Cambodia

3.2 Workforce in the construction industry

3.2.1 Nepalese construction industry

Many hierarchical layers of human resources are involved in the Nepalese construction industry. The construction industry has recognized typically four categories of the human resources namely:

i) Tradesperson/Craftsperson, ii) Sub-overseer/Supervisor, iii) Overseer/Technicians, and iv) Engineer.

i) **Tradesperson/Craftsperson**

This category of the human resources is the lowest level of the skilled work force. These people are skilled at specific work like plumbing, welding, brickwork, reinforcement, etc. These skills are attained from the skill-oriented training programs conducted by governmental and non-governmental organizations. One should have successful completion of lower secondary level (at least 7-years of schooling) in order to participate in the basic level training.

ii) **Tradesperson/Craftsperson (Foreman)**

This is the second lowest hierarchy of the skilled workforce. A person who has completed the certificate level of engineering training would recognize as a sub-overseer. The certificate level trainings are conducted by governmental institution as well as private institution. It requires 2 years of training after the successful completion of 10-years of schooling. These people guide the craftsperson to execute the works at the field level.

iii) **Superintendent/ Supervisor**

This category of skilled workforce is the key element to oversee the daily works in the context of the Nepalese and Cambodian construction industry. A person to be an overseer/technician requires 3 years of engineering education after the successful completion of the School Leaving Certificate (SLC) examination. These people perform surveying, layout, drawings preparation, quantity estimate, and oversee the works done by the supervisor and craftsperson.

iv) **Engineer**

This category of the skilled workforce is the highest in the hierarchy in the construction industry. The minimum of bachelor's degree in engineering is essential to be an engineer. These people conduct investigation, survey, feasibility, design, and estimate of engineering works. These people can serve other services such as project management, and the like. Engineers in Nepal and Cambodia enjoy high decisive and managerial responsibility. However, the industry does not have the appropriate training system for all categories of the skilled workforce.

3.2.1.1 Quality of technical manpower in Infrastructure development in Nepal

Study of the representative infrastructure development project in Nepal showed that the quality of the technical manpower involved in the development works was not enough to deliver the projects efficiently. The study of the second largest irrigation and road networks development project in Nepal revealed the followings. The study was done through the face-to-face interviews, and peer and subordinate's evaluation.

① Project Manager

The client had the project manager who was masters in civil engineering was good at administrative management however the technical input was very low. His leadership could not complete a single contract within the stipulated time and cost.

② Senior engineer

There were 3 senior engineers, 2 of them were masters and 1 hold undergraduate degree only. Among them one was competent at computer added design and drawing, 1 was computer literate and the remaining was not familiar with computer. Similarly, technical input from these 3 senior engineers was comparable with their computer literacy. Among them the engineer who was competent in computer application was equally familiar with the contract clauses, progress reporting and evaluation, and administration. Other 2 were not familiar with contract management and administration skills.

③ Project Engineers

There were 12 project engineers for the execution of the project. All of them hold bachelor's degree in the civil engineering. Among them 5 were not familiar with computer application, and were not competent in the design and supervision of the construction works. No engineers were familiar with project scheduling software like MS Project, Primavera. Two third of them were not also familiar with progress reporting and monitoring techniques, and testing of construction materials. In addition, the contract document preparation, and contract management/administration were the capacity of the only 4 engineers.

④ Superintendent/ Supervisor

Thirty superintendents/ supervisors were employed under the project to supervise the daily construction works. The superintendents/supervisors had skills for survey, layout, line and leveling the structures. However, two third of them were not familiar with quality control and none of them were trained in cost and schedule control techniques. All the contracts were delayed and gone for variation.

⑤ Contractors' Manpower

There were 9 contracts under the project. No contractors' project managers were engineer. The people with a little construction experience hold the position. The contractors were dependent to the clients' superintendents/ supervisors.

3.2.2 Work force composition in the Nepalese, Korean and Japanese construction industry

a) Nepalese construction industry

Since the construction employment data were not available, the total employment in the construction was derived from the percentage of the work force population involved in the construction. The work force population (age over 10 years) data were taken from the population statistics. The work force population was 73.75 % of the whole population and 2.89 % of the work force population were involved in the construction (CBS 2003). The total population of Nepal in the year 2001 was 23,151 thousand. Thus the derived numbers of people involved in the construction were 493,000. The total numbers of the registered civil engineer in the year 2001 were 2,758. Thus, percentage of the civil engineers in the total construction workforce in 2001 was only 0.56%.

b) Korean Construction Industry

The construction employment data were obtained from the 'construction and economy research institute of Korea. The total employment in the construction in the year 2004 was 1,820 thousand. The total number of registered construction engineer in 2004 was 484,224 (Park, H.P. et al 2005). Thus the percentage of the registered construction engineer in the total construction workforce in Korea in 2004 was 21.71%.

b) Japanese Construction Industry

The construction employment data until the year 2003 were obtained from the MLIT's statistics. There was decreasing trend of the construction workforce since 1995. The construction workforce in 2001, 2002 and 2003 were 6,320 thousand, 6,180 thousand and 6,040 thousand respectively. Assuming the similar decrease trend the construction workforce in 2004 was 590.5 thousand. The total registered construction engineers in Japan in 2004 were 2,637,604 (Heavy Civil: 1st level- 568,145, 2nd level- 1,214,541; Building: 1st level- 204,248, 2nd level- 650,670) (registration Office-2005). Thus the percentage of the registered construction engineer in the total construction workforce in 2004 was 44.6%.

3.3 Educational System

3.3.1 General Education

The formal education system in Nepal offers 5 years of primary education, 3 years of lower secondary education and 2 years of secondary education. Upon completion of 10 years of school education one can appear in the national examination for the School Leaving Certificate (SLC). The SLC is mandatory for entry to tertiary education. The educational system in Nepal is shown in the Figure 3.1.

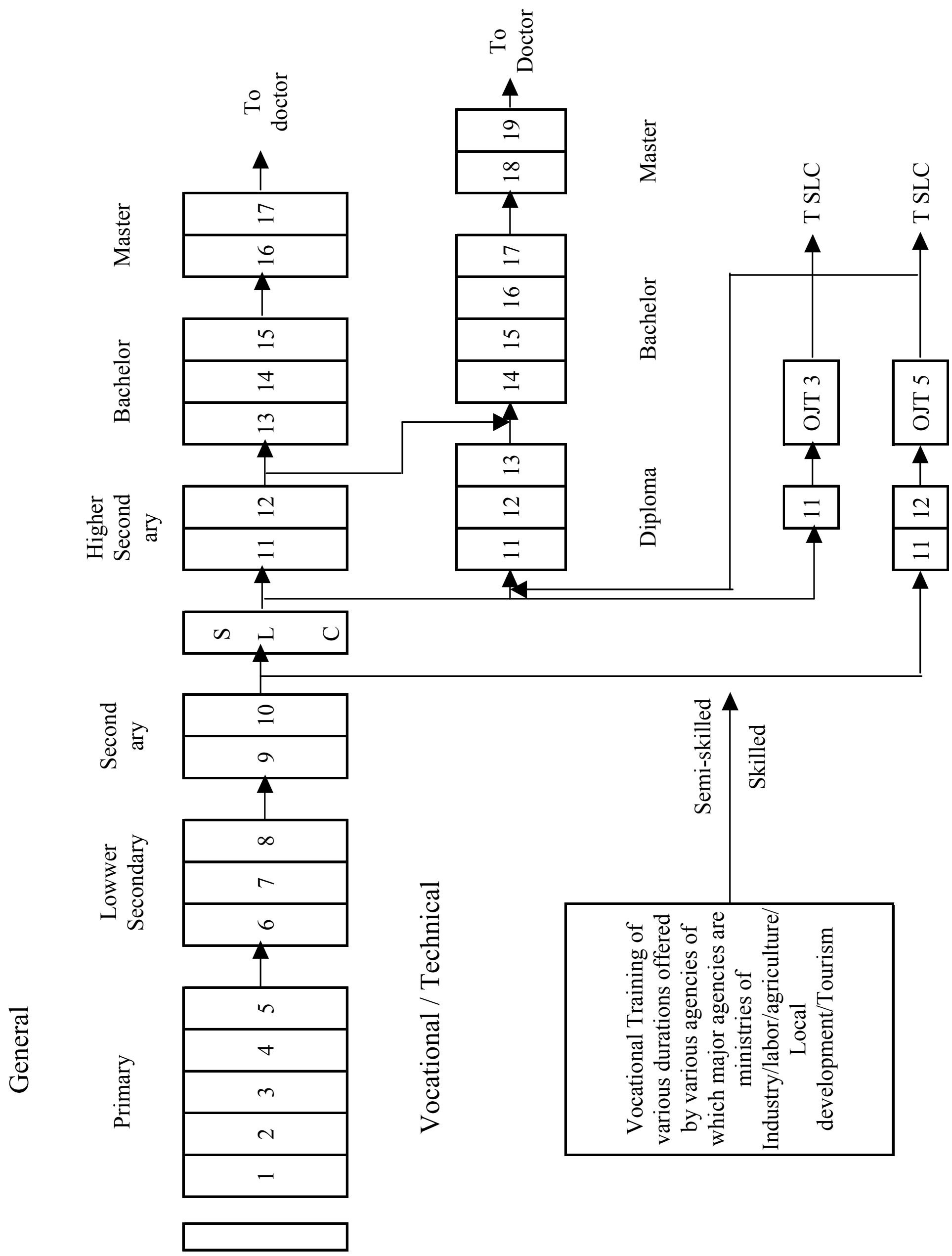


Figure 3.1: Educational System in Nepal

3.3.2 Engineering and Technical Education

3.3.2.1 Engineering and Technical Education in Nepal and Cambodia

History of engineering education in Nepal can be traced since 1942, when Technical Training School was established. The aim of the school was to produce skilled workers for development works. In 1959, Nepal Engineering Institute, with the assistance of the government of India, started offering civil overseer courses leading to Diploma in Civil Engineering. The Technical Training Institute established in 1965, with the assistance from the Government of Federal Republic of Germany, offered technician courses in General courses in General Mechanics, Auto Mechanics, Electrical Engineering and Mechanical Drafting.

In the year 1972, the Nepal Engineering Institute at Pulchowk and the Technical Training Institute at Thapathali were brought together under the umbrella of the Tribhuvan University to constitute the Institute of Engineering and the Nepal Engineering Institute and the Technical Training Institute were renamed as Pulchowk Campus and Thapathali Campus respectively. Since then, the Institute of Engineering has expanded considerably. The superintendent/ supervisor programs in Electrical, Electronics, Refrigeration/Air-conditioning Engineering were started in the Pulchowk Campus, with the assistance from UNDP/ILO.

The Architecture Technician program was started by the IOE in its own effort. With the assistance of the World Bank and UK, later, the existing technician level courses were strengthened and Bachelor's Degree level course in Civil Engineering was started. Similarly, with the assistance of the World Bank, the Swiss Government, and the Canadian Government, Bachelor Degree level courses in the Electronics, Electrical, Mechanical engineering and Arc. From academic year 1998/99 IOE has started Bachelor's Degree program in Computer Engineering.

In 1996 Pulchowk Campus, with support from the Norwegian Government, has started M.Sc. Courses in Urban Planning, Structural Engineering, Environmental Engineering and Water Resources Engineering. hitecture were started in the Pulchowk Campus. Pulchowk Campus has also started M.Sc. courses in Renewable energy and Geothermal Engineering, Information and communication and Power systems Engineering effective from December, 2001 (Institute of engineering, Pulchowk Campus, 2004).

Technical education and vocational training is targeted to students with some years of secondary education to produce the skilled labors and technicians. There are five universities under which 81 constituent campuses and 232 affiliated (private) campuses/colleges are engaged in higher education in Nepal. The tertiary students in science, math and engineering (percentage of all tertiary students, 1994-1997) were only 14 percent (CBS 2003). Similarly, technical education in Cambodia can be traced since 1963 with the establishment of the 'Institut Technique Superieur de l'Amitie Khmero-Sovietique (ITSAKS) which was supported by the co-operation of the former Soviet Union until 1975. The cooperation was resumed from 1980 and lasted until 1991 when the USSR abruptly ended its involvement in the functioning of the institute. Later, the UNDP in association with UNESCO provided support until 1994 enabling the institute to continue to deliver technical education in Russian.

In the mean time, the Royal Government of Cambodia and the French government decided in 1993 to allow the former ITSAKS to retain its role in tertiary education and to place the newly named 'Institut de Technologie du Cambodge' (Institute of Technology of Cambodia ; ITC) at the forefront of the country's industrial development. Since then, the 'Agence Universitaire de la Francophone' (AUF) has been supporting the ITC to make enable it to deliver technical education in Cambodia (Institute of Technology of Cambodia, 2004).

3.3.2.2 The Civil Engineering Education

Although engineering education started since 1942 in Nepal, civil engineers were started to produce domestically since 1984 only. The engineering course was designed for 4 years which is still prevailing in engineering education except architectural engineering which requires 5 years of university education. However, engineering universities in Cambodia have been offering 5 years undergraduate university education. The students who have successfully completed 10 years of school education and 2 years of higher education in science or 2/3 years of technical education are eligible to sit for entrance examination upon success of which he/she can enter to engineering universities.

3.3.2.2.1Civil Engineering Curricula; Department store type

Umbrella University— (numbers of campuses/colleges under a university) concept is still prevailing in the higher education in Nepal. In this system one or many colleges and campuses are accredited under the single university. The umbrella university controls the activities of the accredited campuses/colleges. This system has been in practice for all higher education: humanities and social science, agriculture, forestry, engineering and medicine. There are three universities: i) Tribhuvan university, ii) Pokhara university, and iii) Eastern university currently delivering the civil engineering education in Nepal. Six campuses/colleges under the Tribhuvan University, four colleges under Pokhara University and three collages under the Eastern University are permitted to deliver the civil engineering education in different parts of the country (TU, MoE-2004). Although the construction industry needs skilled workforce in diversified field and universities is the main provider of highly skilled human resources, the curricula of all subjects under a university are the same irrespective of the expertise of the faculties, location of the colleges and local industrial needs. Moreover, the new universities are also following the same curricula of the old university because of the easiness to get permitted from the concerned authority, and easiness to find faculties. Thus, universities in Nepal are delivering “department store” type education offering similar disciplines with similar content rather than concentrating on selected areas in which they have competitive advantage and promote the growth of the local industry. Nepalese and Cambodian universities do not have close linkage with industry especially with the construction industry, and there are no mechanism for systematic feedback from the industry to indicate the kind of knowledge that should be taught and the skills that should be gained from university education. As a result, the university curriculum does not reflect the needs of industry, and graduates are not well prepared to perform their jobs without further training. However, the industry does not provide any further training to improve the skill of the graduates. This resulted the productivity of the graduates far from the expectation, and often created low employability of the new graduates. The common engineering fields incorporated in the civil engineering are structural, geo-technical, transportation, building, water resources and environmental engineering. However, environmental engineering in Cambodia and building engineering in Bangladesh were not incorporated in the civil engineering curricula. The professional practice area which includes construction and project management, economics, professional ethics, engineers’ mission and so forth has not been considered as an important knowledge area of the civil engineering in these countries. For instance, the Nepalese and Cambodian construction industry are suffering from the delay, cost overrun and poor quality of

Table 3.5: Curriculum distribution in the Civil engineering

S.N.	Course	Taiwan	Cambodia	Bangaladesh	Nepal
1	Science and Mathematics	20	18	16	15
2	Humanities	19	16	5	3
3	Basic Engineering	23	21	30	31
4	Professional Practice area	3	9	3	6
5	Structural Engineering	6	19	13	11
6	Environmental Engineering	4	--	5	3
7	Geotechnical Engineering	4	2	5	5
8	Transportation Engineering	4	6	5	5
9	Water Resource Engineering	2	1	8	9
10	Information Technology	--	3	--	2
11	Building / Architecture	2	5	--	2
12	Project work/Thesis/Electives	13	internship	10	8

works, however, the knowledge area related to the time, cost and quality management are not appropriately incorporated in the civil engineering curricula. The % distribution of curricula for the undergraduate in the civil engineering in Taiwan, Cambodia, Bangladesh and Nepal are shown in the Table 3.5.

The civil engineering curricula in Nepal, Cambodia and Bangladesh are mainly concentrated on elemental design of infrastructure. The civil engineering courses contain mostly analysis and design of elemental structures. Universities in Nepal and Cambodia have been following the same curricula without updating for at least 10 years. However, regarding the pace of change the National Academy of Engineering in 'The Engineer of 2020' pp 24 noted the following:

> *'Scientific and engineering knowledge doubles every 10 years (Wright, 1999). The comfortable notion that a person learns all that he or she needs to know in a four-year engineering program just is not true and never was. Not even the "fundamentals" are fixed, as new technologies enter the engineer's toolkit. Engineers are going to have to accept responsibility for their own continual reeducation, and engineering schools are going to have to prepare engineers to do so by teaching them how to learn. Engineering schools should also consider organizational structures that will allow continuous programmatic adoption to satisfy the professional needs of the engineering workforce that are changing at an increasing rate. Meeting the demands of the rapidly changing workforce calls for reconsideration of standards for faculty qualifications, appointments, and expectations.'*

In contrast to the perception of the National Academy of Engineering regarding the effects of technological change in engineering education, universities in Nepal and Cambodia even could not incorporate domestic industrial needs and development in education. The curricula are usually adopted and updated with the help of the donor who is supporting/financing the universities/program. Local industry professionals are neither invited to participate in curricula development nor requested to feed the needs and development of the industries in to education. Thus, engineering education in Nepal and Cambodia still remains far from the industry. Consequently the engineering graduates could not make the industry progressive and healthy.

3.3.2.2.2 Construction Management Education in the Civil engineering

Construction management is the integration of "Mission & Policy" with the technological development and engineering in a practical and effective way (Kusayanagi, S. 2004). Mission and policy here indicates why and what to construct, and technological development and engineering deals with how to construct a facility. Construction management thus integrates why, what and how regarding the social and economic infrastructure development.

Thus it becomes essential to have construction and project management education in the civil engineering in developing as well as developed countries in order to deliver the projects efficiently. The developed countries may introduce such education in various faculties with different names. However, the construction industry of least developed countries Nepal and Cambodia which deploy almost 90 percent of the total engineers with one-degree graduates, needs to integrate the construction and project management education in to the undergraduate civil engineering education.

This would provide the graduates opportunities to acquire the knowledge and skills of construction and project management with the application of the civil engineering technologies during the single university education. Construction and project management education in the civil engineering education will enable the construction industry to have all the field engineers with hands on knowledge and skills required for efficient delivery of the projects. However, as seen in the course distribution in the civil engineering in some least developed countries, the professional practice area which includes construction management occupies less coverage in the whole curricula. The universities still could not realize the importance of the construction management in engineering. This is mainly because of no involvement of faculties in the construction and project management, and professional practitioners in education.

3.4 The Civil Engineers in Nepal and Cambodia

The production of the civil engineers in Nepal was started from 1984, and the annual enrolment capacities the civil engineering universities have reached to 813 in the bachelor’s degree and 104 in the master’s degree as shown in the Table 3.6 and Table 3.7.

Table 3.6: Enrollment Capacity the universities in the Bachelor's degree of the Civil Engineering in Nepal (as of 2003)

Tribhuvan University, Institue of Engineering		Pokhara University		Eastern University	
Campus / College	Enrollment Capacity	Campus / College	Enrollment Capacity	Campus / College	Enrollment Capacity
1) Pulchowk Campus	140	7) Nepal Engineering College	48	11) ACME engineering College	60
2) Western Capmus	48	8) Lumbini Engineering College	48	12) Khwopa Engineering College	60
3) Eastern Campus	24	9) Pokhara Engineering College	48	13) Eastern Engineering College	60
4) Kantipur Engineering College	88	10) Nepal College of IT	48		
5) Kathmandu Engineering College	88				
6) Advanced Colege of Engineering and Management	53				
Total	441		192		180

Table 3.7: Enrollment Capacity the universities in the master's degree in the Civil Engineering in Nepal (as of 2003)

Tribhuvan University, Institue of Engineering		Pokhara University, Nepal Engineering College	
Field of Study	Enrollment Capacity	Field of Study	Enrollment Capacity
Urban Planning	16	Construction Management	30
Structural Engineering	16		
Environmental Engineering	16		
Water Resources Engineering	20		
Geo-technical Engineering	16		
Total	84		30

There are 13 engineering institutions involved in the civil engineering education. There are separate institutions for the technicians. The production capacities of technical institutes were 702 civil superintendents/ supervisors, and total 1065 civil, mechanical and electrical skilled labors annually (source: IOE, CTEVT, Nepal).

Although the domestic production of the civil engineers in Nepal was started from 1984, many engineers graduated from India, Bangladesh, Russia, and Pakistan, and other foreigners have been working in Nepal. The total number of the civil engineers working in Nepal since 1955 can be traced from the registration at the Nepal Engineering Council (NEC). According to NEC, there were 2,758 civil engineers registered until 2003. The cumulative growth of the civil engineers in Nepal is shown in the Figure 3.2.

Similarly, Cambodia also started to produce the civil engineer from the year 1985. Although there is no mandatory registration system for the civil engineer in Cambodia, the total number of the civil engineers was estimated after discussion with the faculties from the Cambodian universities and the

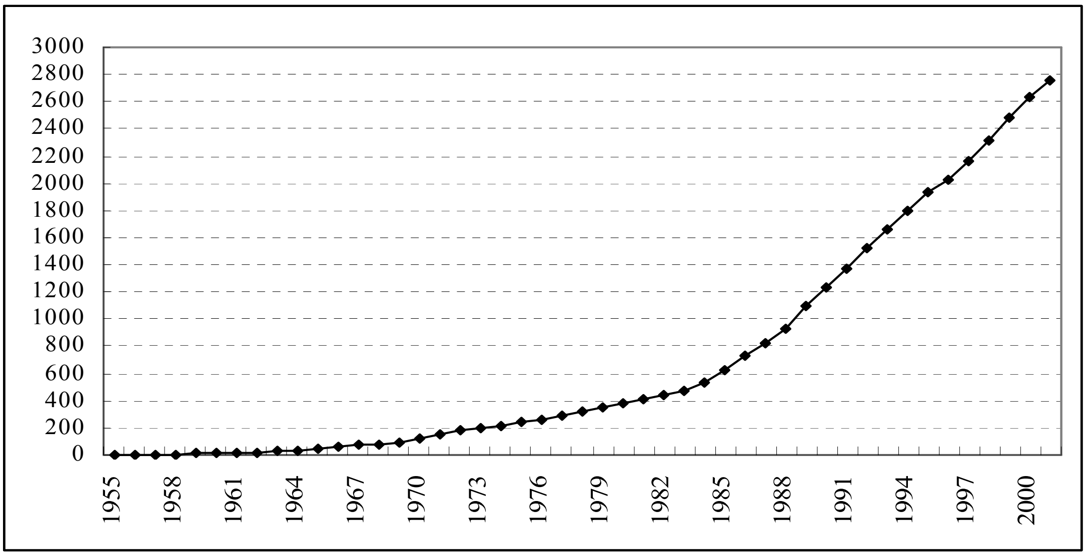


Figure 3.2: Total number of civil engineers working in Nepal (based on registration in the Nepal Engineering Council 2003)

practitioners. The assumptions made for the estimate are as below.

i) The institute of technology of Cambodia started to produce 30 civil engineers every year until 1997.

ii) There were equal number of people went abroad for study until 1997.

iii) In the 1998 ITC produced only 10 engineers.

iv) From 1999 ITC started to produce 15 engineers every year

v) From 1998, only 10 people were going abroad for study

vi) Private university started to produce from 2000 (in 2000—60 engineers, 2001—260 engineers, 2002—260 engineers, and from 2003– 300 engineers)

Based on the above assumption, there were about 1800 civil engineers working in Cambodia in the Year 2003. The assumed cumulative growth of the civil engineers is shown in the **Figure 3.3**.

3.5 Quality of Education

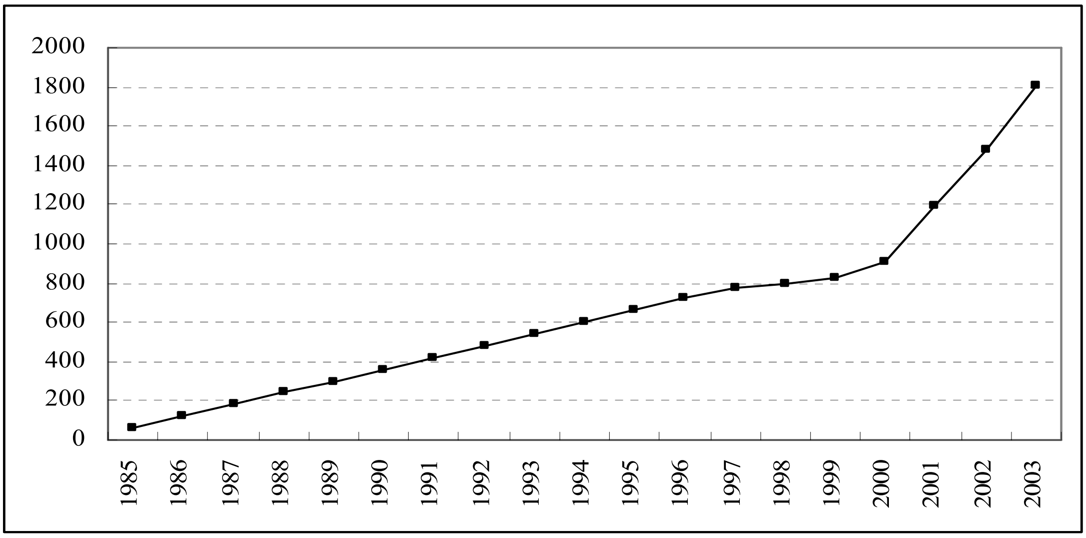


Figure 3.3: Total number of civil engineers in Cambodia (based on production; drawn from discussion with Cambodian faculties and engineers)

The faculty is the heart of any education program (Civil Engineering Body of Knowledge ASCE). However, the trained teaching staff are scarce in Nepal. The ratios of trained and untrained teachers as of 2002 are as follows;

	Trained teaching staff.	Untrained teaching staff
Primary education	47 %	53%
Lower secondary of education	36 %	64%
Secondary level of education	47%	53%

The pass rates of students from the grade 10 of school education (school leaving certificate examination) in Nepal have varied from 33 percent to 45 percent in different years (CBS 2003). The quality of higher secondary education is further unenvied, for instance the graduation rates in 2003 from grade 11 was 34.5 percent and grade 12 of the same year was 39.7 percent.

It was found that almost fifty percent of the faculties in the typical civil engineering universities are still undergraduate persons who had never gone for any advance training and education. Further, faculties of the civil engineering have limited experiences in professional practice. For instance, out of 15 faculty members from a typical civil engineering college from Nepal, only 5 faculties had professional experience. The average years of experience was only 3.5 years (Kantipur Engineering College, Lalitpur, Nepal). Further, their professional experience usually related to the design of elemental infrastructure like structural design of building, bridges, survey, and etc. They do not have opportunities to practice in the whole project cycle: planning, feasibility, design, procurement, execution and operation& maintenance. This is one of the reasons why the civil engineering curricula in these countries still concentrated on elemental design of infrastructure.

Quality of higher education system is the most challenging issue in the developing countries like Nepal and Cambodia. The author visited universities in Nepal and Cambodia for knowing real situation of the quality of engineering education in those countries in November 2004. Universities in these countries tend to focus on teaching students subject matter content ('know-what' knowledge) rather than teaching or coaching them on how to apply or utilize knowledge ('know-how' knowledge). Theoretical knowledge imparting is the domain of education system of many developing countries including Nepal and Cambodia.

The universities provide lecture rooms where faculties deliver lectures and laboratories, and students fulfill the course requirements by testing the fundamentals. However, not all the lecturers/professors do have their own space/rooms in universities. They used to come for lectures only. No research laboratory has been established and regular journals are not available in the universities. It is far from expectation that students be provided extra space and facilities other than the classrooms and library. Usually, the students come to the universities to attend lectures only. Lack of appropriate teaching and learning materials and qualified teachers 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 semester/year is the only measure of competency of the students. The students are encouraged to remember the lecture notes and to read the textbooks referred by the teachers in order to prepare for the exams. 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 for the societal problems, and could not make graduates creative and adequately prepared for the construction industry. The education system has made the students exam-oriented striving for academic certificates by passing the examinations rather than searching and acquiring knowledge and skills. These are real situations of engineering education in the developing countries. When ODA program is planned, it must be well recognized by both recipient and donor countries.

3.6 Investment on Education

Universities in the least developed countries are usually run through the money given by the governments. The tuition fees collected from the student do not cover the expenses for the educational materials. There is also a pressure from society not to increase the tuition fees. Further, the governments of the least developed countries like Nepal, Cambodia and other Asian and African countries have not emphasized to improve the quality of higher education. In contrast to other middle-income developing countries, these countries have been expended a little money for education. Further, the governments of the developing countries as well as donor agencies have been emphasized on basic primary education in the name of poverty reduction. However, the governments and donor agencies have not realized that the necessity of the quality higher education is equally important to develop appropriate resource persons, teaching materials, and educational infrastructures. A typical expenditure on different levels of education in Nepal is shown below.

Table 3.8: Government's Expenditure on Education on Fiscal Year 2002-03 in Nepal

Types of Education	Expenditure in '000 NRs.	Percentage of total expenditure*
Primary	7,841,007	59.0 %
Secondary	3,003,128	22.6 %
Higher	1,445,590	10.9 %
Technical	113,296	0.9 %
Educational Development	140,153	1.1 %
Monitoring	743,432	5.6 %
Total	13,286,606	

* Total may not add up to 100 because of rounding.

Table 3.9: Expenditure on Education in developing countries

Expenditure on Education (% of GNP)								
Country	1970	1980	1990	1995	1998/99	1999/00	2000/01	2001/02
Malaysia****	4.2	6	5.5	-	5.1	6.1	6.8	8.5
Thailand***	3.2	3.4	3.6	4.1	5.2	5.9	5.3	-
Mongolia**	-	-	12.9	6	-	-	6.6	-
Nepal*	0.6	1.8	2	3.2	2.8	2.9	3.6	3.3
Cambodia*	5.8	-	-	-	1.4	1.1	1.9	2.1
Botswana****	4.7	6	6.9	8.6	-	-	-	-
Namibia***	-	-	7.4	8.4	7.9	7.7	-	-
Kenya**	5	6.8	7.1	6.8	6.7	6.9	6.3	-
Benin*	-	-	-	3.2	2.5	2.5	3.1	3.3
Niger*	1.1	3.1	-	-	-	2.1	2.8	2.4
Mali*	-	3.7	-	2.2	3	2.9	-	-

*: Least developed countries, **: Low-income countries,***:Lower middle income countries, ****: Upper middle income countries (DAC classification)
- : not available
Source: UNESCO

From the Table 3.8 it is clearly seen that government did not put much attention to higher and technical education in Nepal. The governments' expenditures on education in some developing countries as seen in Table 3.9 revealed that the least developed countries Nepal, Cambodia, Benin, Niger and Mali spent much lower portion of their gross national product (GNP) than the other lower/middle-income developing countries did.

The government's allocation for the education is hardly sufficient for the incentive to teachers. There is no evident contribution from the industry in supporting universities and in improving the quality of education. There is no any linking medium to work the universities and industry together. Universities are striving for financial and technical assistances to improve the quality of education and to activate research functions.

3.7 Human Resources Deployment System

For the purpose of planning, design, construction, operation and management of the civil infrastructure, public and private clients, and companies require the services of a large number of the civil engineers. The importance of the civil engineers, therefore, is more pronounced in the development stage of a country. Human resources deployment system greatly affects the proper utilization of the human ability and creativity. A developing country should have appropriate system for the deployment of the civil engineering human resources in order to develop infrastructure efficiently.

In Nepal, public enterprises are authorized to create staff positions and to recruit competent personnel. They are required to follow the general principles prescribed by the Public Service Commission, a constitutional body authorized to recruit civil servants in the government offices. The commission prescribes necessary qualifications for various categories of staff of the public enterprises. Officer level cadre and junior staff are recruited as university graduates and high school graduates respectively on the open market. Recruitment is conducted through advertisement of vacancies, invitation of applications and testing applicants as part of the selection process. Senior posts are filled by promotion from within the enterprises.

Generally, there is no free movement of staff from one public enterprise to another. Terms and conditions of service as well as the facilities vary from enterprise to enterprise. At present, there is no central agency to train the staff of all public enterprises; it is the obligation of each enterprise to train its own staff. Some enterprises have developed their regular training programs and some organize their training programs as and when it is felt necessary.

Nepal Administration Staff College and Banker's Training Centre also frequently organize training programs for the personnel of public enterprise on different aspects of management. Such training is of the following types:

- Pre-service training.
- In-service training.
- On-the-job training.
- Workshops and seminars.
- Long term professional training (domestic and foreign).

It is assumed that the technical staffs possess their skill and knowledge imparted in school and university before they enter the service of the public as well as private enterprises. However, administrative staffs possess general academic qualifications (Asian Organization of Supreme Audit Institutions (ASOSAI).

In contrast to the administrative staffs, the technical people are directly sent to the project implementation offices without training to execute the projects. The Construction industry Training Center (CITC) established in 1999 could not attract the attention of the governments and contractors. Government and the construction industry could not establish specific training programs for the construction engineers in order to develop construction and project management skills. The situation is also similar in Cambodia. The efficiency of the new engineers is solely depending on their own abilities and cooperation obtained from the team members. The engineers thus only have option to learn from the traditional practice of the industry alone.

Governments and the construction industry want and assume the civil engineers to have theoretical as well as practical and managerial skills from university education. On the basis of this perception a newly employed engineer can even enjoy larger responsibility. The employers do not spend further resources in human resources development. However, the civil engineering universities continue to impart theoretical knowledge on elemental structure without offering enough opportunity to acquire the practical and managerial skills. This makes a result low productivity of the civil engineer because he/she does not have enough practical and managerial knowledge and skills from the university education to efficiently deliver his/her responsibility. Thus it can be inferred that the performance of the Nepalese and Cambodian construction industry has not improved because of the ineffective civil engineering education system which could not provide opportunities to acquire hands on knowledge and skills in the concerned knowledge areas especially in the professional practice area including construction and project management.

3.8 Conclusions

The quality of faculties regarding the qualification and experience, and teaching and learning environment is responsible for the low skills of the engineers/technicians at the field level. However, the lack of training for the practitioners resulted to not qualifying performance of the senior engineers. There is a need to reform the existing curriculum of the civil engineering and teaching pedagogy to make learning experience gained at university more relevant to society's/industry's expectation.

The civil engineering curricula should be revised to improve the balance between practice and theory, and incorporate contemporary technological development in the concerned areas. Research facilities should be developed in order to deliver research-oriented education. Extensive and varied form of University-Industry collaboration and cooperation should be forwarded to make effective and efficient university education to make the education more relevant to the needs of industry and to make graduates to be more productive in the labor market.

Exchange of human resources and transfer of technology through Universities collaboration between the local (the Nepalese or Cambodian) and the universities from the developed world would enable local universities to able to absorb the modern technology.

Chapter 4

4. Official Development Assistance (ODA) and Donor Countries

4.1 History of ODA

The historical beginnings of official development assistance were the development activities of the colonial powers in their overseas territories, the institutions and programs for economic co-operation created under United Nations auspices after the Second World War.

In 1950, the Commonwealth initiated the Colombo Plan ("Council for Technical Co-operation in South and South-East Asia") with 7 founding member: Australia, Canada, New Zealand and the UK as donors. The US and Japan joined the plan in 1951 and 1954 respectively. In 1955, Japan started World War II reparation projects in Myanmar (Burma), the Philippines, Indonesia, Laos and Viet Nam.

Development assistance group (DAG) was formed in 1960 as a forum for consultations among aid donors on assistances to less-developed countries. Further, the organization for European Economic Co-operation (OEEC) established in 1948 was reconstituted as Organization for Economic Co-operation and Development (OECD) in December 1960.

Many countries started to establish their aid cooperation agencies in 1961 like Kuwait fund for Arab Economic development, USAID, Japan Overseas Economic Cooperation fund, SIDA and so on. However Official Development Assistance (ODA) concept was adopted by Development Assistance Committee (DAC) established in 1961 in 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". In other words, ODA consists of flows to developing countries and multilateral institutions provided by official agencies, including state and local governments, or by their executive agencies, each transaction of which meets the following test (Führer, H. 1996):

a) it is administered with the promotion of the economic development and welfare of developing countries as its main objective, and
b) it is concessional in character and contains a grant element of at least 25 per cent (calculated at a rate of discount of 10 per cent).

There are 23 members in the DAC. These are Australia, Austria, Belgium, Canada, Denmark, Finland, France, Germany, Greece, Ireland, Italy, Japan, Luxembourg, Netherlands, New Zealand, Norway, Portugal, Spain, Sweden, Switzerland, United Kingdom, United States and Commission of the European Communities (OECD).

ODA since its adoption has become a major resource for socio-economic development of developing countries. Different donors have been involved in different areas of socio-economic development in developing countries. Among others the USA and Japan are the largest donors among the DAC members.

As discussed later, this paper is focused on Japan's ODA, as it occupies the largest amount of assistances in the countries which were taken as representatives of the least developed countries in this study. The ODA amounts from the main members of the DAC are shown in the **Figure 4.1.**

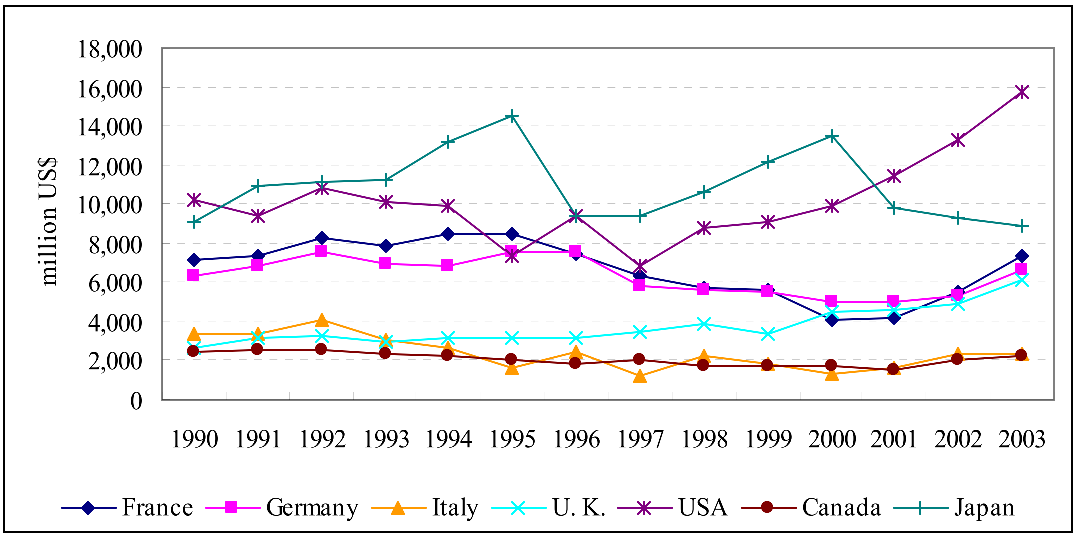


Figure 4.1: Amount of ODA from the main DAC members

4.2 Types of ODA

There are two types of ODA in practice in order to support the developing countries. These two types are i) Multilateral ODA, and ii) Bilateral ODA

4.2.1 Multilateral ODA

Multilateral institutions involved in development assistance can be broadly divided into two categories. The first group consists of international financial institutions that primarily provide funds needed for development, while the second group consists of various United Nations agencies which engage in economic, social and humanitarian activities (JBIC; Japan Bank for International

Cooperation). Multilateral ODA is the financial as well as technical assistances availed by the international institutions like

i) the UN Agencies, Funds and Commissions: United Nation Development Program (UNDP), United Nation Capital Development Fund (UNCDF), Food and Agriculture Organization (FAO), etc.,
ii) European Commission: European Commission – Budget: Development (EC), European Development Fund (EDF), etc.,
iii) International Monetary Fund, World Bank And World Trade Organisation: International Monetary Fund (IMF), International Bank for Reconstruction and Development (IBRD), International Development Association (IDA), World Trade Organisation - International Trade Centre (WTO – ITC)
iv) Regional Development Banks: Asian Development Bank (AsDB), African Development Bank (AfDB), etc.
v) Other Multilateral Institutions: ASEAN Association of South East Asian Nations: Economic Co-operation, IUCN International Union for the Conservation of Nature and Natural Resources (World Conservation Union)

4.2.2 Bilateral ODA

Bilateral ODA is the development assistances provided by one country to another country through their mutual relationship. A developing country can also provide the bilateral aid to other developing countries. However, the bilateral ODA from the developed country like Japan, to the developing countries considered in this study is the highest, and therefore, Japan's ODA is discussed here.

4.3 Japan's ODA

4.3.1 Classification of Japan's ODA

Japan's official development assistance (ODA) is classified into three types such as Bilateral grants, Bilateral loans, and Financial Subscriptions and Contributions to international organizations.

4.3.1.1 Bilateral Grant

Bilateral grants include technical cooperation that transfers technology to developing countries and grant aid that provides funds with no obligation for repayment.

i) Grant Aid:

Japan provides grant aid mainly to countries that have a relatively low income among the developing countries. Grant aid is primarily channeled to support basic human needs (BHN) (such as medical services, public health, water supply, and rural and agricultural development) and human resources development. In addition, Japan provided grants aid to carry out infrastructure projects, such as roads, bridges, and telecommunications. The Ministry of Foreign Affairs implements Grant aid, with the assistance of the Japan International Cooperation Agency (JICA)

ii) Technical Cooperation:

Technical cooperation is targeted toward development of the human resources necessary for the economic progress of developing countries. It includes:

(1) Dispatch of experts

(2) Acceptance of trainees

(3) Provision of equipment and materials to facilitate technology transfer

(4) Project-type technical cooperation incorporating dispatch of experts, acceptance of trainees and provision of equipment and materials

(5) Dispatch of the Japan Overseas Cooperation Volunteers (JOCV).

The fields covered by Japan's technical cooperation range widely from basic human needs (BHN), such as public health and medical services, to computer science and other areas of advanced technology. JICA is responsible for most of Japan's technical cooperation activities.

4.3.1.2 Bilateral Loan

Bilateral loans are the loans that provide the funds needed for development under long-term and low interest conditions. These loans provide funds to develop and improve the economic and social infrastructure necessary to support self-help efforts and sustainable economic development for developing countries. JBIC: Japan Bank for International Cooperation handles the major part of Japan’s ODA loans.

4.3.1.3 Financial subscriptions and contributions to international organizations

Subscriptions and contributions for multilateral aid are indirect methods of extending aid by channeling funds through international organizations. Japan provides considerable amount to the some multilateral agencies listed 4.2.1 in order to support the developing countries through the agencies.

4.3.2 Activities under Japan’s ODA

Japan’s ODA to the least developed countries (LDCs) contains considerable amount of grants aid inclusive of technical cooperation as shown in Figure 4.2 (JBIC, Kokusai Kyouryoku Binran, 2004). 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 in developing countries. Still considerable numbers of hard infrastructure development projects are being carried out under the grant aid as seen in the Figure 4.3 and Figure 4.4.

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 resources development scholarship (Japan's ODA: Annual report 1999, White paper 2002).

4.3.2.1 Infrastructure Development under Japan's ODA

4.3.2.1.1 Project Preparation

Since Japan's ODA requires the developing countries should request the cooperation agencies formally to get the grant aids. It implies that a developing country should have to identify and make the project proposal in order to receive the grant aids for infrastructure development projects. A typical project preparation procedure for the domestic financing and international assistance in Nepal is discussed below.

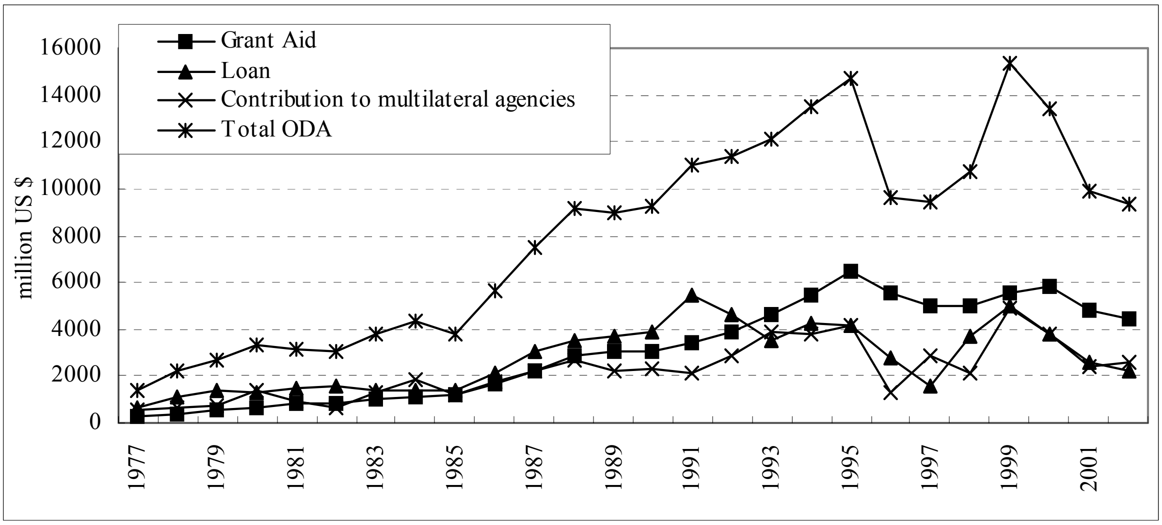


Figure 4.2: Japan's ODA (1977-2002)

Small-scale infrastructure development projects like small irrigation, rural water supply and village access roads are financed from the internal revenue where as foreign assistances are the only resources for most of the medium and all large-scale infrastructure development projects in Nepal. The field level executing agencies identify and collect basic data for all infrastructure development projects. The field level executing agencies design and prepare estimate, and request the implementing agency's (the sectoral ministry) approval for implementation. The sectoral ministries request the finance ministry to allocate the necessary budget.

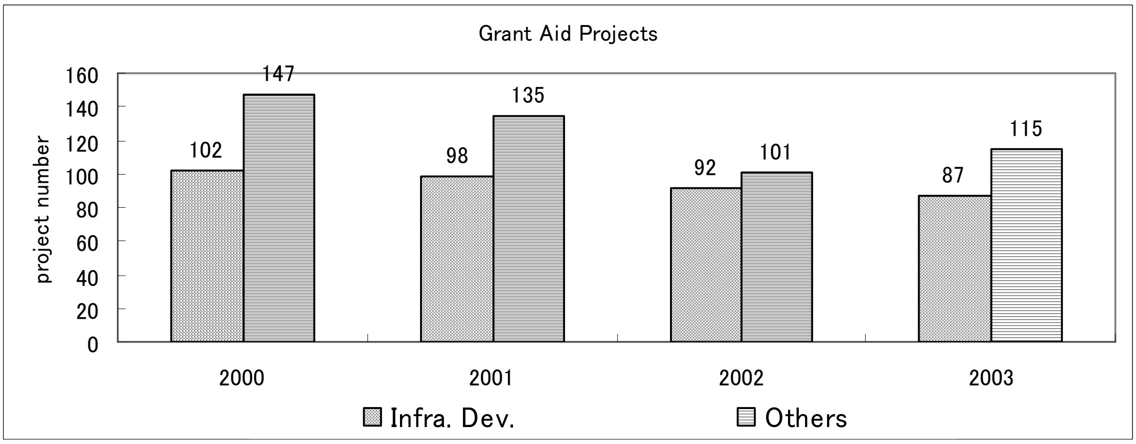


Figure 4.3: Grant Aid projects under Japan's ODA

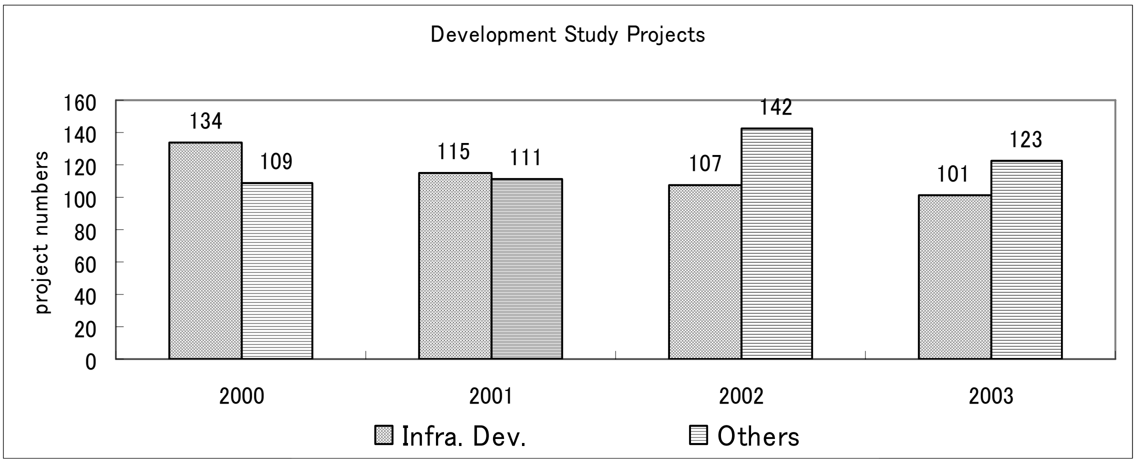


Figure 4.4: Development Study Projects under Japan's ODA

Table 4.1: Japan’s ODA to Nepal, 100 million Yen

	Infrastructure Development									Materials & Equipmen	Food aid & Aid for food	Debt Relief	Miscellaneous	GRANT Aid	LOAN	Technical Cooperation
	Roads	Bridges	Water supply	Buildings	Airports	Power	communication	River Trainin	INFRA Total							
1994		7.66	8.44	4.18	8.76	19.73			48.77	11.52	15	11.16	0.2	86.65		33.36
1995	0.75	4.75			23.71	0.77	0.46		30.44	6.43	9	11.1	0.46	57.43		23.5
1996	9.94				2.06	19.59	5.95		37.54	5.87	8.5	11.05	0.48	63.44	204	27.92
1997	18.49						12.69		31.18	6.19	14.37	10.92	0.16	62.82		23.43
1998	10.52							5.37	15.89		7	28.91	0.22	52.02		23.18
1999	16.71			8.27	12.72				37.7	0.37	9.9	19.59	0.36	67.92		19.34
2000	11.73			13.47					25.2	0.47	8.5	19.37	0.8	54.34	54.94	19.89
2001	26.1		10.44	17.1					53.64		7	19.13	1.44	81.21		18.4

Table 4.2: Japan’s ODA to Cambodia, 100 million Yen

	Infrastructure Development									Materials & Equipment	Food aid & Aid for food production	Health	Education /HRD	Miscellaneous	GRANT Aid	Loan	Technical Cooperation
	Roads	Bridges	Water supply	Buildings	Ports	Power	communication	River Training	INFRA Total								
1994	15.94	14.86	17.71	0	15.68	18.52	0		82.71	0.96	9	0	0	25.54	118.21		11.05
1995	0	0	0	17.61	14.71	0	17.03		49.35	1.34	11.5	0	0	2	64.19		14.86
1996	9.44	1.25	0.42	13.52	0	0	12.73		37.36	0.5	12	0	0	21.93	71.79	8.03	23.66
1997	8.03	10.3	8.8	0	0	0	0		27.13	0	10	0	0	4.71	41.84		27.08
1998	24.68	18.73	12.32	0	0	0.84	0	0	56.57	4.7	6.37	3.63	0	6.96	78.23		18.5
1999	4.09	22.26	0	8.03	0	12.35	0	6.22	52.95	4.42	7	0	0	21.66	86.03	41.42	23.31
2000	4.05	17.61	0.6	0	0	17.88	0	4.82	44.96	0.07	10	0	1.59	22.53	79.15		30.61
2001	16.12	8.51	7.36	0	0	3.6	0	0.66	36.25	0.38	10	3.08	3.11	24.01	76.83		43.06

Foreign assistances are sought for national priority project, medium and large-scale infrastructure development projects. Like the small-scale development projects, the field level executing agencies collects primary information of every medium to large-scale and all priority projects. Foreign assistances are sought not only for the construction but also for the feasibility study, preliminary and detail design of large and complex projects. The highest executing agencies in the hierarchy prepare the necessary design, estimate and proposal for simpler projects. However, consultants’ services are used for large and complex projects. The approval of the highest authority for project approval in the hierarchy (the National Planning Commission (NPC) in the case of Nepal) is necessary before submitting the project proposals to the donors. A typical request-approval procedure between a recipient country-Nepal and donor country-Japan for ODA projects is shown in Figure 4.5.

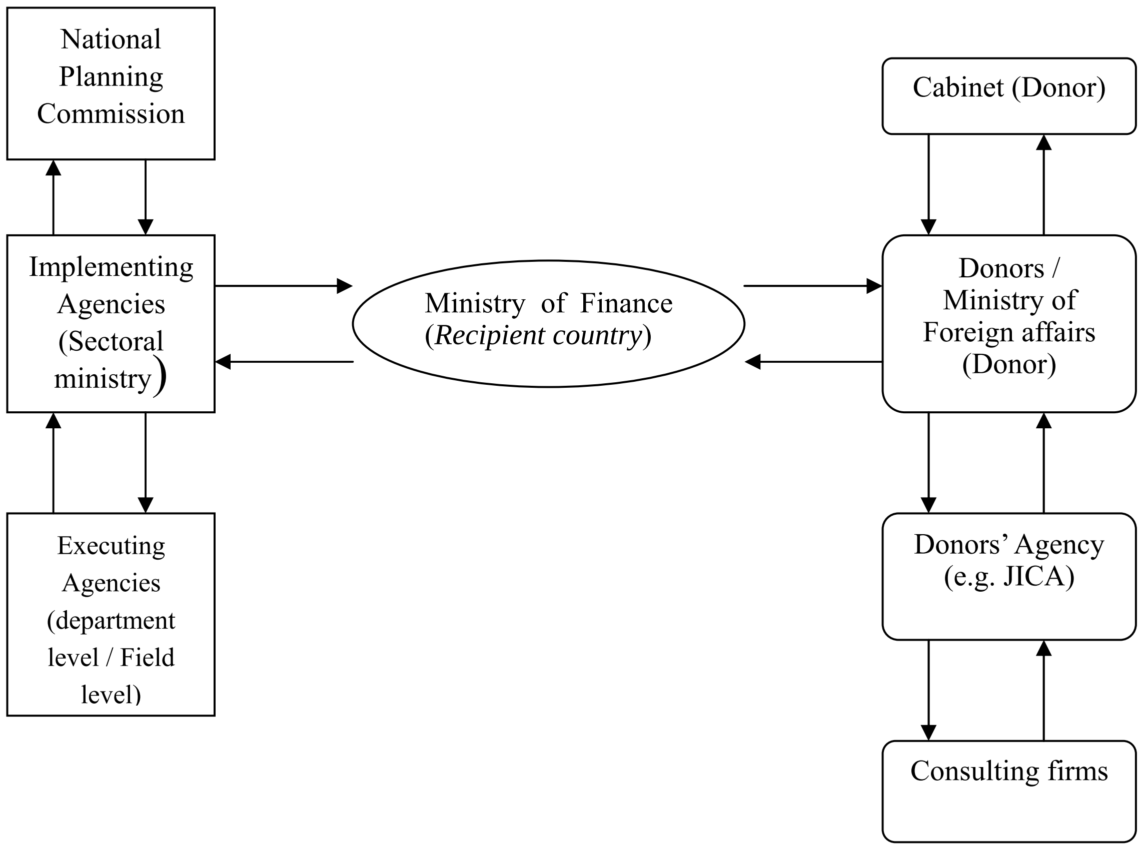


Figure 4.5: Request-Approval procedure for ODA project in Nepal

4.3.2.1.2 Japanese Bilateral Grant Aid project Implementation

Japan International Cooperation Agency (JICA) is responsible for the Japanese bilateral grant aid projects implementation. Once grant aid is approved to a recipient country, JICA selects consultants for detailed design, procurement and construction supervision of the project.

The guidelines for grant aid implementation dictate "the consultants and contractors for the execution of a grant aid project should be the Japanese origin" (source: JICA). Accordingly, the consultants selected for the project makes agreement with the client. The consultants prepare a complete set of construction document including detailed design, estimate, drawings and specifications.

The consultants on behalf of the client then procures constructor. Like in the consulting services, only the Japanese contractors can participate in the biding for the construction of the project under consideration. The consultants evaluate the proposals submitted by the contractors, and the client makes construction contract with the contractor recommended by the consultants.

Since the Japanese contractors only are allowed to bid the project, there are no enough opportunities for the local contractors to participate in the execution. The Japanese contractors mostly use their own human resources and technologies for the construction. The local contractors are limited to small petty works if offered by the main contractors. The main contractors usually offers petty works are like small earthwork, supply of labors, sands, etc.

4.3.2.1.3 Use of Local Resources in ODA Projects

Since the guidelines for the Japanese the grant aid for general projects and for fisheries allowed to use the services of the Japanese consultants and contractors for the implementation of the project, there is a little or no opportunities to deploy the local consultants and contractors. The author had chances while working for the ministry of physical planning and works, HMG Nepal, and during this study to interact with the Japanese consultants and contractors regarding the use of the local resources in ODA projects. It was found that the Japanese consultants and contractors hardly believe the ability and efficiency of other people. They prefer to deploy their own human resources and technologies even it is many times expensive than the local ones, however the local unskilled workers usually used for unskilled services. A counterpart engineer from the client's organization of the recipient country usually involves in the execution of the ODA projects.

The author with Prof. Kusayanagi had a chance to visit a water supply project in Kathmandu funded through the Japanese grant aid. It was surprising that when we found that even a small wooden stop-log for the treatment chamber of the project was brought from Japan. Now, one can easily imagine how the local resources are being deployed in the ODA projects, though the project will be ultimately handed over to the local authority and the operation and maintenance will have to do through the local resources.

4.3.2.2 Human Resources Development under Japan's ODA

The development of human resources is the basis for the development of a country. Assistance for human resources development is one of the major components of Japan's assistance. Japan's ODA for human resources development has envisaged that the assistance for the human resources development not only fosters human resources that directly contribute to nation-building, but also promotes mutual understanding through "person" to "person" exchanges and plays a major role in promoting bilateral relations through building human relationships between leaders from all sectors of society, including young people who are responsible for the future of developing countries (Japan's ODA white paper 2003).

The technical cooperation of the Japan's ODA is includes the human resources development. As stated earlier, the human resources development 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. Japan's supports for the human resources development in developing countries are significant as seen in Table 4.3 and Table 4.4.

Until 2002, 5,839 Cambodian and 3,109 Nepalese people had received training in different fields in Japan (JICA). The technical trainings offered in Japan cover Planning/Administration (development planning/administration), Public works/Utilities (public utilities, transport/traffic, social infrastructure, Communications/broadcasting), Agriculture/Forestry/Fisheries (Agriculture, animal industries, forestry, fisheries), Mining/Industry, Energy, Business/Trade (business/trade,

Table 4.3: JICA's Technical Cooperation to Cambodia, Expenditure in thousand Yen

Year	Trainees		Experts		Study Team		JOCV		Other Volunteers		Provision of Equipment	Total Cost (1000 yen)
	No.	Cost	No.	Cost	No.	Cost	No.	Cost	No.	Cost		
Total up to 2002	5839	4332420	822	8374193	1905	9414068	171	1643167	31	306892	2669150	26,739,890
2000	322	456935	180	1136622	205	1033224	39	162279			262180	3,051,240
2001	1784	526870	171	1497761	277	1582692	50	243940	15	96177	350830	4,298,270
2002	1944	541294	168	1553417	239	1127009	57	265425	30	210715	325130	4,022,990

Table 4.4: JICA's Technical Cooperation to Nepal, Expenditure in thousand Yen

Year	Trainees		Experts		Study Team		JOCV		Other Volunteers		Provision of Equipment	Total Cost (1000 yen)	% of Nepal's national budget
	No.	Cost	No.	Cost	No.	Cost	No.	Cost	No.	Cost	Cost		
Total up to 2002	3109	6,452,258	1278	13,411,863	2828	12,960,603	795	7,673,737	25	349,731	6,864,910	47,713,102	
2000	163	307,166	82	502,336	184	725,818	69	265,779	15	75,383	110,590	1,987,072	1.7
2001	138	255,926	67	541,647	135	555,531	50	254,747	12	99,925	129,250	1,837,026	1.4
2002	162	337,276	54	569,740	106	369,504	63	273,079	20	114,814	106,950	1,771,363	1.3

tourism), Health/medical care and Welfare.

4.3.2.2.1 Human Resources Development in Infrastructure Development Sector

The low-income developing countries are striving for the basic infrastructure like roads, water supply, sanitation, power, etc. and have poor quality of human resources for the development of appropriate facilities. In addition, basic infrastructures are the base of the economic development. Although the developing country Nepal and Cambodia has put more emphasis on infrastructure development, the participants from the infrastructure sector were not significant on the basis of the importance in the nation building.

The Table 4.5 shows that only 70 people from Cambodia and 119 from Nepal were trained in JICA training program in infrastructure sector in between 1994-2002 (JICA database) with as many as 42 from Cambodia (in between 1992 to 2002) in transport sector (ODA evaluation report, Ministry of Foreign Affairs, Japan, 2003). The training under the infrastructure sector included roads, bridges, river works, building and other related area like survey, mapping, etc.

Table 4.5: Number of participants in JICA training in Infra sector from Cambodia and Nepal

Year	Cambodia		Nepal	
	Number of Trainees (Infra. Sector)	Training Cost (1000 Yen)	Number of Trainees (Infra. Sector)	Training Cost (1000 Yen)
1994	5	6,347	12	29816
1995	4	10,469	17	46,671
1996	4	4,768	24	230,884
1997	13	32,702	11	30,314
1998	10	19,043	15	32,043
1999	12	12,911	12	31,368
2000	8	16,117	11	17,958
2001	5	5,877	7	11,933
2002	9	13,566	10	18,391
Total	70	121,800	119	449,378

4.3.2.2.2 A typical JICA Training in Infrastructure Development Sector

The training programs conducted in Japan are generic in nature i.e. a general course in which people from different countries with different background can participate. Although, the trainees will have opportunities to experience modern, advanced technology and affluent infrastructure during the training, these programs are usually not designed to address the specific needs of a country.

The typical training programs in infrastructure development sector are being conducted under the titles:

i) Construction management in civil works with mechanization
ii) Infrastructure development and planning (OSIC 2005)
iii) Practical application of construction technology (YIC).

The author had also opportunity to participate in the JICA group training course in 2002 in Tokyo. The training was on “Practical Applications of the Construction Technologies” for about 2 months. The participants (trainees) were from Brazil, Bolivia, China, Kenya, Malaysia, Nepal, Pakistan, Peru and Viet Nam. The author was from the Ministry of Physical Planning and Works (the then ministry of construction), His Majesty’s Government of Nepal. The courses were well designed to let the trainees to visualize the modern technologies used in the Japanese construction industry however little attention was paid to the relevancy o the technology in the environments of the developing countries like Nepal. There was a good observation tour in the various construction sites in different parts of Japan. The road, bridge, tunnel, building, dam, forestation and others construction sites were visited during the field trip.

The technologies were mostly related to the automation and mechanization, but the construction industry of many developing countries including Nepal is still labor intensive. In such circumstances, the applicability of the modern advanced and automated technology in the developing countries like Nepal and Cambodia is insignificant.

The course had also incorporated practices in the construction management in the international market and in Japan as well. This construction management course had included the management technology that could be applied in the developing countries too. Such course can broaden the construction management knowledge areas which are required in the developing countries in order to improve the quality in infrastructure development.

The Nepalese and Cambodian construction industry is a need of the appropriate technologies (not the advanced automated) which could integrate the human labor and machine effectively for design, material production, construction and construction management. These countries need technology that could produce quality construction materials locally; they need the construction technology that could integrate the skills of poorly educated labors; they need the system technology to manage in multicultural environments and so forth. Thus, in order to increase the effectiveness of the ODA in terms of technology transfer and human resources development, it is required to train the human resources in the knowledge areas and technology as per the local needs, and use the appropriate technology as maximum as possible.

4.3.3 Issues and Problems in Infrastructure and Human Resources Development under Japan’s ODA

4.3.3.1 Insulated Execution System

Although the yen loan is untied in principle, the execution of the projects under the loan is usually done through the international competitive bidding. It is natural that the local construction industry in many developing countries including Nepal and Cambodia does not have sufficient capital, technology, experience and human resources in order to compete with foreign firms. Thus the local construction industry often does not have access to the foreign assisted projects.

Similarly, large foreign-based firms typically dominate the Sub-Saharan African construction industry. There are often a few medium size firms, some of which may be purely local firms, and others are based in neighboring countries such as South Africa, Zimbabwe and Kenya in the case of Southern Africa. A large number of local contractors do not have enough market access because of partly due to the contracting process: frequency, size, condition imposed by employer/owner. The difficulties of the local firms are further exacerbated by

i) limited access to construction equipment,
ii) limited access to capital and credit facilities, and
iii) lack of business training and shortage of technical and managerial skills (Brushett, S. et al 2005).

Moreover, the grant aid projects are insulated in practice as well as in principle. The execution of the projects under the grant aid is solely responsibility of the Japanese consultants and contractors. The lump-sum contracts are used for the execution. There is no claim and process control in the project execution. Although it is said that the consultants work for the clients of the recipient countries, the client has mere a role to make necessary arrangement for payments of the work done by the consultants and the contractor’s work certified by the consultants. The client do have role for the coordination of the local authorities concerned with the project, and land acquisition for the project. Thus the clients are limited to the administrative work rather than the technological management of the project.

The deployment of the local resources is more limited in the grant aid projects. The guiding principle for the grant aids restricts the local consultants and contractors to participate in the bidding. Therefore, the opportunities for the local industry lie in the mercy of the main contractors. However, the main consultants and contractors use the skilled workforce from their own countries. They believe that the local industry do not have enough capacity to perform the task efficiently. It is common knowledge that the capacity cannot be improved without participation. But there is no opportunity for the local industry in the foreign assisted projects which occupies all major infrastructure development. So, there is quite limited improvement in the capacity of the local industry what they had acquired from small infrastructure development projects. In addition, some foreign assisted projects use the construction materials from the donor countries even the similar materials were available locally in the recipient countries, as seen in the water supply project in Kathmandu.

It is evident that there will be no expected economic development if the local resources were not utilized for the execution of a project. Thus economic development and capacity improvement of the local industry in the developing countries in such insulated execution system will be limited.

As the Japanese contractors and consultants in such execution system works with their own human resources and technology, they do not have opportunities to enhance their management capability which is required to work in the multicultural environments where mutually mistrust exists. As the contracting system under the grant aid does not recognize the mutual mistrust, there are no claims and dispute resolution. Thus, the Japanese consultants and contractor do not have opportunities to experience the international practices of the construction industry even working in the overseas projects through grant aid. But, the management ability to work in the multicultural environment where mutually mistrust exists is the dominating skills required to be competitive in the global market (Kusayanagi, S. 2004).

In addition, it is relevant to note, although it is difficult to quantify, the 'honesty and sincerity' of the Japanese people at work needs to transfer to the developing countries like Nepal and Cambodia as a cultural technology. The increased 'honesty and sincerity' would help improve the productivity of the labor. However, the insulated project execution system could not provide the Nepalese and Cambodian construction industry opportunities to work under the Japanese management.
The existing execution system, therefore, not only did not provide local industry of the recipient countries enough opportunities to improve their capacities, but also kept the Japanese consultants and contractors away from the international practices. As far as Grant aid is not just donation activity, it shall make merits for both the recipient and the donor sides.

4.3.3.2 Inefficient Technology Transfer

Although the word "technology transfer" is often highlighted in every development project carried out by the foreign companies, the reality is not same as written in the document. The effect/impact of technology transfer is limited when the final service or products are used for the transfer of technology. In such case, the recipient will know only how to use the product. The recipient countries will have a long way to know the technology of production, operation and application.

The situation is similar in the infrastructure development project, if the final facilities are delivered to the recipient without involvement of the local resources during the process of execution. The design, construction and management technology could not be transferred from the final product. The local industry cannot develop the similar facilities themselves in the future. This makes the local industry ever dependent to the foreign industries. For example, if a cable stayed bridge was built in a developing countries without involving the local consultants and contractors during investigation, design and construction, the local industry never knows the investigation, design and construction technology required for the cable stayed bridge, and therefore, the recipient country always has to request the foreign firms to build the similar facilities, if needed, again and again.

Although the Japanese quality in production of a facility is the number one in the world, the developing countries could not follow the Japanese system yet. This is mainly because of that there were no enough opportunities for the local construction industry in the developing countries to work with the Japanese counter part in order to acquire the time and quality management skills required for the construction projects. Since the use of the local resources in planning, investigation, design and construction of a facility is limited, there is quite limited opportunity for the technology absorption in to the local industry. As a result, there is no significant improvement in the performance of the construction industry in the developing countries.

Moreover, internalization of a technology is further limited in the existing practice. Since there are many organizations involved in the infrastructure development in Nepal and Cambodia, and there were no flow of the human resources across the executing agencies. In addition, the existing system of human resources development is mainly focused to the client's people. Thus a technology transferred to an organization will flow vertically, and no opportunities for the horizontal dispersion as shown in Figure 4.6. However, the universities could be the better option in order to make effective absorption and internalization of a technology in the developing countries.

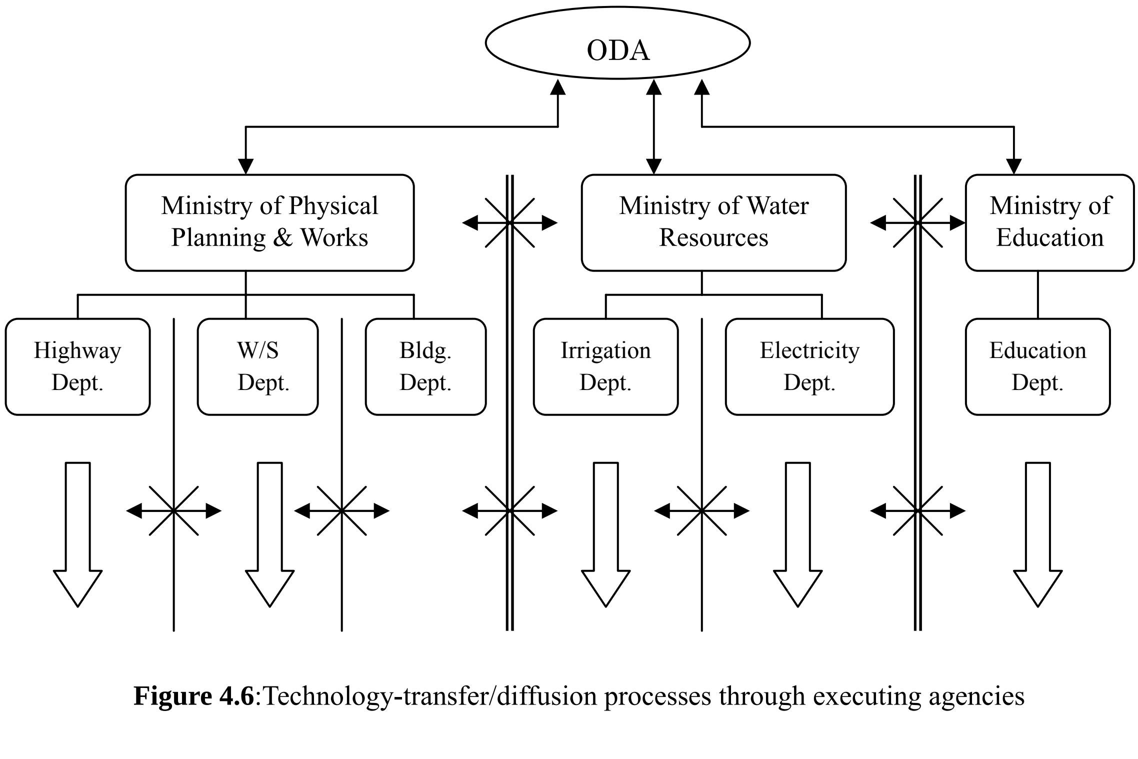


Figure 4.6:Technology-transfer/diffusion processes through executing agencies

4.3.3.3 Inefficient Human Resources Development System

The major activities of the human resources development under Japan's ODA are dispatch of the experts and acceptance of the trainees. The experts are dispatch upon the request of the recipient governments to assist the clients either in project investigation, design or management. In addition, the JICA offers the developing countries opportunities to send their human resources to be trained in Japan or in third country.

The governments of Nepal and Cambodia usually send the clients' people in infrastructure sector training in Japan. The group-training course offered by the JICA is not directed to address the specific needs of a country. The training course in infrastructure development, as discussed earlier, is generic in nature, and provides the opportunities to observe the modern, advanced technology used in infrastructure development. Moreover, probably with the reason of providing the equal opportunities to organizations in the recipient country, JICA does not provide regular opportunities for an organization to participate in the similar training. Thus, training for one people in one field from one organization in the long-year gap does not improve the skill level of the organization. Also, training for one people does not effect when hundreds of untrained people entered in the industry. This is also must be considered when we think effectiveness of ODA activities.

Tertiary (university) education is the source of the skilled work force. It is fact that the inadequate educational and research infrastructure and lack of quality faculties are the reasons for poor quality of human resources in the developing countries. However, the governments as well as donor agencies had not put attention to improve the quality of in-house higher education in the developing countries. Instead, they are spending a large sum of money to train a few people in the overseas.

For instance, in year 2002, 162 people went from Nepal to Japan under the JICA human development program, and the training cost was 337,276,000 Yen (approx. 219,229,400 NRs.). The average of duration of the training program was 3 months. On the other hand, the Nepal government invested 1,445,590,000 NRs for 150,000 students' enrolled higher education program in the physical year 2002. From this data, it can be made following simple evaluation.

C_1= NRs 219,229,400 ÷ 162 persons

≑ NRs 1,353,300／person-year

C_2= NRs 1,445,590,000 ÷ 150,000 persons

≑ NRs 9,640／person-year

$C_1 \div C_2$= NRs 1,353,300 person-year／NRs 9,640 person-year

= 140 times

$S_0 = 140 \times 162 = 22{,}680$ students

C_1 : ODA Training Cost for 1 person
C_2 : Education Cost in Nepal for 1 person
S_0 : Number of students educated with ODA cost per year

Similarly, as discussed earlier total 70 people from Cambodia went for training on infrastructure sector in between 1994 to 2002; approximately 8 people a year where as about 300 new civil engineers in a year are producing in Cambodia. Similarly, more than 800 civil engineers in a year are being produced in Nepal (IOE 2004). Rise in skill level of a few clients' people where hundreds of untrained people enter in the industry did not improve the performance of the construction industry.

The above calculations does not have cost for foreign teaching staff and other expenses but it indicates that if appropriate ODA human developing system can be set up together with Japan in recipient counties, it must be more economical, efficient and productive. The problem is how to find out the appropriate ODA human developing system. The author will work out it in this study.

4.3.4 Recommendations to Improve the ODA System

4.3.4.1 Use of Alternative Project Delivery System

Since the existing system of execution does not provide opportunities to deploy the local resources effectively, such system will not help improve the performance of the local industry. This will make the developing countries more to depend on the developed countries. Further, the Japanese consultants and contractors cannot acquire the management skills required to work efficiently in the multicultural and mutually mistrust environments.

The construction management project delivery system which allow to use the modern technology and management through the general contractor/construction manager (GC/CM) or construction manager (CMR) as discussed in the chapter 8 as well as to deploy the local resources for the actual construction, would help improve the performance of the local industry and competitiveness of the Japanese professionals simultaneously. The Construction Management System will provide the local contractors opportunities to learn from the Japanese professionals which would foster the transfer of the construction technology and management to the developing countries. On the other hand the CM system provides the Japanese professionals opportunities to improve the contract administration /management, negotiation, claim management and dispute resolution skills.

4.3.4.2 Use of University Functions in Technology Transfer and Human Resources Development

Since, by the organizational structure, there is only vertical flow of the human resources and technology in the executing agencies, and the executing agencies (clients) are not involved in researches, a technology transferred to a client therefore remains obsolete with time. There will be a little or no prospect of updating the technology through the clients only. The effective absorption, updating and internalization would be achieved if university functions were incorporated. University can provide continuous flow of researchers in order to absorb and update a technology, and the internalization can be done with the help of the local industry. Thus appropriate system which combines the functions of the university with industrial activities would foster the technology transfer, absorption, updating and internalization. The author found that the civil engineering universities from Nepal and Cambodia were eager to do researches related to the technology for construction material, construction and management. However, those universities did not have enough research infrastructures.

The governments of the low-income developing countries Nepal and Cambodia could not provide sufficient funds for the higher education. Universities in these countries lack minimum educational and research infrastructure, and no enough faculties with advanced degree and experience are available. Since universities are the producer of the skilled manpower, the graduates educated in a poor educational environment with low level of faculties will not produced the marginal productivity stipulated for a standard skill manpower. As a result, the capacity of the construction industry in Nepal and Cambodia is low. Increase in overall quality of higher education would increase the marginal productivity of hundreds of graduates. Thus, a little improvement in the quality of higher education will have higher impact in the performance of the industry than from the training for some clients' people.

Training for a few people where hundreds of untrained people enter an industry would not improve the overall performance of the industry. In order to improve quality of human resources in the developing countries, ODA for human resources development should be utilized to develop appropriate educational and research infrastructure in the local universities along with the advanced training/study for the faculties. This will enable local university to deliver quality education domestically, and help reduce the dependency in human resources development to the developed countries. In addition, large number of people will be trained domestically with the same money that is currently used for training a few people in the developed countries.

4.4 Donor Countries

4.4.1 Introduction

The developed countries initiated assistance program for less developed countries through the institutions and programs for economic cooperation created under the United Nations auspices after the Second World War.

Development Assistance Group (DAG) was formed in 1960 as a forum for consultations among aid donors on assistances to less developed countries. The Organization for European Economic Co-operation (OEEC) established in 1948 was reconstituted as Organization for Economic Co-operation and Development (OECD). The Development Assistance Committee (DAC, www.oecd.org/dac) is the principal body through which the OECD deals with issues related to co-operation with developing countries.

There are 23 members in the DAC. These are **Australia (**Member since 1966), **Austria (**Member since 1965), **Belgium (**Member since 1961), **Canada (**Member since 1961), **Denmark (**Member since 1963), **Finland (**Member since 1975), **France (**Member since1961), **Germany (**Member since 1961), **Greece (**Member since 1999), **Ireland (**Member since 1985), **Italy (**Member since 1961), **Japan (**Member since 1961), **Luxembourg (**Member since 1992), **Netherlands (**Member since 1961), **New Zealand (**Member since 1973), **Norway (**Member since 1962), **Portugal (**Joined the DAC in 1961, withdrew in 1974 and re-joined in 1991), **Spain (**Member since 1991), **Sweden (**Member since 1965), **Switzerland (**Member since 1968), **United Kingdom (**Member since 1961), **United States (**Member since 1961), **Commission of the European Communities (**Member since 1961) (OECD DAC members and date of membership).

Japan was the largest donor in 1990s among the development assistance committee (DAC) members. However, Japan still maintains its second position since 2001 in providing official development assistance to developing countries. The two countries: Nepal and Cambodia considered in this research as representatives of the least developed countries continue to rely heavily upon external financing. More than 50 percent of the whole development expenditure in Nepal (Economic survey of Nepal (2003-04) had been covered through foreign assistances. Among the bilateral donors, Japan continues to be the largest. In recent years, Asian Development Bank (ADB), the World Bank (WB) and Japan have accounted for about 55 percent of total external assistance to Nepal.

Bilateral donors to Nepal are Australia, Belgium, Canada, People’s Republic of China, Denmark, Finland, France, Germany, India, Japan, Kuwait, Netherlands, Norway, Saudi Fund, South Korea, Switzerland, the United Kingdom and the United States. (ADB, http://www.adb.org).

Similarly, 75 percent of the capital investment in infrastructure in Cambodia had been covered through foreign assistances (Kaneko). The major bilateral donors to Cambodia are Australia, Belgium, Canada, People's Republic of China, Denmark, France, Germany, Japan, Netherlands, New Zealand, Sweden, the United Kingdom and the United States. Japan continues to be the largest among the bilateral donors (Cambodia Country Assistance plan (2001-03), ADB (http://www.adb.org/Documents/CAPs/CAM/appendix.pdf). Moreover, the six among nine least developed Asian countries (classified by the DAC) had received largest amount of ODA from Japan in 2002 and 2003. Those six countries are Bhutan, Cambodia, Laos, Maldives and Nepal.

4.4.2 The Construction Industry in Japan

4.4.2.1Construction investment and Project Execution System

Japan had successfully achieved postwar rehabilitation soonest possible and also established enough economic infrastructures to achieve the so-called world miraculous economy. The performance of the Japanese construction industry made it possible to deliver the socio-economic infrastructures to enable Japan among the world's economic power in a very short period (Kusayanagi S (2004), Build up new project execution system for upgrading transparency of the construction industry in Japan).

The Figure 4.7 shows the investment in the construction and civil engineering works in Japan since 1960. The construction investment in Japan had been increasing along with the postwar rehabilitation. The steady increase of the construction investment in the postwar rehabilitation period underpinned the rapid growth of the construction industry. The industry did not require exploring markets as the governments continued to request more and more construction products.

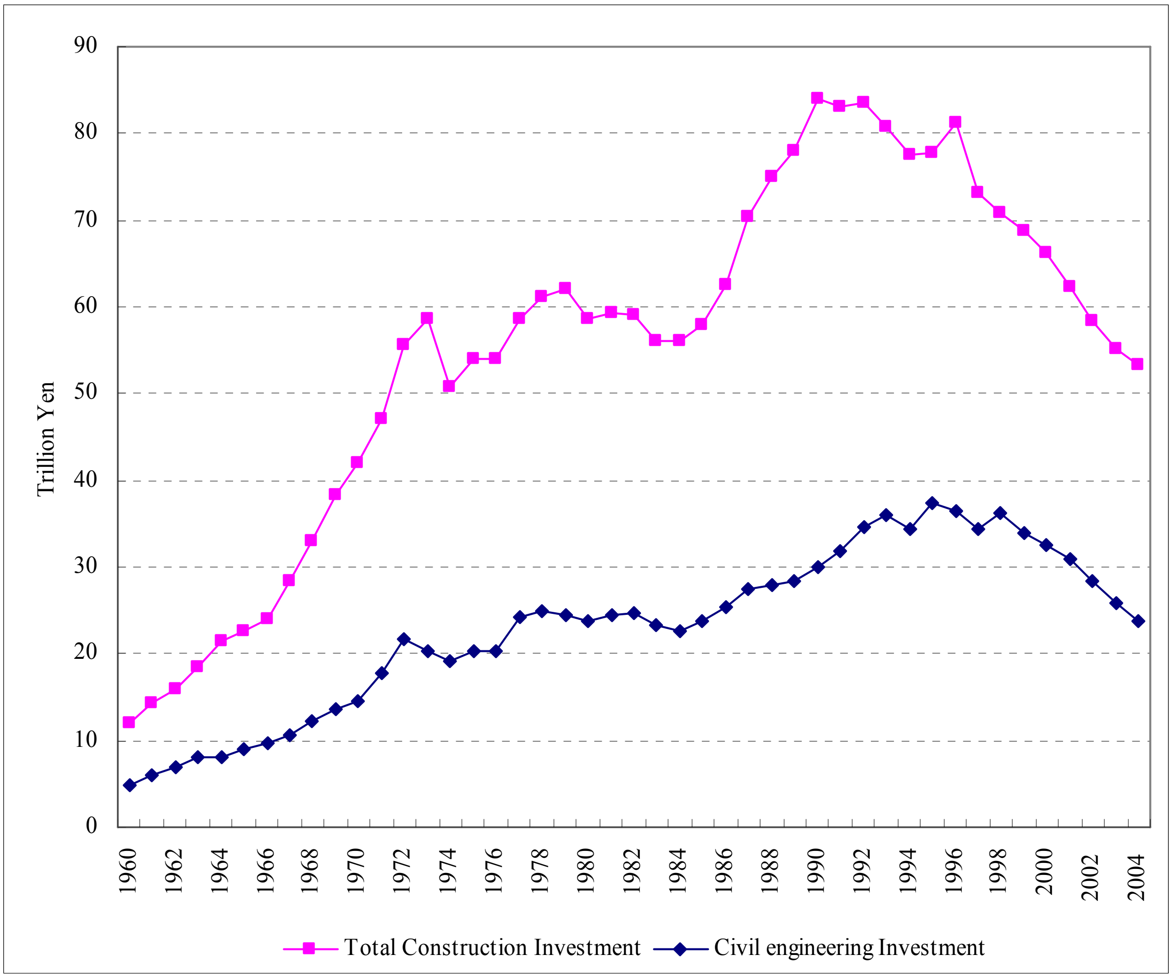


Figure 4.7: Total Construction and the Civil engineering investment at 2000 constant price in Japan

The industry was engaged in technological innovations to fulfill the clients' demand as early as possible. The investment was reached to nearly 59 trillion yen at constant 2000 price in 1973 until the first oil-shock crisis broke out. The average annual increase in the investment in between 1960 and 1973 was 13 percent. Thereafter there was no significant growth till 1979, the year of second energy crisis. The rise in the construction investment was further slowed down until 1992.

The largest investment in the construction was observed in 1992. The investments have been continuously decreasing thereafter. The investment in 2004 in real term (at 200 constant price) was less than the early 1980s investment amount. The investment in the construction industry has gone back to 20 years past situation. The industries after the 1980s were inflated because of the bubble economy. The industry turned to the situation where it was before after the burst of the bubble economy. The early 1980s can be taken as the major turning point for Japan where she turned to the developed country from a developing country (Kusayanagi, S. 2004).

Unlike to the international practice in project execution, the Japanese construction industry deployed one-page bidding and two-party execution system. The two actors were the employer—government and the contractors. Consultants were limited to assist the clients. The role of consultants was not distinct in project implementation. The system is still prevailing in the Japanese construction industry. Further, the Japanese consulting engineers are being treated as "support staff" and not as professionals such as the medical and accounting professions (Galloway, P.D. 2005).

Most of the public works in Japan are decided simply by a tender price (single sum) in a page for the project in question from the designated bidders. The bidding system does not require the details of the tender amounts and execution plan. 30-40 percent of the contract price is paid as the advance payment when a contract is awarded to start up the project and other remaining amount usually paid after completion of the project. There is no progress payment system in the industry. The client and contractor are concerned only to the date of completion. There is no any cost and schedule control measures to improve the efficiency in project execution. If unforeseen works during the construction were encountered which require additional cost and time would be dealt in the name of design change in contrast to the 'claim' in the international practice. Although the Japanese public works standard contract articles state that changes in the completion time and additional costs are to be decided based on "discussion of the both parties", the employer decides himself regarding the changed matters and instruct the contractors to follow in the real practice. The third party like the independent consultants' involvement was not envisaged in negotiation and claim settlement (Kusayanagi S. 2004).

The one-page bidding and two-party execution system, in which the client requested the contractors directly, facilitated the clients to make decision in a very short time. Such system would be the most suited to deliver projects as early as possible provided the involved parties are competent and honest. This system made the Japanese construction industry possible not only to rehabilitate the war-devastated infrastructure as soon as possible, but also to establish the economic infrastructure to attain world miraculous economy within a very short period. However, such project implementation system could not provide the industry opportunities to be more competitive in the global construction market.

4.4.2.2 International revenue of the Japanese Contractors

The Japanese construction industry has to depend more on own finance than international market as seen from the figure 4.8. Also, there was no significant increase in the international contract amounts after 1980s (figure 4.9). The top 9 Japanese contractors in 2003 received only 15 percent of the total revenue from overseas contract where as the American contractors received 60 percent from the overseas in the same year (figure 4.10). However, the Japanese domestic construction investment and international market share of the Japanese construction industry have been decreasing. The share of the Japanese construction industry in the global market in 1994 was 20.4 percent. However the share was only 8.1 percent in 2001 as seen in the Figure 4.11. (Lee, Y. 2005). Further, The data for the top 50 international contractors from the Engineering News Record (ENR 2004) revealed that the total international revenue of the 9 Japanese contractors ranks only in fifth position (Table 4.6). The first, second, third and fourth were the American, French, Germany and Swedish contractors respectively. The total international revenue of Skanska AB, Stockholm, Sweden and Hochtief AG, Essen, Germany alone were greater than that of the 9 Japanese contractors.

As such Japan has great contribution on ODA and the Japanese construction industry is dependent on the ODA for its major international business. In effect, the Japan's ODA influences the international sales of the construction industry ODA. Further, the author observed that the participation of the Japanese contractors in the projects financed by the governments of other countries and multilateral agencies like the Asian Development Bank, World Bank in the developing countries were low. The figure 4.9 indicates that the Japanese contractors could not increase the overseas sales significantly after 1983 despite a sharp increase in 1995-96 period. After that it again fell to the 1980s value. It indicates that the Japanese contractors have limitation to increase the overseas sales beyond the 1980s value.

Why the Japanese construction industry could not expand the business even though Japanese technology is of the world class. The major reasons, the author believes, are

i) the domestic practice and ODA policy

ii) the civil engineering education and training opportunities

iii) the lack of motivation in the young engineers,

Since the technology is of the world class, the reason behind the no expansion of the overseas sales must be related to the capacity of human resources working in the overseas business, and opportunities in the ODA projects. The university education has also affected the quality of the human resources. As discussed later, it was found that 19 out of 209 civil engineering universities in Japan deliver construction management education. In addition, no single university's curricula covers the complete construction and project management area, and there are not enough opportunities to acquire the required skills for international project management. As a result, the graduates are lacking many of the project management and administration skills including communication, negotiation, and dispute resolution, etc. which are required to be competitive in the global construction market. This has influenced the performance of the Japanese construction industry to expand the overseas sales. Similarly, author during his study had interacted many Japanese students to know their interests in the overseas business. However, it was observed that more than 90 percent of the students interacted were not interested in the overseas business. Some of the reasons were: poor and unsafe life in many developing countries, unaware of the practice and situation of the infrastructure development in the developing countries, feel difficult to communicate with foreigners, etc.

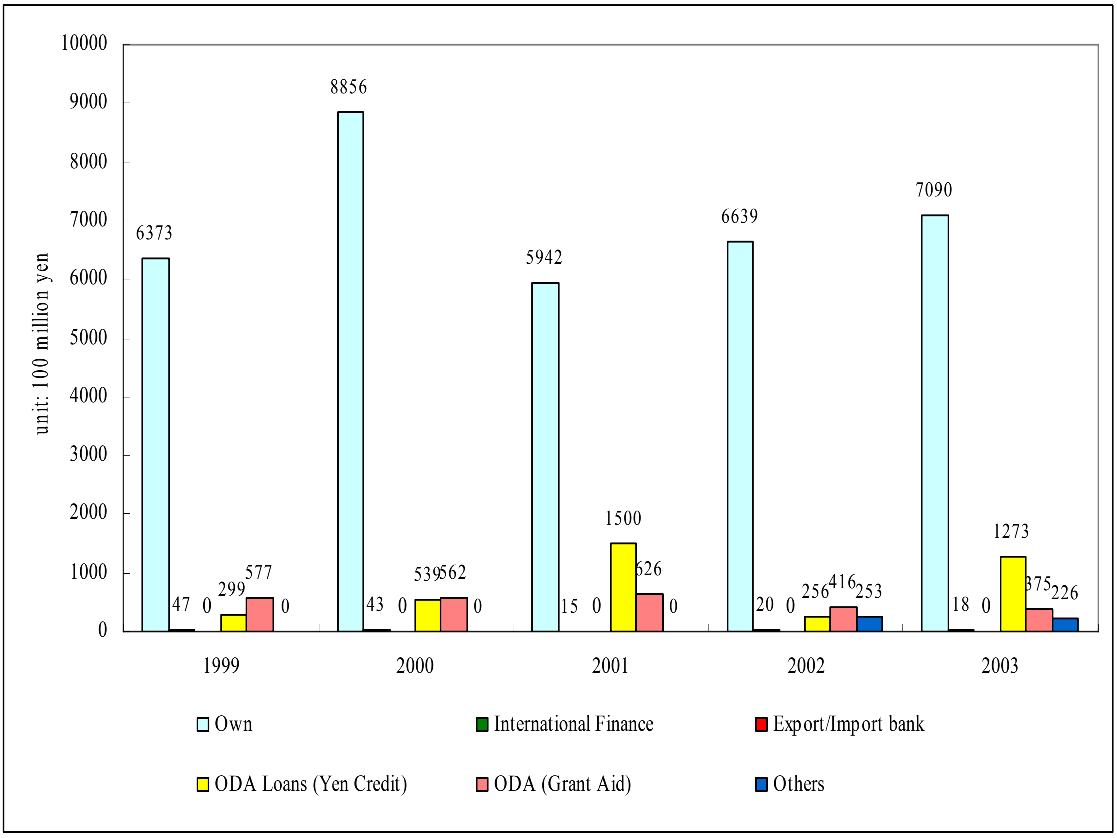


Figure 4.8: Construction Contracts awarded to the Japanese Contractors (1999-2003) by Source of Finance

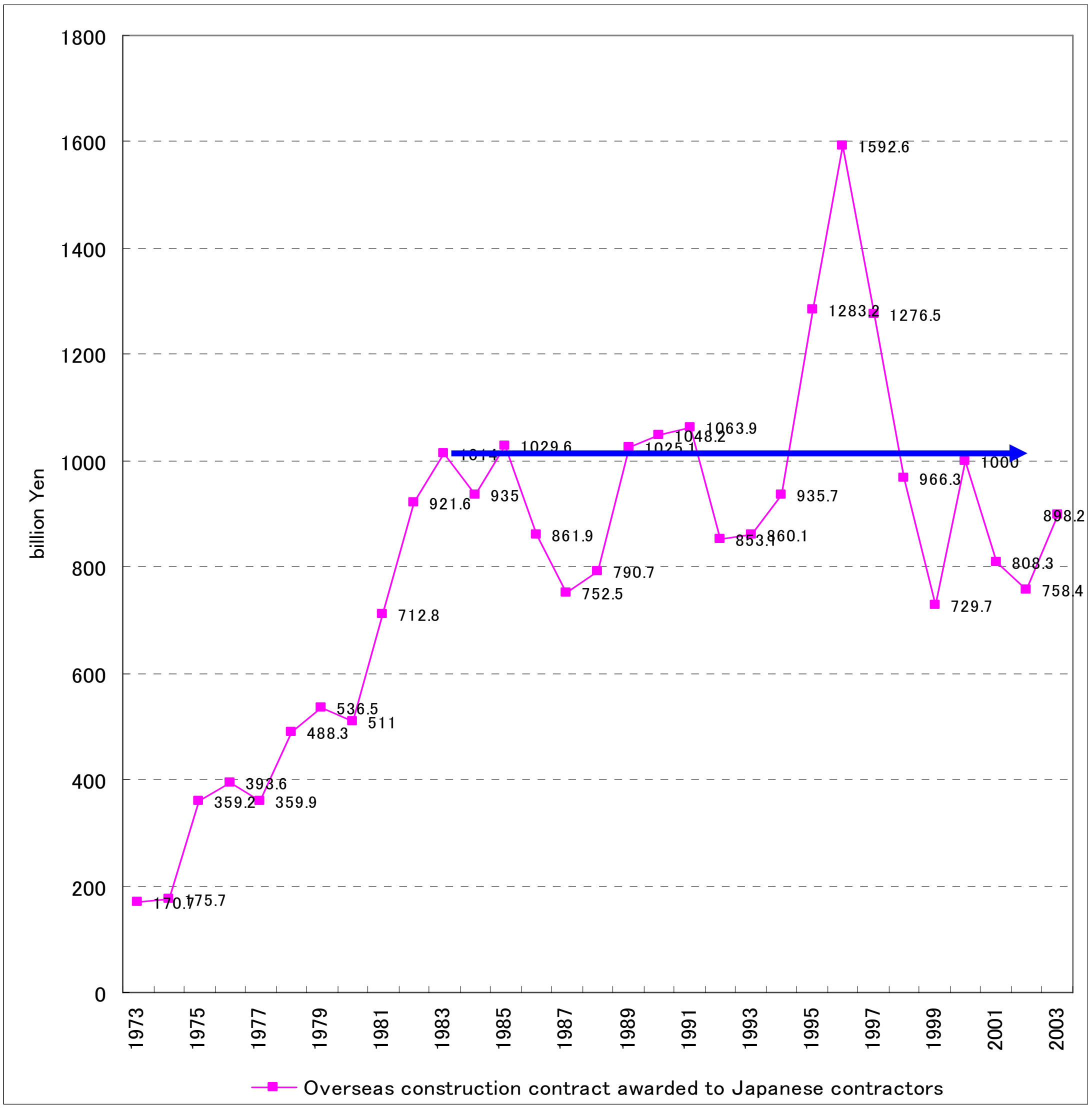


Figure 4.9: Overseas contract award to the Japanese Contractors

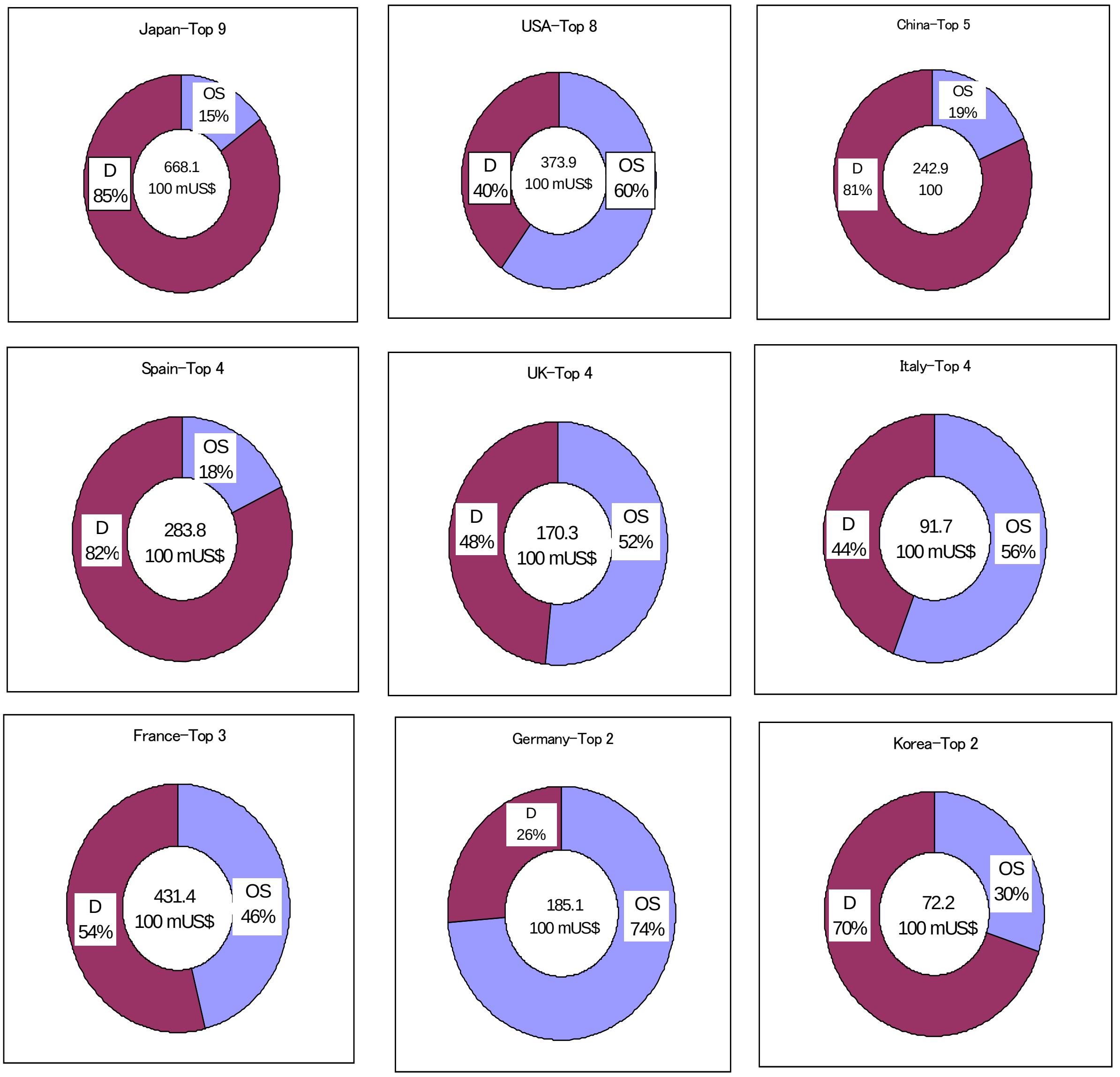


Figure 4.10: Proportion of the Overseas/Domestic Turnover (% of Total Turnover, 2003)

Table 4.6: 2003 International and Total revenue (US$ Million) of Top 50 International Contractors

Contractor from	2003 Revenue (US$ Million)	
	International	Total
USA-Top 8	22,253.70	37,389.90
France-Top 3	19,963.90	43,140.90
Germany-Top 2	13,778.30	18,506.70
Sweden-1	11,504.00	14,056.00
Japan-Top 9	10,231.20	66,812.20
UK-Top 4	8,915.80	17,026.80
Italy-Top 4	5,167.80	9,170.10
Spain-Top 4	5,116.40	28,376.90
Austria-1	4,694.60	6,468.40
China-Top 5	4,612.20	24,290.50
Netherland-1	4,497.00	8,625.00
Norway-Top 2	2,216.00	3,287.60
Korea-Top 2	2,163.90	7,216.40
Greece-1	1,823.90	1,823.90
Brazil-1	1,281.00	1,576.00
Australia-1	688.00	3,709.00
South Africa-1	597.00	1,174.30

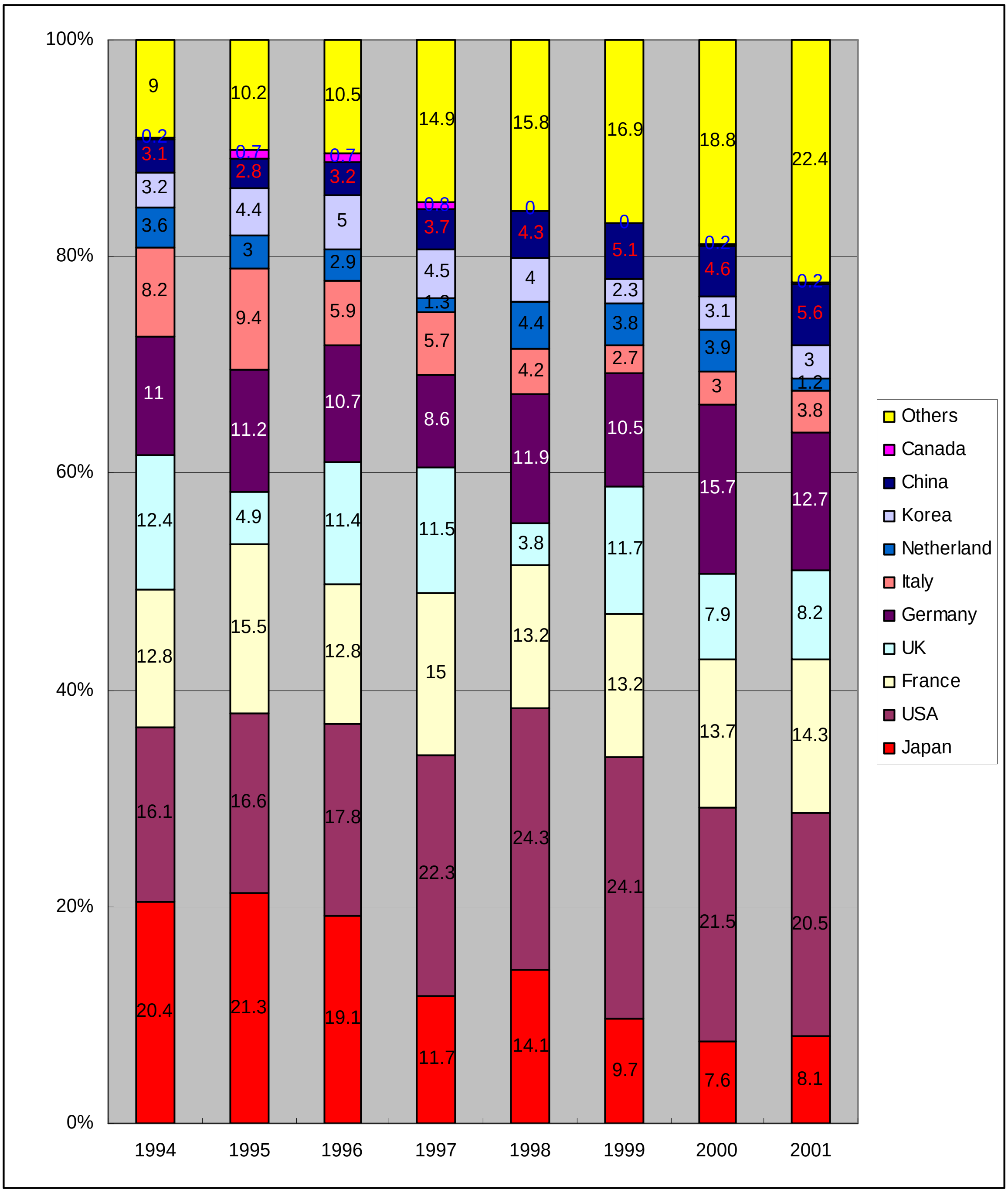


Figure 4.11: International construction market share by contractor's nationality

Like the contractors, Japanese consultants are also dependent on the domestic market. Consultants in Japan are mostly engaged in the design work rather than overall implementation of a project. The Consultants services in Japan are supportive in nature rather than decisive. The overseas business of the Japanese consultants is mainly concentrated in the Japanese official development assistance to developing countries. For instance, nearly 90 percent of the overseas revenue of the members of the Japan civil engineering consultants association in the year 1997 was from the ODA Table 4.7.

Table 4.7: Overseas services of JCCA in 1997

Source	Organizations	Amount (100 mln Yen)
Official Development Assistance (ODA)	JICA	235.9
	Funding without compensation	59.9
	OECF	254.4
	International Organization	16.1
	Others	3.5
	Sub total	***569.8***
Non-ODA	Overseas Government	24.1
	Private	48.4
	Sub total	***72.5***
Total		**642.3**

Source: Japan Civil Engineering Consultants Association; http://www.jcca.or.jp/english/

Galloway, P.D. 2005 pointed that 'the current Japanese Consulting Engineer simply does not possess many of the needed skills such as communication, project management, dispute resolution and so forth in order to compete internationally or to move the domestic construction market ahead in Japan. While Japanese Consulting Engineers are strong on technology, they are weak at management capabilities and communication skills. Japanese engineers continue to be regarded as a "commodity" and, as is being experienced in other parts of the world, as technicians, not professionals.

4.4.3. The Civil Engineers in Japan

A new university system in Japan was enforced in 1949 by which Higher education institutions were unified in to new-system universities. A large number of students were attracted in to science and engineering after 1957 and 1961 respectively. Master courses were developed from 1963 onwards and doctorate courses were introduced since latter half of the 1970s (Akatsuka Y. 1999).

Oshima, K. (2004) based on the survey conducted in 1990 by the Japan Society of Civil Engineers (JSCE) planning Committee noted that the civil engineering graduates are continue to rise in number despite the slow economic growth and lower construction investment. The number of graduates from the civil engineering departments stood 3,142 for the five years between 1950 and 1954, an average of 628 graduates per year. The number of graduates for the years between 1995 and 1999 was reached to 43,063 an average of 8,613 per year. The total numbers of the civil engineers reached to 201,000 in 2002. The production of the civil engineers in Japan is shown in the Figure 4.12.

Although the numbers of the civil engineer were increased steadily, the construction investment in the domestic industry did not increase with the same ratio of the production of the engineer. The decreased investment per civil engineer was observed since 1972 as discussed in the Chapter 7.

Further, the decrease in the construction investment and the civil engineering projects as well resulted to the graduate limited opportunities to experience the practical works in the domestic construction industry. Thus, the engineers produced in the later years could not have enough opportunities to acquire the practical skills in the construction management from the university education. Since, there is a little opportunities to be involve in the practice during the university education, the flow of knowledge and skills from the senior professionals to the graduates were also limited. In addition, the civil engineering university in Japan could not provide the graduate opportunity to have knowledge and skills in the construction management, as discussed below.

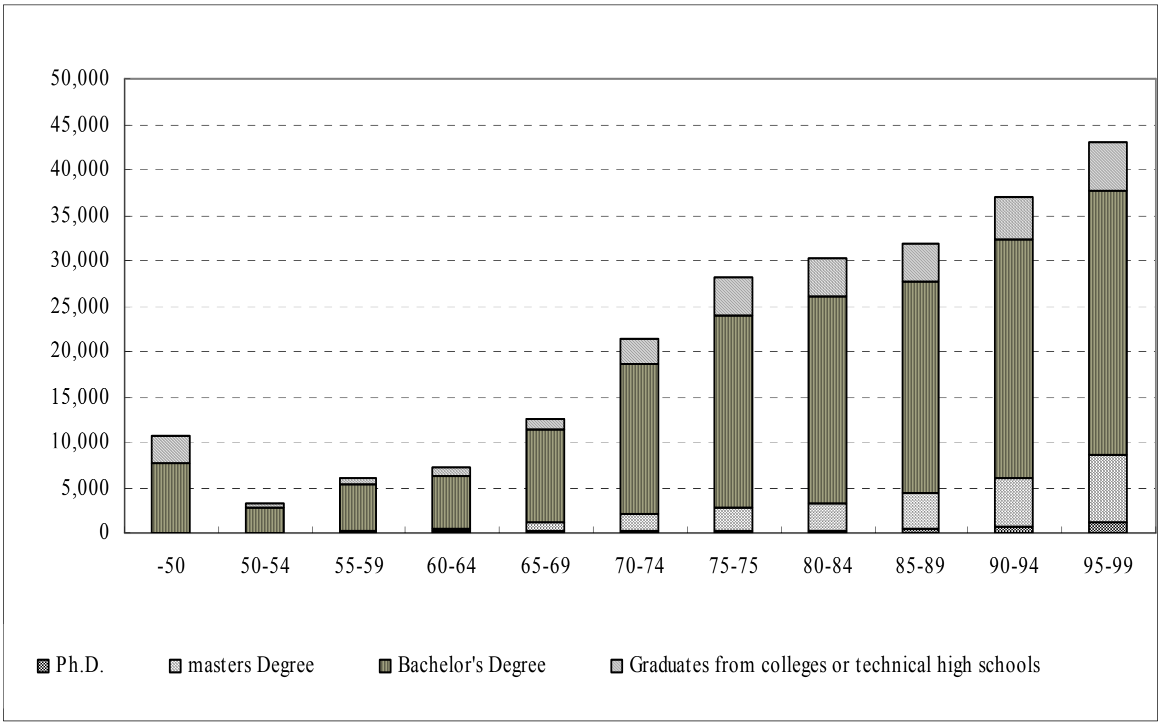


Figure 4.12: Civil engineers production in Japan

4.4.4. Construction and Project Management Education in Japan

Construction management education is the management in engineering which incorporates management aspect of all the stages of a project cycle. Normally, a construction project undergoes from initiating, planning through feasibility, design, procurement, construction till hand over after the completion of the facility.

A construction project, therefore, requires various engineering, technological and managerial knowledge and skills in order to implement a project efficiently. As shown on the Figure 4.13**,** Kusayanagi, S. (2004) descried three Functions of Civil engineers such as "Technological development & Engineering", "Mission & Policy" and "Construction management". He says that most of engineers have been concentrated in the area of Technological development & Engineering function but did not seriously think about the function of Mission & Policy.

Further, the function of "Construction management" is how to combine the Mission & Policy and technological development & Engineering practically and effectively (Kusayanagi S. 2004). Here, the mission and policy should find out and clarify the necessary infrastructures for people and society. In other words, why and what shall be made for the people and the society?

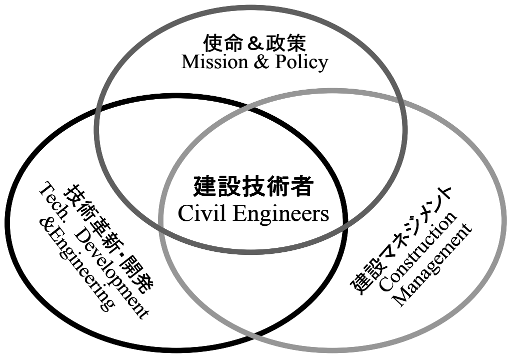


Figure 4.13: Functions of Civil engineers (adapted from Kusayanagi, S. (2004)

4.4.4.1 Functions of the Civil Engineers

When we look at the role of the civil engineers in the society, we can find the major three functions of the civil engineers. The hierarchy of the three functions may be the subject of discussion, because it must be considered the social and industrial conditions and environment in own country. However, those functions in this study are treated as equally important in the civil engineering profession. The first and foremost function is mission & policy: to find out the appropriate facility and services required for the welfare, health and safety of the society. In addition, the civil engineers should clarify why those facilities and services are required, and how those facilities and services would promote welfare, health and safety of the society.

The second function of the civil engineers is to find out the appropriate engineering science and to develop appropriate technology in order to supply the facilities and services decided in the mission and policy. Thus, a civil engineer should need to find and/or develop appropriate technology to deliver the facilities and services for the welfare, health and safety of the society.

Similarly, the third function is to integrate the mission & policy and technology development & engineering in order to implement the facilities. Thus, the construction management would deal the appropriate ways for the implementation of a facility by using the engineering and technology effectively and practically.

4.4.4.2 Necessity of the Construction Management Education

Although there was no formal construction and project management education in Japan in the past, the graduates could acquire the practical construction and project management skills from practical works and internship which covered almost half of the university education. As a result of such education the construction industry did not face any problems regarding the human resources and technology for infrastructure development. However, the 6-years education system does no longer exist in Japan now. In addition, the civil infrastructure development projects are also decreasing.

The graduates in the civil engineering in recent years do not have enough opportunities to involve in practical works, and to acquire hands on knowledge and skills in practical works and management. The necessity of establishing formal construction and project management education in the civil engineering education in Japan is also realized recently (Kusayanagi, S. 2004).

The civil engineers and the civil engineering education in Japan after the Second World War were engaged in engineering and technological development function only with little or no attention to other functions listed above. The main aim of the construction industry in that period was to rehabilitate and construct fundamental and the war devastated infrastructure as early as possible in order to keep the people's life. The industry in the 1940s and 1950s was engaged in the rebuilding of the basic infrastructure.

In the aftermath of the rebuilding period i.e. in the 1960s a high economic growth was observed in Japan. The construction industry had to build the economic infrastructures as steadily as possible in order to support the economic growth of the country. Thus the Japanese construction industry after the Second World War was continuously engaged in the technological development and the implementation of the facilities, and did not consider about the efficacy and long-term effectiveness of the system developed. In effect, there were no proper evaluations of the facilities in the onset of the implementation. The civil engineering education was also guided accordingly with the trend of industrial growth to the technological development.

However, the industry suffered severe problem after the burst of the Bubble Economy. As discussed above, the domestic construction investment as well as international construction market share started to decrease continuously after the burst of the bubble economy. In addition, public have also started to question about the appropriateness of the facilities developed in the past. Thus, the Japanese construction industry needs to integrate the three functions of the civil engineers/engineering effectively for the sustainable growth of the industry in order to maintain the existing and to develop new facilities efficiently. Further, the Japanese engineers need contract administration, dispute resolution and risk management skills in order to be competitive in the global construction market (Nielsen, K. 2005).

4.4.4.3 Curricula of the Construction Management Education

Curriculum is the main guiding frame of the knowledge areas which lie in the subject. A curriculum should provide enough content in order to be familiar with the concerned knowledge areas, and to acquire necessary skills required to practice in the industries. Although the contents for basic principle, theory are the same, a curriculum should address the application areas of the theories in the local context which may differ country to country, and in the global context as well.

Japanese construction industry needs the construction and project management knowledge area which not only promotes the sustainable growth of the domestic industry but also improves its competitiveness in the global construction market. The construction management education should cover the knowledge areas concerned with the whole cycle of a project. The knowledge areas regarding the planning, assessment, feasibility, design, procurement, construction, operation and maintenance should be included in the construction management education.

As there are many stakeholders in the construction projects, and are implemented through various phases, the construction engineers require contract administration, negotiation, communication and risk management skills. Thus, the CM education should provide graduates opportunities to acquire enough skills to implement the construction project in a homogenous as well as heterogeneous society. The construction management education which offers graduates opportunities to acquire the knowledge and skills to implement a project in the Japanese society and, at the same time enable them to be able to work in the mutually mistrust environment would be appropriate for the Japanese construction industry.

A typical curriculum for the construction management education proposed by Prof. Kusayanagi, S. (Kusayanagi, S. 2004) is relevant to discuss here. It was found that 209 universities out of total about 400 in Japan have been engaged in the civil engineering education. Further, only 19 universities among 209 are offering Construction management education under 30 faculty/department. However, no universities in Japan offer the whole courses. Kochi University of

Technology offers the most of the courses, where as Toyo University, Ashikaga Institute of technology, and Shinsu University have been offering some of the content. The rest of the universities offer only a few courses related to the construction management.

4.5. Conclusions

Infrastructure implementation practices and the construction industry development have made the Japanese construction industry insulated which did not provide the parties—consultants and contractors opportunities to exercise the international practices which are now become the standard for a project implementation in the global construction market. This resulted in to poor skills of the consultants in project management, claim management and so forth. The domestic project implementation system could not enable contractors to work efficiently in multicultural environment where the mutual mistrust exists. In addition, the participation of the Japanese contractors and consultants in the global market were mostly limited in ODA projects.

Since the domestic investment has been decreasing the global construction market will be the major source of business in the years to come. The Japanese construction industry needs to be equipped with all necessary skills to compete in the global market. Exercising international practices in the domestic market and human resources development compatible with the needs of the global construction market would help the Japanese construction industry to be remaining competitive in the global construction market. Experience and skills of the retiring professionals should be utilized in order to develop developing countries, and to improve the competitiveness of the young Japanese engineers. For this purpose, the ODA project should be taken as the opportunities to provide the developing countries and the young engineers to acquire knowledge and skills from the senior professionals.

Since the existing civil engineering education in Japan do not offer the students opportunities to acquire enough knowledge and skills in the integrated construction management area, the civil engineering university should establish and deliver the construction management education in collaboration with the construction industry. The integrated system developed in this study would help the Japanese engineers/graduates to be familiar with the international construction management practices in the multicultural and mutually mistrust environment.

Chapter 5

5. Figure out the New Concept of ODA Scheme: Integrated System For Human Resources And Infrastructure Development

5.1 Introduction

Infrastructure such as roads, bridges, water supply, sewerage system, and telecommunication, power are the prime prerequisite for a country's development. The level of services that the infrastructure offers to the user determines the development level of a country. As such, infrastructure development depends on many factors including capital, human resources, materials, equipment and management technology. Capital and human resources factors influence the production and development of materials, equipment and management technology. In addition, capital is the single factor that influences the deployment of appropriate human resources and technologies. On the other hand efficiency of human resources affects the efficient utilization of the capital and technologies. The importance of the human resources is further noted from the chartered institute of building's thought on human resources as it notes human resource as:

> *"Although it is important to exploit new technology in order to achieve technological leadership and thus a competitive advantage, it is feasible that all firms could ultimately have access to similar technology. It is, therefore, the human resources that will make the difference and ultimately create the competitive advantage. Even computer-based systems are only as good as their designers and operators. People are our industry's most important resource. (The Chartered Institute of Building, 2002).*

The importance of human resource factor is more pronounced in the developing countries where the capital and technologies are scanty. The insufficient capital and technologies are observed in the low-income developing countries like Cambodia and Nepal. These countries are still dependent for capital, human resources and technologies on the developed world. The seriousness of due to the lack of appropriate human resources in a country can be drawn from S.I. Cohen (1996) S.I. Cohen in his book named 'Human Resource Development and Utilization' noted from F.H. Harbinson (1973)

> "*Human resources- not capital, nor income, nor material resources – constitute the ultimate basis for the wealth of nations. Capital and natural resources are passive factors of production: human beings are the active agents who*

accumulate capital, exploit natural resources, build social, economic, and political organizations, and carry forward national development. Clearly, a country which is unable to develop the skills and knowledge of its people and to utilize them effectively in the national economy will be unable to develop anything else." (Cohen, S.I. 1994)

5.2 Concept and Background

As seen in the Japanese engineering education in the Meiji era, appropriate combination of the theory and practice in university education is essential in order to fully satisfy the demands for human resources and technological innovation. Theoretical education provides graduates know the basic principles and philosophies while practical education offers opportunities to apply and observe the application of scientific and engineering knowledge in practice. Thus appropriate combination of theoretical and practical knowledge would make engineer enable to use efficient technology for the welfare, health and safety of the people.

5.2.1 Human Resources Development in Japan

Comparing the two extreme education systems in England other continental by the Nature in its May 17, 1877 issue highlighted the uniqueness of the human resources development system in Japan. However, higher education in the field of engineering in Japan was developed along two separate paths. The Nature explained that the British education was totally practical without lectures neglecting the importance of theories. Under the system a youth intended for an engineer was taken from school at the age of sixteen being thereby deprived of the most valuable years of his education, and placed in some engineering manufactory, where he remained for about four years. In those four years his so-called training consisted in going through the manual routine of the various workshops and picking up what knowledge he could by keeping his eyes open and living on good terms with the workmen. His last year was usually spent in the drawing-office, where, by a similar process of 'picking up' he learned how to draw if not to design machinery or works of construction. At the end of that time his education was supposed to be complete, and he either remains as a draughtsman until something better was offered him, or he enters the office of another engineer for the purpose of improvement. All this time the far important theoretical training was neglected altogether, no classes or examinations were held, and no lectures or other instructions were given. On the other hand the French and German education were totally theoretical neglecting the necessity of practice. This system is as bad as other, the Nature pointed (Nature 1877)

'*in engineering works a practical man without scientific training seldom makes* *such serious blunders as a scientific man without practical experience*'.

The following view expressed in the Nature is equally important in theses days also:

> *"It can only by a judicious combination of the two systems, allowing science and practical experience to work hand in hand together in the education of an engineer that the best result can be looked for, and in theses days of close competition, not only between man and man, but between country and country, it is of the utmost importance to a nation that its engineers should be instructed upon the best and soundest principles.*

5.2.2 Japanese Engineering Education in the Meiji era

The two extreme educational systems were also existed in Japan in the beginning of the higher education in engineering. The department of engineering at the ministry of public works (now ministry of land, infrastructure and transport) based on the British model started engineering education in 1871. The other extreme was started at Tokyo Kaisei Gakko in 1873, a precursor to Tokyo University based on the German model. Later these two lines of educational system were merged into university of engineering by the establishment of the imperial university. While England was so far behind in delivering appropriate combination of theory and practice in engineering education, Japanese government with the help of Mr. Henry Dyer, a British engineer, had developed a unique educational model in engineering education to provide students a highly scientific training, combined with actual practical experience in engineering workshops.

The system adopted was as follows: - The course of training was extended over six years.

- The first two years were spent entirely at college;
- During the next two years, six months of each year were spent at college and six months in the practice of that particular branch which the student may select;
- The last two years were spent entirely in practical work. The system of instruction in the college was partly professional and partly tutorial, consisting in the delivery of lectures and in assistance being given to the students in their work.

The whole system of training could be divided into three courses: -

i) General and Scientific,

ii) Technical, and

iii) Practical

The general and scientific course which was taught in the first two years, included

i) English language and composition,

ii) Geography,

iii) Elementary mathematics,
iv) Elementary mechanics,
v) Elementary physics,
vi) Chemistry, and
vii) Mechanical drawing.

The Technical course consisted of the following branches of engineering: -

i) Civil engineering
ii) Mechanical engineering,
iii) Telegraphy,
iv) Architecture,
v) Chemistry and metallurgy, and
vi) Mining.

These courses were taught during the third and fourth years of the curriculum. The practical course, in which the students were engaged during the last two years in the practice of special branch each may have selected, consisted of working in the laboratories of the college, and in the engineering works where they served a regular engineering apprenticeship. While this course was going on lectures on special subjects were given, and the students were required to prepare reports upon the work in which they had been engaged.

The technical course included the higher mathematics and natural philosophy, engineering, civil and mechanical, geology, mineralogy, surveying, naval, architecture, strength of materials, practice in the chemical, physical, metallurgical, and engineering laboratories, and in the drawing office and workshops.

A typical curricula for Colleges of Engineering in 1885 is shown below (source: System for infrastructure development)

Table 5.1: Curricula of engineering in 1885 in Japan					
First Year: Preparatory	Second Year: Preparatory	Third Year: Specialization	Fourth Year: Specialization	Fifth Year: Practical	Sixth Year: Practical
English Mathematics National History Science Drawing	English Mathematics National History Science Drawing Chemistry	Applied mechanics Surveying Steam engine engineering Civil engineering drawing Metallurgy & mine engineering Survey drawing & field survey Geology Civil engineering Mathematics Science	Field survey of planned railway lines (first term) Civil engineering Steam engine engineering Civil engineering drawing Mechanical engineering	Field studies	Field studies Graduation thesis

Thus unlike the situation in the Europe, the imperial universities in Japan offered engineering education as an applied science. As results of such education system the nationwide demand for human resources trained in applied sciences (engineering, medicine, agriculture, etc.) was fully satisfied. This had important consequences in the course of Japan's industrialization.

5.3 ISHID System Structure

Unlike the human resources development system in the development stage of Japan in the past, the low-income developing countries Nepal and Cambodia are not yet able to establish appropriate engineering educational system which could satisfy the demands for human resources and technology. It resulted in to the lack of qualified engineers and appropriate technologies in the construction industry. As discussed earlier, universities in the low-income countries lack enough number of competent faculties, physical infrastructure and facilities. Further, financial resources as well as soft infrastructure essential for knowledge searching and creating are also scanty. As such, the industry practitioners dominates educational professional (teachers) in Cambodia and Nepal, the university faculties could not have enough practices in the industry. The low academic and professional background of the faculties further hindered universities to participate in the industry practice, to conduct research, and to absorb contemporary development in the respective field. In effect, the lack of enough professional practices of university faculties could not integrate the theory and practice together in university education. Thus, a new system should be designed such that the universities in the low-income developing countries could acquire enough capability to search, absorb and create knowledge, to participate in professional practice, and conduct research for appropriate technological development. At the same time engineering educational system should offer graduates opportunities to acquire theoretical knowledge and practical skills in parallel from the university education. Thus it becomes necessary to integrate human resources development with infrastructure development together in developing countries in order to develop appropriate human resources and technologies.

5.3.1 Element of the ISHID

Competency of the graduates is greatly influenced by the quality of education. Researches have shown that quality of education is influenced by the competency of faculties, teaching-learning environment and materials, and physical facilities available in the schools/universities. Faculties' strength is the major influencer for the creativity of the graduates. The Accreditation Board for Engineering and Technology (ABET), USA noted, "the faculty is the heart of any education program" (Civil engineering body of knowledge ASCE). Thus it becomes first and prime importance to enhance the university faculties' strength in order to deliver quality education. The civil Engineering Body of Knowledge, ASCE has pointed out the four characteristics of the model full or part-time civil engineering faculty member, namely: (ibid.)

1) Scholars: Faculty should acquire and maintain a level of expertise inn subjects they are teaching. Being a scholar mandates that engineering faculty be life-long learners, modeling continued growth in knowledge and understanding
2) Have Practical Experience: Educators should have practical experience in engineering subjects that they teach.
3) Effective teachers: Student learning is optimal when faculty members effectively engage students in the learning process. The development of engineering faculty as effective teachers is critical for the future of the profession.
4) Positive Role Models: Regardless of personal desires or choice, every civil engineer who is in contact with students serves as a role model for the profession. Engineering faculty should be aware that students are viewing them in that light.

Thus it becomes essential for civil engineering faculty to acquire academic qualification as well as professional experience in order to deliver quality education.

5.3.1.1 University Collaboration

Since the universities from the low-income developing countries do not have sufficient financial resources to provide faculties opportunities to acquire higher education abroad. In addition, there are a little or no opportunities to acquire advanced education domestically. Some universities from the developed world may provide study and research opportunities which immediately benefit the developed world and but may not have immediate application and do not help address the current requirements of the local industry in the developing world. Faculties from the developing countries educated in such environment may not find right opportunities to work in their own countries which ultimately enforce or create environment to emigrate to the developed world. Such systems will further deteriorate the quality of education instead of improving in developing countries (base on interviews with faculties in Nepal).

Faculties should be scholars in the subjects, and enable them to deliver quality education to make the graduates more creative and productive in the industry. In order to make the civil engineering education relevant to the domestic needs and to make graduates productive in the industry, faculties should be aware of needs and growth trend of the industry. Thus faculties should also be scholar in the knowledge areas which have immediate and long-term influence in the domestic industry. Therefore, industrial need oriented universities collaboration would provide faculties from the developing countries opportunities to acquire hands on knowledge and skills to improve the industrial performance and quality of education.

(a) Industrial Need Oriented Universities Collaboration

An infrastructure development project undergoes various phases from planning to the completion. Different technologies are required in different stages of the project cycle. For infrastructure development a construction industry needs:

i) Investigation technology
ii) Planning technology
iii) Design technology
iv) Material design and production technology
v) Construction technology
vi) Maintenance technology
vii) Management technology, etc.

The needs of the construction industry may differ from countries to countries. A construction industry may have design technology however it may lack investigation technology. Similarly, a construction industry having investigation technology for foundation may not have appropriate design technology for bridges.

As discussed in the thesis, the low-income developing countries Cambodia and Nepal lack appropriate human resources and technologies in order to develop infrastructure efficiently. Further, the construction industry in these countries has not developed a system for human resources and technology development compatible with the industrial needs. Thus industrial needs of these countries should be investigated and analyzed before searching for knowledge and technologies.

(b) Investigation of industrial needs

The needs of a construction industry can be investigated in various ways. A distant investigation can be done from the construction industry database including type of human resources including educational background, project delivery system, project implementation period, delay, cost overrun, design standards, construction technology, etc. However, such databases are rarely available in most of the developing countries. In such situation, the needs of the industry can be investigated through the questionnaire survey asking the stakeholders regarding the practice and situation of the industry. The face-to-face interviews with the industry practitioners and stakeholders, and field visits would give the better opportunities to investigate the actual problem of the industry.

Since the construction industry and infrastructure development database were not developed in Cambodia and Nepal, the needs of the construction industry of these countries were investigated from the author's personal experience in the industry, literatures review, questionnaire survey, and interviews with industry practitioners.

Respondents were selected randomly, through personal approach, to represent all stakeholders of infrastructure development in a developing country. The respondents consisted of clients' engineers, contractors, consultants, lecturer/professors and donors' individual consultants. The respondents were first contacted through telephone and e-mail, and the questionnaire was then sent and interview was conducted at the time of collection of the questionnaires. The authors succeeded to receive positive consent from altogether 28 individuals: 11 from Cambodia, 15 from Nepal, 1 from Mongolia and 1 from Thailand. The Cambodian interviewees consisted of 3 client's engineers, 2 consultants, 3 contractors' engineer and 3 university's teachers. Similarly 5 client's engineers, 3 consultants, 4 contractors' engineers, 3 university teachers were interviewed from Nepal. The respondent from Mongolia was a researcher and a consultant from Thailand responded the questionnaire. However, filled questionnaire were only received from the respondents from

Mongolia and Thailand.

Questionnaire was designed to investigate the existing practices and problems in infrastructure development and the civil engineering education in the respondents' countries. Issues related to the construction engineers were also collected from questionnaire. The civil engineering education system was also investigated and recommendations from the respondents were also sought.

(c) Survey Results

1) All respondents reported that infrastructure development projects have acute problem of cost overrun, delay and poor quality of works.

2) All respondents except 2 university teachers claimed that every infrastructure development project had problems in one or all the stages of a project cycle.

3) All respondents from contractors and consultants background and 2 clients' engineers reported that the clients' engineers/supervisors were not familiar with contract administration, and lacked schedule, cost and quality management skills.

4) All respondents from consultants background and clients' engineers claimed that contractors' project manager in a project execution did not have enough technical and managerial knowledge and skills.

5) All respondents claimed that construction engineers as well as craftsperson did have poor communication skills.

6) 20 respondents claimed that the most of the construction technicians/engineers lacked construction and project management skills which includes management; leadership; monitoring & evaluation; schedule, cost and quality management; reporting, communication & negotiation skills.

7) All respondents reported that financial problem, lack of enough qualified construction and project management professionals, political instability and influences, large number of incompetent contractors, lack of appropriate legal system were the major problems in infrastructure development in their countries.

8) Respondent claimed the project management knowledge for the field engineers dominates

engineering knowledge in the construction stage of a project.

9) 21 respondents claimed that the fresh graduates from the civil engineering were poor at planning and project management, and lack practical skills, and 7 reported that they were uncertain regarding the quality of the fresh graduates.

10) All respondent claimed that graduates could not acquire practical skills even from the university education. The civil engineering education should incorporate more on professional practice area and internship. The entire respondent viewed that at least 10 percent of the whole curricula of the civil engineering should be covered from construction and project management area.

The author visited Cambodia and Nepal, and carried out interviews with the respondents and visited some construction site in order to investigate the actual condition of infrastructure development. Authors contacted most of the respondents who participated in the questionnaire survey. The interviewees reiterated that delay, cost overrun and poor quality of works were the major problems of public infrastructure development. They also claimed that the civil engineering education could not integrate the needs of the construction industry and could not enable graduates to acquire practical and management knowledge and skills from the university education, and consequently it could not make the industry healthy. Further, 2 contractors from Nepal expressed that they would not hire fresh civil engineers due to lack of practical skills. They claimed that fresh engineers need training but contractors were not able to offer trainings for the employees due to lack of resources.

The major issues of the construction industry in Cambodia and Nepal were related to

i) Own national standards for design and construction, and
ii) Technology for Construction and project management

Thus the Cambodian and Nepalese construction industry are in need of the human resources who could contribute in preparing standard and address the construction and project management issues. The civil engineering universities from these countries should seek collaboration with universities from the developed countries which could provide opportunities to acquire hands on knowledge and skills in the needy areas.

5.3.1.1.1 A Case of Cambodia

Like in many other developing countries, the people of Cambodia are suffering from poor and insufficient basic infrastructures. The national (primary) and provincial (secondary) roads in Cambodia are 4165 km and 3554 km respectively. Most of the facilities are centralized in the capital, and almost 10 percent of whole population is living in capital, Phnom Penh. The rural roads are about 31000 km and less than 29 percent of rural populations have access to clean drinking water supply. More than 75 percent of cultivated land is still dependent on rain water though the country has agro-based economy. The roads have large number of bridges, about 4000 on national highways alone. The road network was mostly developed before 1960. The general design standards for the roads and bridges were to cater lighter loads than current loads with many existing bridges designed for gross vehicle load of 10 tons, well below the current standard of around 20 tons (Chanphal 2004).

Most of the road network is very old and in bad condition, and many parts of the country remain isolated during the rainy season. The road condition survey 2002 has revealed that only 25 percent of the road networks in Cambodia is in good or fair condition. There were many events of bridge collapse due to the vehicle carrying the loads more than the bridge is supposed to bear. It is estimated that at least half of the primary road network and nearly all the secondary and tertiary roads are in need of urgent repair. Likewise the rehabilitation and construction of bridges is essential to provide the access for all essential services to the people throughout a year.

Non- existence of appropriate laws, regulation and a national standard for procurement, design, construction and management for infrastructure development are the major reasons of delay, cost overrun and insufficient quality in public works in Cambodia. Designers choose the design standard in which they are familiar and feel comfortable which lead to inconsistent design and quality control. British, French, Russian, American standards are among the commonly used design standards. (Source: from interviews with industry practitioners)

Traditional project delivery system (Design-Bid-Build) has been still widely used in public works. Two-actor (Owner – Contractor) project execution is common in domestically financed development works. Consultants' services are sought in the complex and foreign aided projects. Design and construction standard may vary even in similar structure implemented by different organizations due to lack of a national standard. Insufficient and weak construction supervision has lead to poor quality of works. The necessity of construction management has not been realized yet. Simple bar charts have been using in project scheduling. Critical path method was not popular in project scheduling. The contractors have not realized importance of schedule and cost analysis during the execution of a project. The construction management standards for schedule and quality management do not exist in the construction industry.

The Cambodian construction industry needs first the human resources and technologies for establishing their own standards for design and construction, and construction and project management skills in order to develop infrastructure efficiently.

(a) Assessment of existing human resources (faculties/practitioners)

Cambodian construction industry is lacking the civil engineers in quality as well as in quantity. There is no any registration system for the engineers in order to deliver the professional services. Total number of the civil engineers is not known. A fresh graduate can even practice in the industry without registration. It is therefore difficult to find exact number of the civil engineers working in Cambodia. However, it was estimated that there were about 1800 civil engineers as of 2003 were working in the Cambodian construction industry with as many as 90 percent of the whole civil engineers were on-degree graduate (undergraduates). (source: interview with the industry practitioner).

Theoretical education was the domain of the education system including the civil engineering education in Cambodia. Universities were continuing in imparting theoretical knowledge and understanding at the expense of teaching graduates skills. However, professional practice area like construction and project management is not sufficiently included in the civil engineering education. The Institute of Technology of Cambodia (ITC)—the oldest and most equipped engineering university in Cambodia still offers the following courses in its 5-year undergraduate program in the civil engineering. (Source: ITC)

Table 5.2: Course Distribution at ITC

Subjects	Hours
Mathematics	384
Physics	320
Chemistry	98
French	384
English	240
Sports	120
Technical Drawings	144
Survey	112
Construction Materials	96
Electrical Technology	80
Strength of Materials	128
Plumbing	160
Construction Equipment	64

Hydraulics	96
Geology	48
Construction Technology	216
Architecture	222
Soil mechanics & Foundation Engineering.	96
Steel Construction	238
Reinforced Concrete	238
Timber construction	128
Safety	48
Estimation	52
Economics	48
Information	148
Road construction & Design	180
Bridge design & construction	72
Structural analysis	216
Computer aided design	72
Infrastructure	48
Hydrology	48
Hydraulic Structure	48

The civil engineering subject mostly contains the elemental analysis and design of structure. However the course could not offer in the holistic way. Further, the courses do not appropriately cover the construction and project management areas like time, cost and quality management, procurement, contract administration/management, etc. The graduates, therefore, could not find opportunities to acquire hands on knowledge and skills in the areas which could improve the performance of the Cambodian construction industry.

Not only the construction industry but also the civil engineering universities in Cambodia were lacking appropriate human resources. The universities lacked faculties with higher academic achievement, research and professional experience. For instance, the institute of technology of Cambodia (ITC) had 50 percent of its faculties were undergraduate (Out of 15 faculties in the ITC 8 were undergraduates) (as of 2004). No faculties from ITC had expertise in construction and project management area. Thus the knowledge area related to the construction and project management was not included in the curriculum. However, the construction industry was demanding the engineers with expertise in the construction and project management in order to improve the efficiency in project delivery. On this ground, the client (government) preferred international contractors/consultants for the implementation of medium to large and complex projects. A problem triangle can be drawn with complains from the clients, construction industry and the universities.

The clients: the construction industry lack technical, financial and managerial capability for efficient delivery of the projects. The domestic industry practitioners lack sufficient knowledge and skills for efficient time, cost and quality management. International contractor/consultants would be suitable for infrastructure development. Local industry should compete with international companies

Construction Industry (Contractors /Industry practitioners): the clients should support human resource development and R&D, make standards, laws, regulation, and provide fair opportunities to the local contractors/consultants in infrastructure development. The civil engineering universities should deliver more practical education.

Universities: We do not have resources to deliver practical and research based education, and not much familiar with industrial needs & problems. No industry practitioners involved educational activities.

When we look at the triangular problems (figure 5.1): the clients (government) want the local industry capable enough to deliver projects efficiently and to compete with the international companies. A company needs enough technical and financial capability for the efficient delivery of a project. Further, it needs its own competitiveness to compete with the other domestic as well as foreign rivals. On the other hand contractors are demanding for privileged opportunities for the local companies, as they were aware of their lower capacity against the international rivals. In addition, they are complaining the universities education which could not fulfill the demands for the human resources and technologies required for the construction industry.

However, the universities do not have the resources (financial and human) to deliver industrial-oriented practical and research-based education. They need infrastructure to deliver quality education. As no industry practitioners were involved in educational activities, universities were unaware of the various needy areas of the construction industry. The central point of all the problems lies in the appropriate human resources and technology development compatible with the needs and development of the construction industry.

Since the construction industry in Nepal and Cambodia still remains in the form of trader, it alone cannot develop appropriate human resources and technologies. In such circumstances, it would be appropriate to strengthen universities first to make them enable to absorb, search and create knowledge and technologies to address the industrial problems. For this purpose, a bridging mechanism between the industry and universities need to be established which could feed the industrial needs and problems, and at the same time functions as the body of knowledge to search and create knowledge and technologies. This could be achieved through the Center of Excellence for Education and Research (COE&R) concept in the universities.

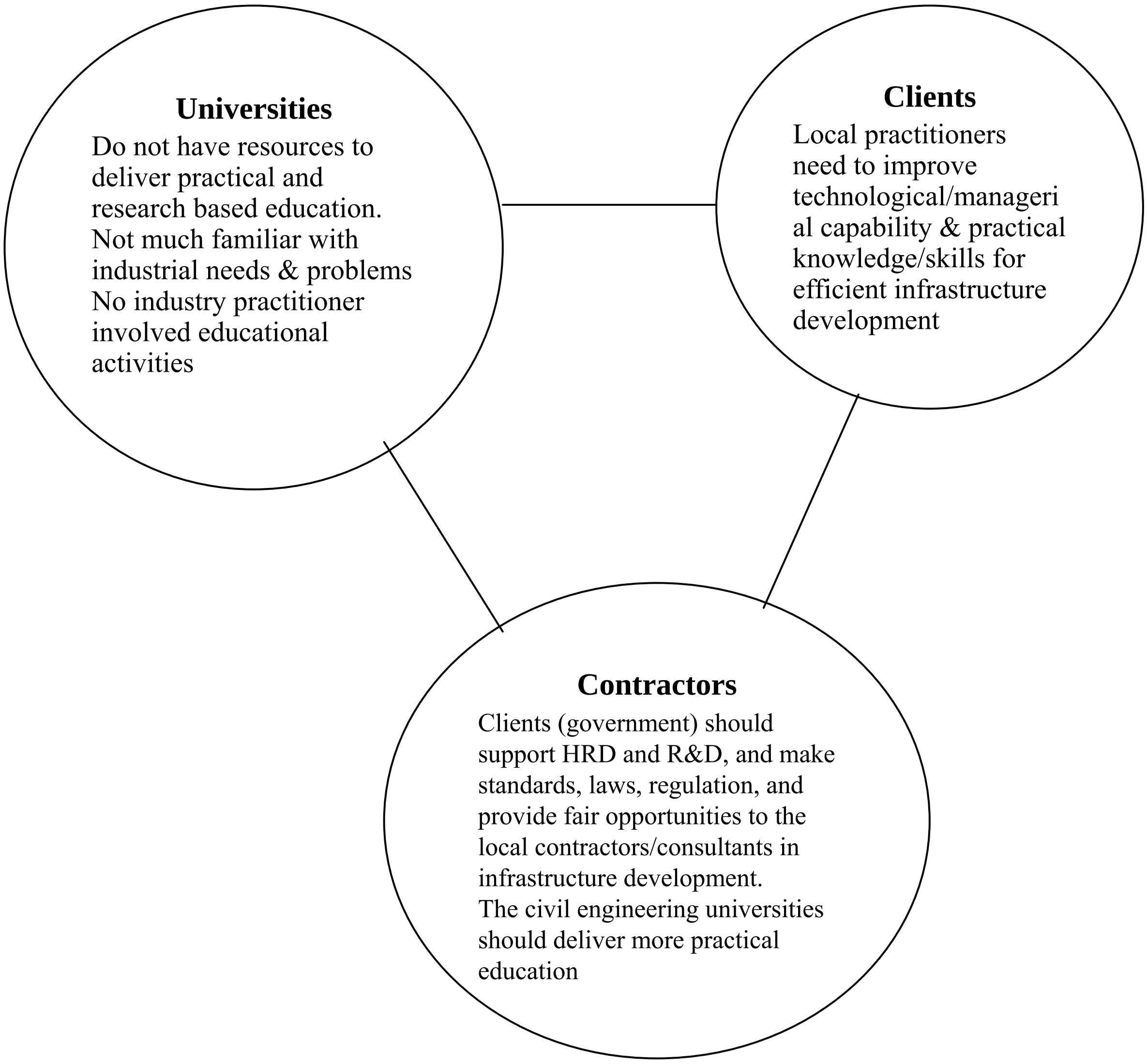


Figure 5.1: Problem triangle in construction industry development in Cambodia

(b) University Collaboration between Kochi University of Technology (KUT) and the Institute of technology of Cambodia (ITC)

As stated above, the Cambodian construction industry was in need of their own standards for infrastructure design and construction to ensure consistency and quality in infrastructure development which require research and development on construction materials and management. However, neither the industry nor universities had initiated research in those areas. The Cambodian universities also did not have enough human resources to conduct researches. The oldest and most equipped university in Cambodia, Institute of Technology Cambodia, had total 15 faculty members in the civil engineering department among them 8 were bachelor's degree holder and the remaining 7 were masters. Moreover, those faculties did not have enough capacity to deal with the need of the construction industry.

Universities collaboration between Kochi University of Technology, Japan (KUT) and Institute of Technology, Cambodia (ITC) was established in 2003 to enhance the capacity of the ITC (Figure 5.2) in construction materials research and management. Two faculties from the ITC were invited for higher studies on concrete and construction management at the KUT. A successful test production of Self Compacting Concrete in Cambodia was already demonstrated in June 2004. Further research on concrete materials and management are undergoing and the collaboration will continue in other fields also. This universities collaboration aiming at contributing to prevailing specific needs of the local industries has attracted interest of other universities from China, Nepal and Mongolia. New collaborations will be forwarded on the basis of the need of the construction industry of these countries.

Further to universities collaboration, as a part of this research, a Center of Excellence and Research was proposed to establish at the ITC to initiate research and development works on construction materials and construction project management to fulfill the needs of the Cambodian construction industry. The center will provide opportunities to university faculties, students and local professionals to conduct research and development works together to develop appropriate construction materials and their standards in Cambodia. In addition, the center will remain continuously investigating needs of the industry and providing feedback to education to help improve curricula, educational materials and teaching-learning environment in the Cambodian university education. The center will bring professional practitioners and foreign experts in to the academic, research and development activities in parallel. The center could also be developed as a center for technology diffusion in Cambodia.

However, this system requires coordinating executing and donor agencies for financial support to enable to establish and run smoothly. ODA from the developed country in the form of technical assistance and grant aid would be essential for start-up of the center. The investments on education in some middle-income developing countries indicate that at least additional 2 percent of the gross domestic product should be allocated to improve quality of education, and for research and development in the least developed countries.

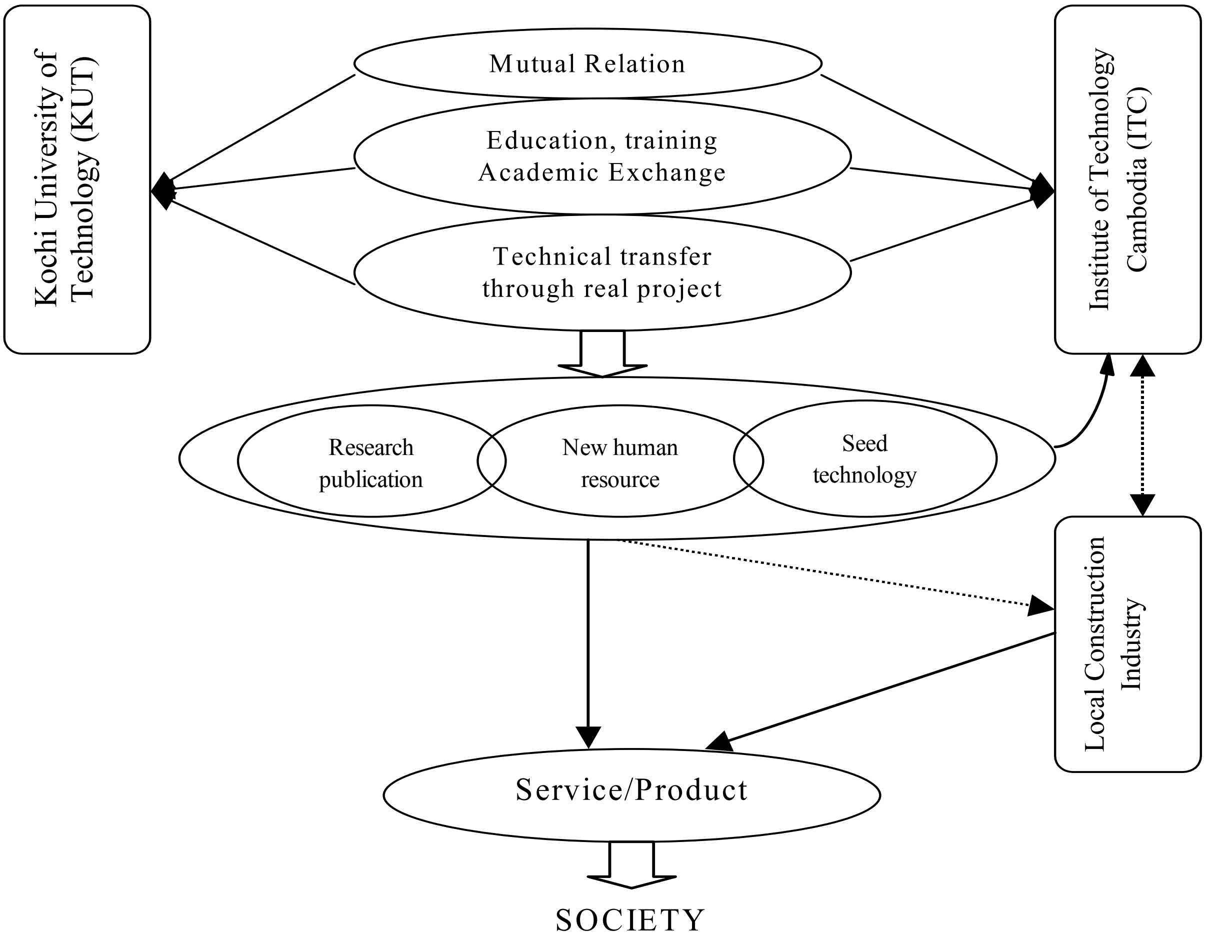


Figure 5.2: Working Modalities of Universities (KUT-ITC) Collaboration

5.3.1.2 Center Of Excellence for Education & Research (COE&R)

The concept of the center of excellence was initiated in the United States in 1990. In 1990, Congress in the United States enacted a public law that allowed for the creation of Centers of Excellence (COE). The purpose of these Centers of Excellence was to generate a "critical mass" of expertise and produce work of unsurpassed quality, value and relevance. In addition, Congress mandated that Centers of Excellence provide for continuing education of students, professional networking, and the collection and distribution of information (Vanchieri, A.R. 1997). Almost 10 years later the COE concept was adopted in Japan. The ministry of education, culture, sports, technology and science (MEXT), Japan established a program named 21st Century COE program in 2002 to cultivate a competitive academic environment among the Japanese universities.

However, the center of excellence for education and research (COE&R) in this study is a non-profit making organization established at a university. The center normally, comprises of faculties, researchers, and industry professionals with enough capacity for education, research and development. The management and business of the center is made free from the governmental bureaucracy to reduce the control over knowledge creation and academic freedom. The administration and accounts are kept independent from the university's administration and accounts to make easy and radial interaction and business with government and industries. In order to develop appropriate human resources, technologies and materials, the COE&R establishes research, training and production facilities.

In effect, the establishment of COE&R at the universities is to consolidate the scattered human resources and knowledge, to make integrated theory and practice in the university education, and develop appropriate technologies for infrastructure development.

5.3.1.2.1 Activities of the Center of Excellence for Education and Research

The activities of the center will be, but not limited to, 1) education and training, 2) research, 3) professional services, and 4) production of special materials.

(a) Education and Training

The education and training function of the center is intended to enhance the capacity of the faculties, practitioners and graduates. The education and training includes infrastructure planning, design, construction, operation, maintenance and management. The technology for materials production, construction and management are introduced accordingly to the needs of the industry. The trained faculties through university collaboration, industry practitioners and faculties from the developed countries are the resource persons for the education and training. The education and training activities are aimed at:

- to investigate the needs and growth of the industry, and make faculties, graduates and practitioners aware of the prevailing issues and future needs of the construction industry.
- to offer faculties, graduates and practitioners training on infrastructure planning, design, construction, maintenance and management in order to address the needs of the local as well as global construction industry.
- to make the faculties, graduates and practitioners familiar with modern technology and

contemporary research and development which could help improve the performance of the local construction industry

- to develop appropriate curricula in order to combine theory and practice in the university education, and update accordingly with the industrial growth.
- to offer graduates internship training compatible with the local as well as global industrial needs.

The graduates as well as practitioners from the developed world, through the education and training activities of the COE&R, would have opportunities to experience the infrastructure development environments in developing countries, and help make them able to work in the multicultural environments. These opportunities would especially help the Japanese graduates/practitioners (who were often commented for low communication and management skills in multicultural and mutually mistrust environments (Kusayanagi 2004)) to improve their communication and management ability in order to improve their global competitiveness.

The education and training function of the center will enable universities in the developing countries able to deliver appropriate education and training domestically which would reduce the education and training cost that are currently done in the developed countries. This will help lower the loan burden of the developing countries.

(b) Research

Researches in the center are designed to develop appropriate technology as well as to transfer technology from the developed countries in order to improve the performance of the local construction industry. Researches are primarily focused on the construction materials, design standards, construction technology and construction management with the industrial needs and growth.

The center could be developed as a technology diffusion center to disseminate the modern technology and researches. The modern technology developed in the developed countries could be made available in the least developed countries through ODA and/or universities/industries collaboration, and be materialized through the researches at the center.

(c) Professional Services

Since the main objective of the center is to strengthen the university's human resources and technological strength, it would create pool of the faculties who can deliver the professional services required for the construction industry. The lacking area of the local faculties can be supplemented from the developed world through the university collaboration. Professional services in a specific as well as integrated area can be delivered through such as construction manager, consultants and experts. This function of the center will make the universities to be financially self-sufficient.

The professional service delivery through the center will provide the local industry opportunity to get the integrated service from the single organization which will reduce the contractual complexity and administrative burden that may arise in a project due to the involvement of many organizations for different services. This will also enable the local university to be self-financed. The benefit from the services would enable the university able to invest more on research, and deliver education at the reasonable cost.

(d) Production of Special Construction Materials

In order to improve the efficiency in infrastructure development, the center introduces special type of materials with higher performance and quality than the local industries have. The technology for the production of such materials will be brought from the developed country through the university collaboration. The production of the special materials at the COE&R will also enable universities to improve financial condition.

Further, such system helps universities to enhance the education, research and social contribution functions, and industry to acquire capacity for technology development and innovations. Thus, the center would help improve the quality of education, and provide academics and professionals opportunities to work together. The integration system of industrial activities to university education through the functions of COE&R is shown in Figure 5.3.

The existing human resources and infrastructure development environments in Nepal and Cambodia show that these countries need immediate establishment and operation of COE&R for infrastructure development and management at the civil engineering university. The COE&R should first work on infrastructure design and standards, and construction materials, technology and management. Thus, a COE&R in Nepal and Cambodia may have several branches like infrastructure design and standards, construction materials, construction technology and construction project management. However, the existing faculties strength and financial resources of a typical civil engineering universities/colleges from Nepal and Cambodia are not sufficient to perform research and development in the above-said areas. In order to improve the situation, industry and the governments should allocate additional funds to universities for research and development which is not existed now. Further, inviting foreign advisors and/or sending faculties for higher studies through universities collaboration and technical cooperation from the developed countries could strengthen the capacity of the universities and the center as well. Industrial need oriented universities collaboration established in this research would be appropriate for a university from the least developed country to enhance the human resources and technological strength required to contribute for the industries. The collaboration between the Kochi University of Technology (KUT), Kochi, Japan and Institute of Technology Cambodia, described in following paragraphs, shows industry-oriented universities collaboration.

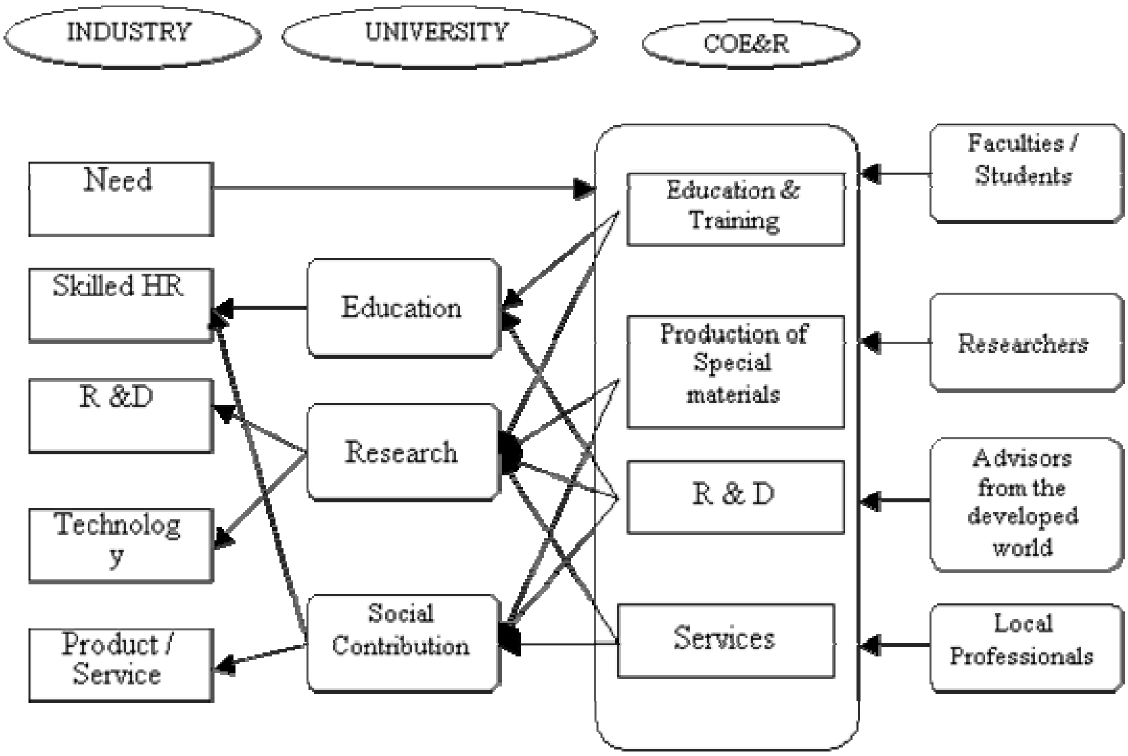


Figure 5.3: COE Interface to strengthen Industry through University functions

5.3.1.3 Involvement in the Development Works

The whole activities of the COE&R will make universities to be self sufficient in human resources and technology that enable them to involve in the development activities through the professional services, products and technologies. This will strengthen the university-industry linkage, and encourage the universities to develop industry oriented human resources and technologies.

5.4 Model for Integrated System for Human Resources and Infrastructure Development

Based on the concept and background, and the elements discussed above, an "integrated system for human resources and infrastructure development" has been developed. Universities collaboration is the first and primary activity of the system. A university (or university consortium) from the developed countries makes collaboration with the universities (or university consortium) in the developing countries. With the involvement of the trained faculties, a center of excellence for education and research with enough educational, research and development facilities is established at the universities in the developing countries. Human resources, technologies and materials are produced in order to fulfill the demands for infrastructure development. The model for "integrated system for human resources and infrastructure development" is shown in figure 5.4.

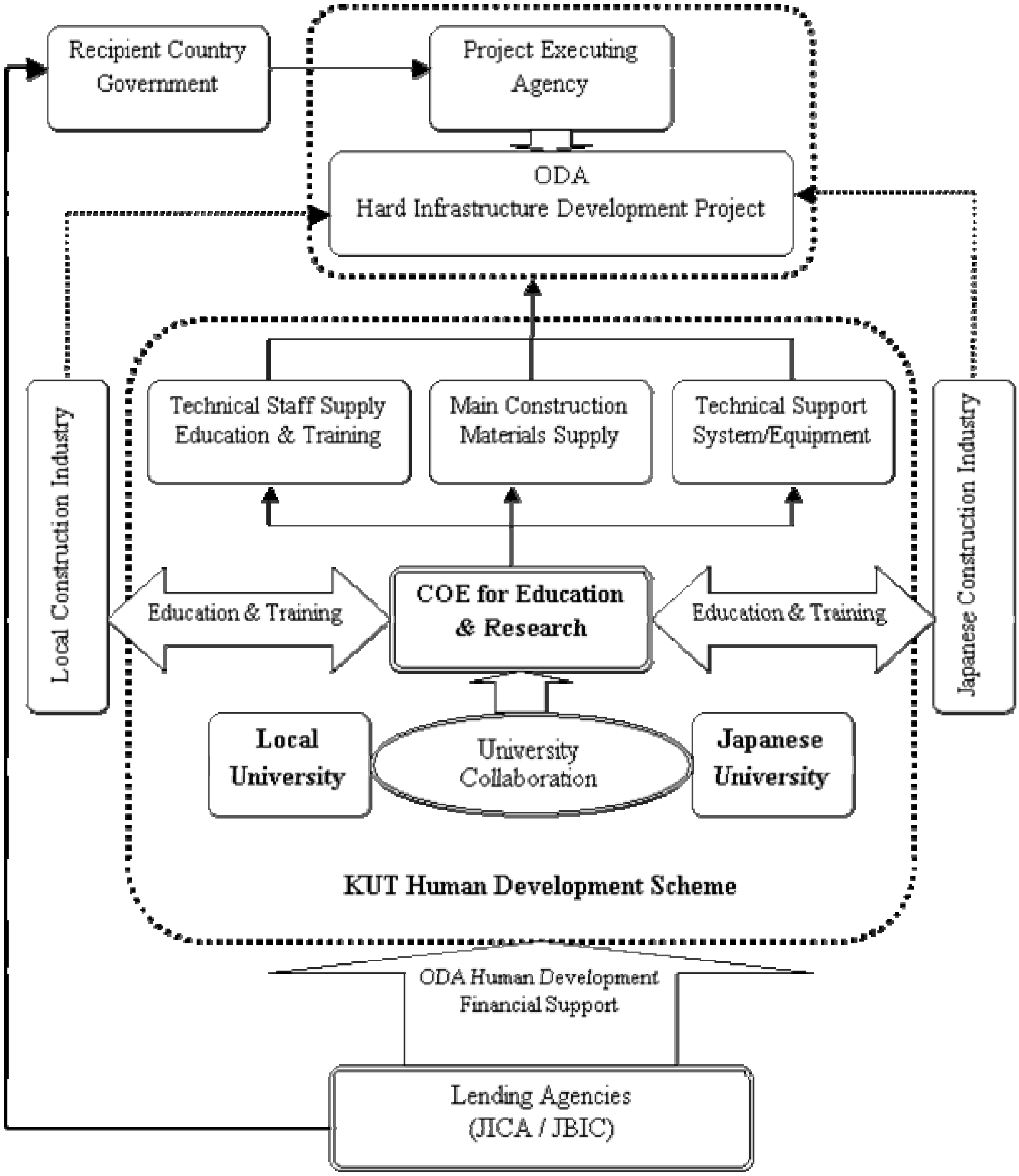


Figure 5.4: Model for Human Resource and Infrastructure Development under ODA

5.5 Technology, Knowledge and Skill Transfer Process in the Proposed System

The proposed system offers the vertical as well as horizontal transfer process in order to transfer technology, knowledge and skills efficiently among the participants of the system. It was assumed that the faculties and professionals are kept on one horizontal level and the graduates are kept on the second horizontal level. The faculties and professionals from the developing countries will have opportunities to acquire the technology, knowledge and skills from the faculties and professionals from the developed countries. The modern technological knowledge and experiences (in the development stage of their countries) of the faculties and professionals from the developed countries will be the resources for the faculties and professionals from the developing countries, and graduates from the developing as well as the developed countries. Since there is a little or no opportunities for the graduates in the existing education system to share the knowledge and experience of the senior industry professionals, the proposed system will provide the graduates from the developing as well as developed countries opportunities to acquire knowledge and skills from the senior faculties and the professionals from developing as well as developed countries. This transfer system in the proposed system is termed as vertical transfer process. For example, sending the Japanese graduates with the faculties/senior professionals through university collaboration and involving in the activities of the center of excellence for education and research in the developing countries would provide the participants opportunities to share the knowledge and skills each other. The faculties and the graduates from the developing countries will have chance to learn from the Japanese faculties and professionals, and at the same time the Japanese graduates will have opportunities to acquire knowledge and skills from the faculties and professionals, and share their knowledge with their counterparts. The Japanese graduates can experience the development environments and culture of the developing countries. This will help them to acquire skills required to work in the global construction market. The faculties and graduates from the developing countries as well as the graduates from the developed countries would be benefited from the single integrated system proposed in the study. The technology, knowledge and skills transfer process in the proposed system is shown diagrammatically in the figure 5.5.

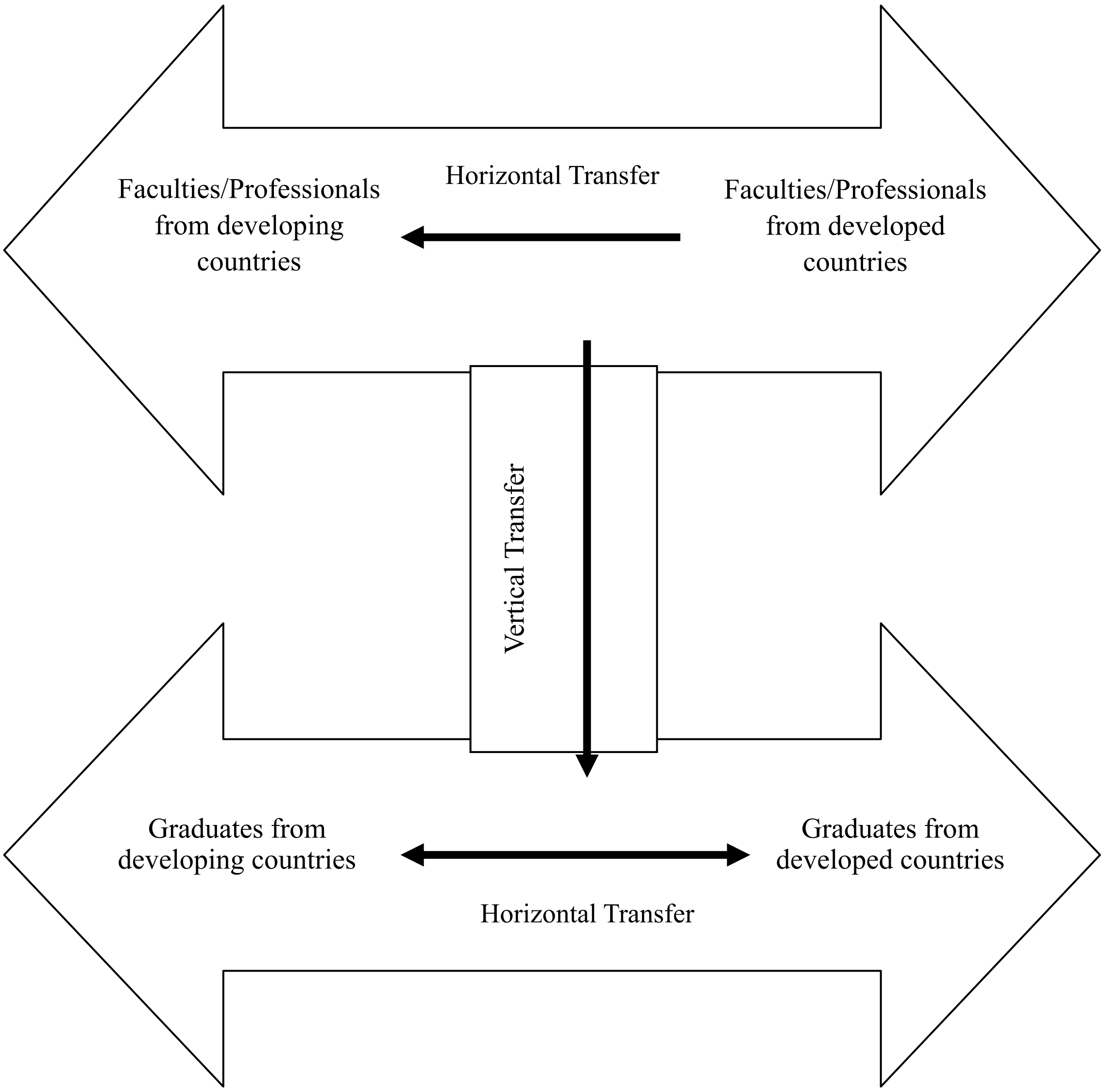


Figure 5.5: Horizontal and Vertical Transfer of Technology, Knowledge and Skills

Chapter 6

6. Implementation Procedure of the Integrated System for Human Resources and Infrastructure Development

6.1 Introduction

This chapter provides the overall implementation system for the 'Integrated System of Infrastructure and Human Resources Development'. The proposed system is the integrated system of development works, human resources and technology development. This system is especially useful for the developing countries which are not yet able to produce appropriate human resources and technologies required for the socio-economic development. It will provide local universities from the developing countries opportunities to produce appropriate human resources and technologies with the help of the universities and the concerned industry from the developed countries through the development assistance program.

6.2 Overview of the Integrated System

The integrated system has been developed in order to enable the low-income developing countries to be able to produce appropriate human resources and technologies domestically through the Official development Assistance (ODA) program. This system integrates the existing fragmented system of hard infrastructure and human resources development under ODA program. In contrast to the existing ODA system which do not consider the capacity of the local universities regarding the human resources and technology development in developing countries, this system incorporates the university functions in infrastructure development process in order to develop appropriate human resources and technology required for the development works. The proposed system also provides the opportunities to deploy the human resources and technologies developed within the system in the targeted projects which do not exist in the existing ODA system. Further, the universities and the construction industry would have opportunities to work together in the proposed system.

The proposed system contains three major consecutive activities which are also shown in the Figure 6.1, are: i) capacity improvement through University Collaboration, ii) development of human resources and technologies at the Center of Excellence and Research, and iii) deployment of the human resources and technology in infrastructure development projects.

6.3 Implementation System

Before explaining the implementation system of the new system it essential to brief about the existing project implementation system. As discussed earlier development projects are usually prepared in haste for implementation in order to fulfill the demand for the infrastructures. However, appropriate human resources and technologies are not developed in order to develop infrastructure efficiently. Further, what appropriate human resources and technologies would give efficient delivery of the projects were not considered in the existing system. In addition, the quality of human resources and technologies applied in the projects were never evaluated even though the project was not completed within the planned resources (time and cost) and suffered from quality problems. Even the existing ODA projects do not consider the local human resources and technology while implementing the development projects. ODA projects are implemented on the assumption that foreign human resources and technology will fulfill the lacking of the local

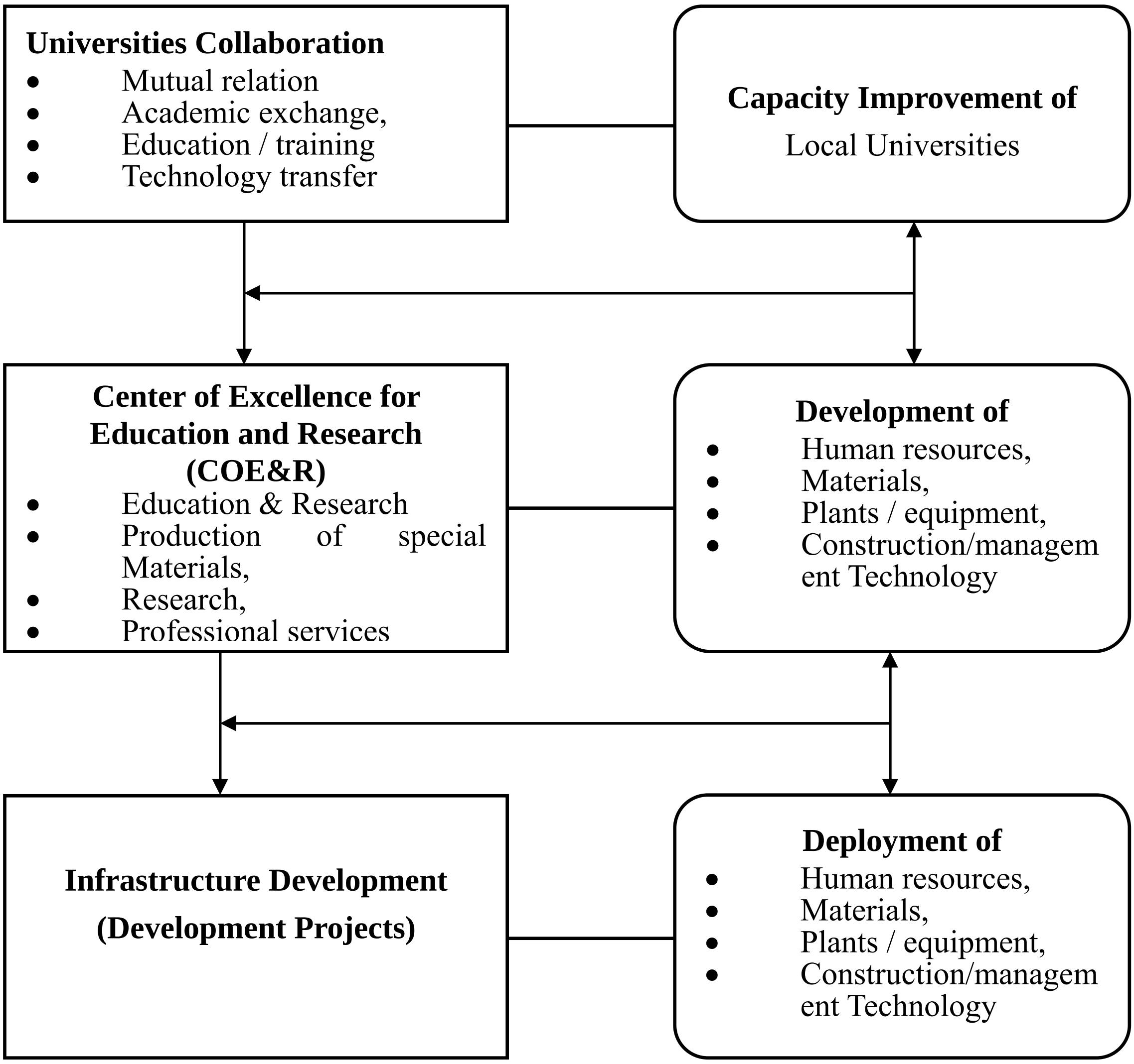


Figure 6.1: Sequence and Major Activities of the Integrated System

industries. Because of such system local human resources development system (university education) is not linked with the development system in developing countries, and the universities could not produce human resources and technology compatible with the needs of the industries.

The three major activities of the new system as listed above i) capacity improvement through University Collaboration, ii) development of human resources and technologies at the Center of Excellence and Research, and iii) deployment of the human resources and technology in infrastructure development projects are envisaged and planned in the Project Preparation phase of infrastructure development. What type of human resources, materials, equipment and system technologies would be appropriate to deliver the project efficiently are investigated during the project preparation. The technological investigation includes the technology required for materials production, construction and management technology to be developed for the efficient implementation of the projects in question. The human resources capable of handling and managing the technology required for the projects are also developed before the execution of the projects. The execution plan of the system is described below.

6.3.1 Step 1: Capacity improvement through University Collaboration:

As discussed earlier the universities from low-income developing countries Nepal and Cambodia were not capable enough to develop appropriate human resources and technologies domestically. The universities in these countries lack enough number of qualified faculties, physical and research facilities, and financial resources in order to develop qualified human resources and conduct research for appropriate technology development.

Once the quality of human resources and type of technologies required for the project in question were known, the local universities assess their own capacities and seek for universities collaboration from the developed countries in order to fulfill the deficient area. The suitable universities are selected from the universities database from the developed countries. The university collaboration includes mutual relation, academic exchange, education/training for faculties and technological transfer from the developed country. The universities from the developed country provide the universities from developing countries opportunities to acquire hands on knowledge and skills on the required technology and management in order to develop appropriate human resources and technologies for the project under consideration. In order to achieve the targets the local universities could either send their faculties to the collaborated university or request the faculties/researchers to come to the local university to train the faculties in recipient countries. In this way the local universities could be made capable to handle and manage the targeted knowledge area and technologies. This would enable local universities able to reproduce the technologies locally and to develop new human resources for future projects.

The activities under the university collaboration can be summarized as below:

1.1) A university from a developing country will collaborate with a university (or university consortium) in Japan to exchange human resources for making the bases of technological transfer in the recipient country.

1.2) The exchange of human resources between two universities shall be carried out as follows.

- From the Japanese university side: Faculties with enough knowledge and skills in i) construction materials (concrete), ii) structural analysis & design, and iii) construction technology and management will deliver the special lectures at the university in the recipient country. Those three fields (*more other fields can be included as per the needs of the construction industry of the recipient country*) were selected in order to establish the standards for infrastructure construction, and improve the quality of construction materials, infrastructure analysis & design, and construction technology & management in the developing countries.

- From the university of the recipient country: The university of the recipient country will dispatch their faculties to the Japanese university. Faculties from the university of the recipient country will have opportunities to go for higher studies/ advanced trainings/researches in order to acquire hands on knowledge on technology and management skills at the Japanese university. The trained faculties will be the key persons for managing COE for Education & Research that will be established in the recipient country. The advanced studies/trainings/research will be focused in order to develop appropriate technology and management to fulfill the needs of the construction industry of the recipient countries.

1.3) The technology and management required for the construction industry of the recipient country will be determined, and the appropriate infrastructure development projects shall be sought under the joint operation of two universities.

These activities can be done in parallel to the feasibility study or investigation stage of infrastructure development project. The consultants as well as contractors from the developed country designated for the projects under consideration could be the resource persons to enhance the capacity of the local universities.

For Cambodia:

As discussed earlier, road networks in Cambodia were developed in the 1960s and about 4000 bridges/culverts are along the networks. The bridges were designed to bear about 10 tones only, and there were many cases of bridge collapsed due to the overloading, and many parts of the country remain isolated during rainy season due to lack of bridges and good roads. In addition, the local construction industry and universities do not have enough number of technical manpower in making standards for infrastructure design, and technology for developing appropriate construction materials for roads and bridges. In such situation, the collaboration between the KUT and ITC will help improve the situation by training the faculties from the ITC and transferring the concrete technology to produce high strength pre-cast/pre-stressed concrete beam/girder in Cambodia. Thus, enough numbers of engineers should be trained and complete technology for producing the concrete beam/girder should be transferred before the bridge rehabilitation projects start.

6.3.2 Step 2: Establishment of Center of Excellence for Education and Research (COE&R) and Development of Human Resources and Technologies

Since the universities in the low-income countries lack research habit and physical facilities to conduct research, it is essential to establish the Center of Excellence and Research (COE&R) at the universities with the assistance from the government and/or donor agencies in order to develop appropriate technologies along with qualified human resources suitable for the local needs and environments. Once the local universities acquires the capacity to handle and manage the targeted technology, the research and development in local environment with the local industry practitioners will be done at the center of excellence and research. It would be further appropriate to establish the production facilities at the center in order to convert the research in to the products to use in the projects under consideration. The production facility and the immediate use of the products developed in the project would ensure the sustainability of the transferred technology. This will provide universities and industry opportunities to develop appropriate technologies or modify technology to make it appropriate for the local industry. At the same time, the universities conduct education and training program in order to make the construction engineers able to handle and manage the technology.

The center of excellence and research would also bridge between the universities and the industry. This will bring the practitioners and academics together to develop targeted technologies and human resources for the projects under consideration which will pave the way to feed the industrial needs to the education system. The involvement of the graduates in the activities of the center of excellence and research will provide opportunities to be familiar with the industrial problems and find solutions with the industry practitioners. This will enable universities able to deliver industry-oriented research-based education.

The technological assistances from the developed countries could be continued through the universities collaboration. The services of the designated consultants and contractors could be taken in the research and development works at the center during the implementation of the projects. The activities i) and ii) can be overlapped for a project having short implementation period.

The activities under the establishment of the COE&R and development of human resources and technologies are summarized below:

2.1) Under the scheme of NPO (non profitable organization), Center of Excellence for Education and Research (COE&R) with the involvement of trained faculties will be established at the university of the recipient country to conduct activities as discussed in 2.4 below. The COE&R will invite appropriate personnel from the industry side as necessary.

2.2) Research laboratory with enough facilities for research and training will be established at the university of the recipient country.

2.3) The facilities for special construction materials production will be provided to the COE&R from the Japanese university side under the scheme of the Japanese ODA for developing the appropriate technology for the materials production.

2.4) The activities of the center will be, but not limited to, 1) education and training, 2) research, 3) professional services, and 4) production of special construction materials.

2.4.1) Education and Training (E&T)

- The center will organize the education & training on the construction materials (concrete, etc.) technology, infrastructure analysis & design, construction technologies, and construction project management.
- The education and training program will be offered to the university graduates as well as the construction industry practitioners. The university graduates and construction industry practitioners from the recipient country as well from Japan can participate in the program.
- The training specific to the local industrial needs will be regularly conducted. Contemporary researches and development in the related area will be introduced through training and seminars.
- Appropriate curricula in order to combine theory and practice in the civil engineering education in the recipient country compatible with the needs and growth of the construction industry will be developed and introduced.

- In order to provide practical education, internship training for graduates will be provided in the summer/winter vacation period.

The education and training function of the center will enable universities to deliver appropriate education and training domestically which would reduce the education and training cost that are currently done in the developed countries. This will help lower the loan burden of the developing countries.

2.4.2) Production of Special Construction Materials

- The center will involve in the production of special materials that shall have higher performance and quality than the local industries do have. For instance, the high strength pre-stressed/pre-cast concrete products are intended to produce in Cambodia in order to make availability of the high strength concrete beam/girder in the local industry to facilitate the rehabilitation of bridges. The products that COE&R produce will be supplied to ODA project provided by Japan, and ODA projects will refund those materials cost back to COE&R. The COE&R will be able to continue its operation under this scheme.

2.4.3) Research

- Researches in the construction materials, design standards, construction technology, and construction management will be done through the faculties/researchers from the recipient country. The advisors from the Japanese university will help and guide the researches.
- The development of appropriate local technologies and transfer of the Japanese technologies will be materialized in the recipient country through the researches at the COE&R.

For instance, technologies for self-compacting and high strength pre-cast/pre-stressed concrete products were intended to transfer to Cambodia through the university collaboration between Kochi University of Technology (KUT), Japan and Institute of Technology of Cambodia (ITC). The research on the concrete technology is already in progress. 2 faculties from ITC are currently pursuing Ph.D. at KUT in the concrete technology and management in order to transfer the above-said technology to Cambodia through university collaboration.

The research functions of the center will enable the universities not only to be able to develop appropriate technologies for the construction industry but also able to deliver research-oriented education which is non-existence at present in many low-income developing countries.

2.4.4) Professional Services

- The COE&R will create pool of the faculties who can deliver the professional services in infrastructure planning, analysis, design, material production, construction and management.
- The Japanese faculties/experts will supplement the lacking fields.
- Professional services in a specific as well as integrated area will be delivered through such as construction manager, consultants, experts and so forth.

The service delivery function of the center will enable the universities to provide professional as well as experts services in elemental as well as integrated area in infrastructure development.

For Cambodia:

The COE&R with production facilities should be established at the ITC in order to materialize the seed technology for high strength concrete beam/girder production in Cambodia. The faculties trained in these fields at KUT would be the key persons to conduct the research and development in concrete products. The training on concrete technology and management can be delivered in order to produce enough numbers of competent engineers locally for infrastructure development. Thus COE&R at ITC would enable the Cambodian construction industry to have enough numbers of qualified engineers and special construction materials for roads/ bridges rehabilitation and development.

6.3.3 Step 3: Deployment of the Human Resources, Materials and Technology in the Development Works

The human resources, materials and the technology developed from the center will be deployed in the execution of infrastructure development projects. This study envisaged that the construction management project delivery system, as discussed later, would be appropriate to efficiently deploy the human resources, materials and technology in the development projects. The donors' consultants/contractors in coordination with the client of the recipient country will have the responsibility for the management and administration of the project. The local construction industry will execute the work through the local human resources and materials. The required advanced technology, materials and human resources will be provided through the COE&R. The project execution method is shown in the figure 6.2.

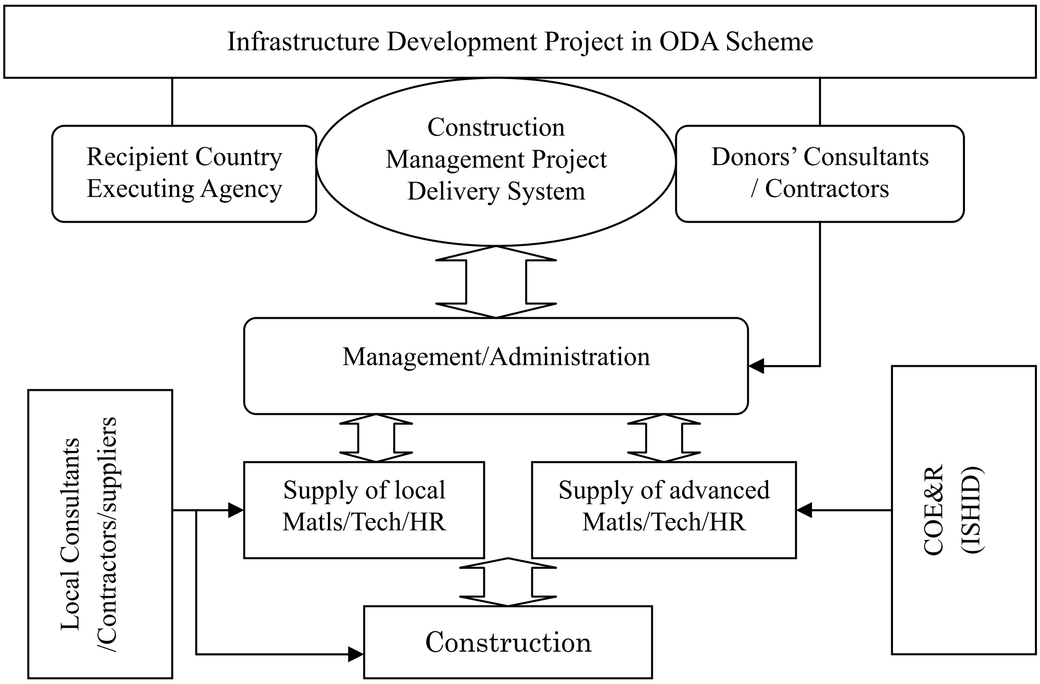


Figure 6.2: Proposed execution system for ODA Project

The use of the local human resources and the materials will help improve the capacity of the local industry. The involvement opportunities of the faculties and graduates with the consultants and contractors would create environment for the flow of knowledge and experience of the industry professionals to the new generation. In addition, the proposed execution system would provide the donor contractors, for instance the Japanese contractors, to manage and administer the project instead of construction. This would provide the Japanese construction engineer to enhance their management skills including communication, negotiation skills, etc. Further, the local contractors would have opportunities to acquire skills and technology from the Japanese contractors/consultants. This would further help to diffuse the Japanese technology and management in the developing countries.

For Cambodia:

The engineers trained in the infrastructure design, construction and management could be deployed in the roads and bridge rehabilitation projects. There will be no need of expensive foreign human resources so that project cost could be reduced. Similarly, if the local industry could produce the required construction materials like the high strength pre-stressed/pre-cast concrete beam/girder, the faster construction with reasonable price would be possible. This would enable the Cambodian construction industry able to rehabilitate/develop the roads networks. Alternatively, the ODA projects could also deploy the engineers as well as the construction materials produced by the local universities so that the universities would be encouraged to produce more productive engineers and appropriate technology for infrastructure development. This will further reduce the loan burden to hire foreign human resources and technology for infrastructure development in Cambodia.

6.4 Opportunities for the Japanese construction Industry in the ISHID

6.4.1 To improve competitiveness

It was found that the construction and project management education in Japan is insufficient as only a few civil engineering universities in Japan are involved in the same. Only 19 out of 209 civil engineering universities are delivering some of the areas, if not integrated, of construction and project management. Further, the existing opportunities at the universities are insufficient to acquire enough skills to be competitive in the global construction market (Galloway, P.D. 2005).

In addition, the author drew a similar perception from the interviews with the Japanese engineer that they (Japanese civil engineer) do not have enough confidence and/or ability to manage the local people in the developing countries. Such observation also supports the remarks drawn by Kusayanagi, S. 2004 that 'the Japanese civil engineers are ambiguous in their saying. Their negotiating skills on international practices, communication ability in foreign languages, and management ability are not sufficiently high'. The author has experience of the Nepalese construction industry, and has visited Cambodia, China and Indonesia to observe the construction environment in different countries. The author found that the Japanese contractors and consultants were engaged only in the Japanese ODA projects, and were unable to win major consulting and construction contract through the competitive bidding. A Japanese contractor in Cambodia informed that he could not compete the Chinese/Vietnamese contractors because of their lower price in the bidding. The author asked the Japanese contractor, why the Chinese/Vietnamese contractors could bid at lower price than yours? The answer was he proposed all the technicians Japanese, and the Japanese are expensive than other Asian. So the price naturally was higher than any other Asian contractors. He further claimed that the quality of the Japanese contractors are better than that of Chinese/Vietnamese, and consequently the price will also be higher compared to others. The author further questioned regarding the use of the local technicians under the Japanese management, he told that he is afraid of using many local technicians as he did not have confidence on the quality of the local human resources and thinks that using many local technical human resources requires extensive management skills to manage them and may create risk in the timely completion and anticipated quality of the project.

As discussed in the preceding chapters, the Japanese civil engineers need to improve their management skills including communication, negotiation, dispute resolution which are required to be competitive in the global construction market and to work in the multinational teams in multicultural environments. However, the existing education system does not have incorporated all these matters. So, the author has proposed the education and training for the Japanese graduates/practitioners at the center of excellence for education and research established at the universities from the developing countries. The training on the local legal/political/management/administration system, construction management practices, communication/negotiation in local culture and environments, and so forth will be conducted through the COE&R. The training course can be tailor made according to the need of the industry. In addition, the proposed system will also provide internship opportunities for the Japanese graduates in the developing countries. This would enable the graduates as well as practitioners to enhance their communication and negotiation skill and widen their understanding about the developing countries' people and working environments. This would improve the confidence and ability of the Japanese civil engineer to work in multinational teams and multicultural environments, and enhance management ability to manage other people.

6.4.2 To transfer technology, culture and management

University collaboration in the ISHID consists of human resource development and technology transfer simultaneously, and the COE&R will materialize the transferred technology at the recipient countries. In contrast to the existing clients' ODA, the proposed system will provide opportunities to develop and innovate the technology at the COE&R, and provide opportunities to apply in the real projects. In effect, the proposed system develops human resources and technology in parallel. This will make radial diffusion of the technology in the recipient countries. All concerned agencies/organizations will have access and opportunities to use the human resources and technology developed at the COE&R. In addition, the Japanese culture, management and technology could be transferred efficiently by providing local industry opportunities to work under the Japanese management as proposed in the infrastructure execution system in 6.3.3.

It is relevant to discuss about the Japanese culture of 'honesty and sincerity' at work in relation to the construction industry in Nepal and Cambodia. The author during his study (3 years) in Japan observed that the employee (part/full timer) in Japan use to work very honestly and sincerely. The author observed some of activities in the construction site, restaurants and supermarkets, and found that the employees did not have any intentions to cheat the employer. They were working continuously without resting in the working hours. They even have the fixed time for drinking water and taking break. However, it is difficult to experience such honesty and sincerity at work in the Nepalese as well as Cambodian construction industry. A contractor needs supervisors to watch the construction workers in Nepal. The workers tend to do less work as much as possible. The decision making process in the Nepalese bureaucracy has the similar characteristics. The 'tomorrow' culture is prevailing in the governmental bureaucracy.

The author was reported an interesting facts regarding the tendencies of the construction workers in Cambodia. One concrete factory established by a Japanese company at Phnom Penh, Cambodia used to operate with the Japanese skilled workers. There was no necessity to check the skilled workers (Japanese) activities once they were instructed to do a job. Later the management replaced the Japanese workers by the Cambodian. The management required additional people to employ to watch the activities of the Cambodian workers continuously; otherwise they would go for talking, taking break and work improperly. The author realized that it is necessary to transfer the Japanese working culture to the countries like Nepal and Cambodia to improve the productivity of the labor force. As envisaged in the ISHID, the Japanese culture and management could be efficiently transferred if the local industry provided opportunities to work under the Japanese management or in the Japanese team as proposed in 6.3.3. This would be the great achievement of Japan's ODA if it could provide the labor force from the countries like Nepal and Cambodia opportunities to improve their 'honesty and sincerity' through the transfer of the Japanese working culture.

6.4.3 To formulate strategy for overseas business

The existing ODA system provides the industry opportunities to involve at the execution level. However, the ISHID system would provide the Japanese industry practitioners enough opportunities to know the conditions regarding the human resources, technology and development. This would enable the Japanese industry to analyze the real situation, necessity and prospective business in the recipient countries. Accordingly, the Japanese construction industry would have opportunities to transfer the technology for design, construction, material production and management. It will further pave a base for the acquisition of the local firms and improve the overseas business. The proposed ISHID could be the medium to formulate the strategy in order to improve the overseas business.

6.5 Interrelation of the ISHID activities and Infrastructure Development Project Cycle

The activities incorporated in the integrated system for human resources and infrastructure development (ISHID) are done continuously at the macro-level of infrastructure development. However, the activities under the ISHID can be linked at the micro-level project also. A development project normally passes thorough several stages of the project cycle. The common stages of a project cycle are i) feasibility stage: it includes project formulation, feasibility studies, strategy for design and implementation, etc., ii) Planning and Design stage: project design, preparation of cost and implementation schedule, defining and finalizing contract terms and condition, detailed planning are the activities performed in the planning and design stage, iii) construction: all construction activities at the construction sites, manufacturing, installation, testing are done during the construction stage, and iv) operation and maintenance: operation and maintenance of a facility are done after the completion and hand over of the project.

The activities of the proposed system can be linked with the project cycle. The activities under the university collaboration can be done at the initial stage of the project. Capacity improvement of the universities and the transfer seed technology can be linked with the project planning, feasibility and strategy design. The linkage at this stage enables the universities from the developing countries to acquire project specific technology and skills which will have immediate application in the domestic industry.

The development of technology for production, construction, system management, and training for human resources are done at the center of excellence for education and research at the planning and design stage of the project. This enables the industry to get the right technology, materials and human resources at the right time. The utilization of the technology and materials are done at the construction, operation and maintenance stages of the project cycle. However, human resources can be deployed from the initial stage throughout the project cycle. The trained faculties are deployed from the feasibility stage however the trained engineers/practitioners can be deployed from the construction stage. The interrelation of the ISHID activities and the project cycle are shown in the figure 6.3.

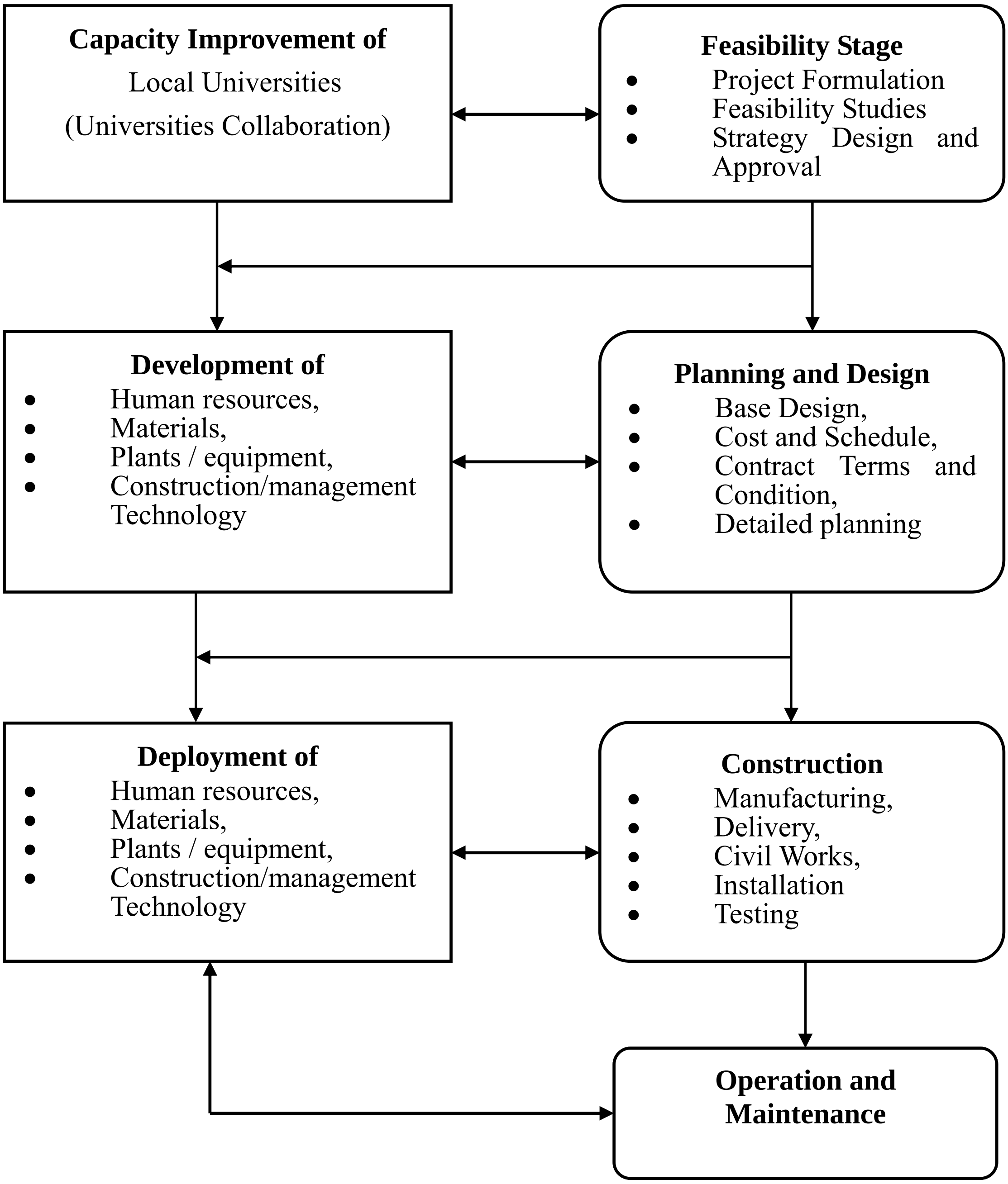


Figure 6.3: Interrelation of the activities with the stages of the development projects

6.6 Applicability and Implementability of the ISHID

Response from the universities and practitioners

A questionnaire survey was conducted in order to get the response of the universities and practitioners from the least developed countries and Japan regarding the applicability and implementability of the ISHID. Questionnaire with the description of the proposed system was sent through the e-mail and responses were also collected through the same means. 3 universities and 4 practitioners were the respondents from Nepal, and 1 university and 3 practitioners were involved in the questionnaire survey. Similarly, 1 university from Ghana and 1 practitioner from Mongolia responded. Total 15 responses from the Japanese professors, consultants, JICA experts, and volunteers were received until now. The responses are continued to collect.

Out of the 9 Japanese professors 7 responded as very interested, 1 interested and 1 replied as no interest. However, all 5 universities from Nepal, Cambodia and Ghana responded that they are very interested on the proposed system.

Similarly, 7 professors out of 9, from Japan responded as the system is implementable where as 2 replied as the system is difficult to implement. But, all 5 universities from Nepal and Cambodia replied that the system is implementable.

Like wise, all 9 professors replied that the system is important to Japan (8- very important, 1- important). And, all 5 universities from Nepal and Cambodia replied that the system is very important to their countries.

Regarding the industry professionals, all Japanese professional replied that they are very interested on the system, the system is implementable, and it is very important to Japan. All 8 industry practitioners from Nepal, Cambodia and Mongolia responded that they are very interested. 7 of them told that the system is implementable where 1 respondent replied it is difficult to implement, however all 7 respondents replied that the system is very important to their countries.

Overall, the author found the positive responses from all the respondents, and the system is implementable and is important for the developing countries as well as Japan. The universities and the practitioners from the developing were very much interested to implement the proposed system. In addition Ministry of Land Infrastructure and Transportation, Japan and the Japan Society of Civil Engineers have shown interest to implement the proposed system. However, all universities from Nepal, Cambodia and Ghana responded that they do not have financial resources and sufficient competent faculties to implement the system. And, some Japanese professors responded the time and resource constraint to involve in the proposed system. The respondents who responded that the system is difficult to implement on the ground that the system needs consent from the both recipient and donor country. It indicates that if donor and recipient agreed, the system can be implemented.

Chapter 7

7. Analysis of Efficiency of the Proposed System (ISHID)

7.1 Efficiency of the existing ODA

Since most of the development works including infrastructure development projects in Nepal and Cambodia are financed by bilateral and multilateral assistances, multilateral agencies use international competitive bidding and bilateral donors use their own consultants and contractors for the execution of the projects. In addition, the Nepalese and Cambodian contractors do not have enough capacity in terms of financial, technical, experience and management in order to compete with foreign firms. Inevitably the ODA projects are far from the satisfactory local participation.

Moreover, the salary differential of a foreign engineer is 30 times higher than a local engineer in Nepal (Vaid, K.N. 1999). Thus a project executed by the foreign professionals is naturally expensive than the local engineers do. This resulted to enormous increase of loan burden for the developing countries. Further, it is estimated that upto 75 percent of the value of foreign aided contracts and 60 percent of foreign assistance is pulled back to the donor countries for the supply of equipment, materials, personnel, supervision and consultancy of the project (ibid.). Since there is not enough opportunity for the local industry to participate in foreign assisted projects, the sense of ownership of the users/beneficiaries is very low. It is evident to experience insignificant economic growth despite the large investment in infrastructure development in Nepal (Mihaly E.B. 2002).

Technology transfer through the existing ODA system is also not efficient. A recipient usually receives the products from the donor. The process, knowledge and skills regarding the product are not efficiently transferred. The human resources development included in the ODA is mainly limited to offer training for the client's people in the donor's countries. For instance, total 42 trainees from Cambodia participated under Japan's ODA in the course of 10 years in transport sector with average training period per person of 39 days (Kaneko). Providing the training for a few people would not improve the skilled labor index (index based on education and training). Moreover, the general training especially related to the construction management and infrastructure development in Japan are not custom designed to the needs of the developing countries. From such training, the trainees will have opportunities to learn advanced technology and experience affluent infrastructure, however, they neither can use the technology they observed nor they will have opportunities to modify to make it suitable in their home countries. The actual needs of the trainees' organization (developing countries) could not be fulfilled unless they are trained in the needed area with appropriate technology. The clients from developing countries still could not utilize the collective absorption of technology through the trainee as the training were not custom designed to their needs, and there was no continuous participation of enough number of employees from the same organization regularly. In effect, there was no significant organizational benefit from the training for one-two people each year in the abroad. *(Drawn from interactions with clients during interviews)*.

7.1.1 Overview of the JICA Training Program

Japan spends a significant amount of money in human resources development through JICA training programs. For instance, table 4.3 and 4.4 in chapter 4 show the technical cooperation cost for Cambodia and Nepal respectively under Japan's ODA. It was found that the amount expended on technical cooperation for Nepal was nearly the 1.5 % of the national budget of Nepal. However, the number human resources trained in the cooperation is very insignificant, and there was no evident of technology development through such program.

The JICA training program has a number of courses for Group Training as well as individuals. However, there are only 4-5 group training program related to infrastructure and construction industry development. These programs are general, and do not address a country specific needs. Moreover, there is no regular participation of trainees from one country in the same program. It indicates that JICA training is not focused in addressing the country specific needs rather than providing equal opportunities for various countries to participate in the training. As for example, the "practical application of the construction technology" could provide some knowledge areas in the construction management in developing countries like Nepal and Cambodia, however, there was no trainee from Nepal after 2002 and no records of participation of trainees from Cambodia until now. Since, there was no opportunity to participate regularly in the training on the needy area, there would be no possibility to develop body of knowledge in the concerned area. The impact of such discrete training system will have insignificant impact to improve the body of knowledge in developing countries. Does such system of training improve the performance of the trainee's organization? Certainly no, because it is scattered and discrete. This system neither improves the performance of the organization nor enables the organizations able to absorb and internalize the technology in developing countries. It only facilitates for the individual benefits from the training.

It is the fact that the universities from the developing countries especially low-income countries Nepal and Cambodia do not have enough educational infrastructure and human resources to deliver quality education. Cambodia produces around 300 civil engineers every year since 2001. In effect, the human development in infrastructure sector under Japan's ODA can not significantly improve the organizational performance by providing training for 4-5 people, as seen in Cambodia transport sector in 1992-2002, from the client's organization in discrete manner where hundreds of untrained engineers every year enter the industry.

The impact of the human resources development system of ODA would not be materialized in developing countries unless the educational and research infrastructure at the local universities were developed. At least 10 times more people could be trained against 1 people in existing system as discussed below, and quality of education in developing countries could be improved if the proposed system is implemented.

7.1.2 A Typical JICA Training Cost: some empirical data

<u>The Cambodian case:</u>
The number of people trained in between 2000-02 = 4050
Total money spent for training = 1,525,099,000 Yen
Average expenditure per person = 376,568 Yen /person

A typical JICA Group Training cost per person per month (excluding accommodation and transportation) = 226,000 Yen (source: Prof. MURAKAMI, Kochi University of Technology)
Allowing for

- Accommodation cost @ 4000 Yen per day for 30 days = 120,000 Yen
- Living cost @ 4000 Yen per day for 30 days = 120,000 Yen
- Transportation and field trip cost = L.S. 150,000 yen

Total Tentative cost = 226,000 + 120,000 +120,000 + 150,000 = 616,000 Yen per person per month
Say 600,000 Yen per person per month

Therefore the average training days in between 2000-02 was less than one month (approx. 19 person days).
As such, training under the technical cooperation under Japan's ODA was not country specific and the estimated duration was also short, the trainees naturally could not acquire expected skills to address their countries' needs.

7.2 The Proposed ISHID System

7.2.1 Logic Model of the Proposed ISHID System

Qualified human resources and appropriate technologies are essential for efficient delivery of a project. The clients as well as donors involved in the developing countries procure required technology and the services of human resources internationally. This has made the projects costlier than that would have done by using local resources. The governments of developing countries like Nepal and Cambodia are receiving the services of the skilled workforce either procuring internationally and/or sending some people overseas for training without improving domestic human resources development system. However they have never investigated the reasons for the unavailability of appropriate human resources and technologies locally in the developing countries. Instead the clients requested some donors to provide for some employees opportunities to study abroad, and the donors provided the same. But the number of participants was limited: one or two people from one project may get opportunities to be trained abroad. The training/study cost for a person in abroad is many times higher than in a developing country needs for the similar training. Many trained human resources and appropriate technologies could be developed domestically instead a few from abroad if appropriate educational systems and research infrastructure were developed locally. The human resources and technologies could be made compatible with a country' needs if the educational/training system and research could integrate the needs and growth of the country.

Since tertiary education is the main provider of highly skilled workforce, Cambodia and Nepal need to strive to improve the quality of higher education compatible with the growth of the country. Moreover, the construction industry from these countries do not have enough resources to train the human resources and to conduct research, the educational system integrated with infrastructure development proposed in this study would enable the universities and industry able to develop appropriate human resources and technologies. The proposed system would provide the developing countries opportunities to train, develop and use the local resources for the sustainable transfer of technology, and development of human resources and technology. In addition, the new system would provide developed country opportunities to train their graduates in the multicultural environments of the developing countries. This would enable the new graduates familiar with international construction environment, and prepare them for working in the global construction market. The basic logic model of the proposed integrated system is shown in the Figure 7.1.

i) Inputs/Resources: Inputs/resources include the human, financial, organizational, and community resources a program has available to direct toward doing the work (W.K. Kellogg Foundation 2004). Human resources inputs for the proposed system include faculties from the developed countries, and university faculties and graduates, industry practitioners from the recipient country. Similarly, capital, plants, equipment and technology are secured from official development assistance (ODA) as well as from recipient government.

ii) Activities: Activities are what the program does with the resources. Activities are the processes, tools, events, technology, and actions that are an intentional part of the program implementation (ibid.). Activities included in the proposed system are intended to develop human resources and technology for efficient infrastructure development. Education, training/seminars and faculties practice in the industry and graduates internships are for human resources development. Likewise, technology research includes transfer of seed technology to the recipient country, development of appropriate technology for construction materials production and management. Product development activities enable to produce special types of construction materials.

All the activities are used to bring the improvement in the existing environments. The intended results include all the system's desired results (outputs, outcomes and impact)

iii) Outputs are the direct products of program activities and may include types, levels and targets of services to be delivered by the program. The major outputs expected from the proposed system are:

a) Trained civil engineers, and
b) Technology for special material production, construction and management.

Since the Cambodian and Nepalese construction engineers were deprived from appropriate training, and the graduates were unable to acquire practical and management skills from university education, the proposed system offers the opportunities to acquire the same domestically. In addition, the transfer of seed technology and technological research in the recipient countries enable local industry to develop appropriate technology and the construction materials locally.

iv) Outcomes are the specific changes in program participants' behavior, knowledge, skills, status and level of functioning (ibid). As the proposed system first intends to enhance the capacity of the faculties by offering them opportunities for advanced studies/training in the developed country, the first short term outcome will be the competent faculties in the recipients' universities. This enables the local university to able to deliver the professional services as demanded by the construction industry which help improves the financial status of the university. Further, the investigation of needs of the construction industry, and education and training function, as discussed above, of the COE&R will offer the industry practitioners as well as graduates help improve their skills compatible with the needs of the industry. For instance, the industry practitioners in the Nepalese and Cambodian industry did not have enough skills in the construction and project management. The training on such needy areas and the incorporation of the construction management education in the civil engineering will enable the practitioners as well as graduates to acquire hands on knowledge and skills as per the needs of the industry locally. This will improve the productivity (output per labor input) of the engineers. Similarly, the continuous involvement of the center in technology transfer through the university collaboration and research in the recipient country will enable local university and industries to make available more technologies for material production, construction and management. For example, the local industry in Nepal and Cambodia do not have the technology for producing the self-compacting concrete, high strength pre-stressed/pre-cast concrete product which would facilitate for example culvert, bridge construction and rehabilitation.

Transferring such technologies to these countries and producing the construction materials like beam, girder, slab etc. locally will enable the local industry to introduce new technology, materials for the construction of infrastructure at reasonable cost.

v. Impact is the fundamental intended or unintended change occurring in organizations, communities or systems as a result of program activities in the long run (within 7 to 10 years) (ibid). The system will enable the local universities able to deliver industry-oriented education and develop appropriate technology for infrastructure development. This will reduce the dependency of the developing countries for human resources and technology on the developed countries. As such, when the local universities were able to deliver appropriate education, training and research compatible with the industrial needs, it helps reduce the loan burden for the developing countries as well as to lower the grants from the developed countries which were spending for training human resources in the overseas such as JICA training program.

The increase in skill level of engineers through the new system will increase the skill level of the labor force which enables the industry able to deliver projects efficiently. This would make the users to get early benefits from the projects which were at present differed due to late delivery of the projects. Thus, producing the human resources and developing technologies domestically to fulfill the demands for infrastructure development will enable a country to have sustainable growth in the economy.

In addition, the new system will provide the Japanese graduates/engineers opportunities to learn from their peers and the seniors in the multicultural and mutually mistrust environments. This would help improve the communication and management skills of the Japanese engineers which are required to be competitive in the global construction market.

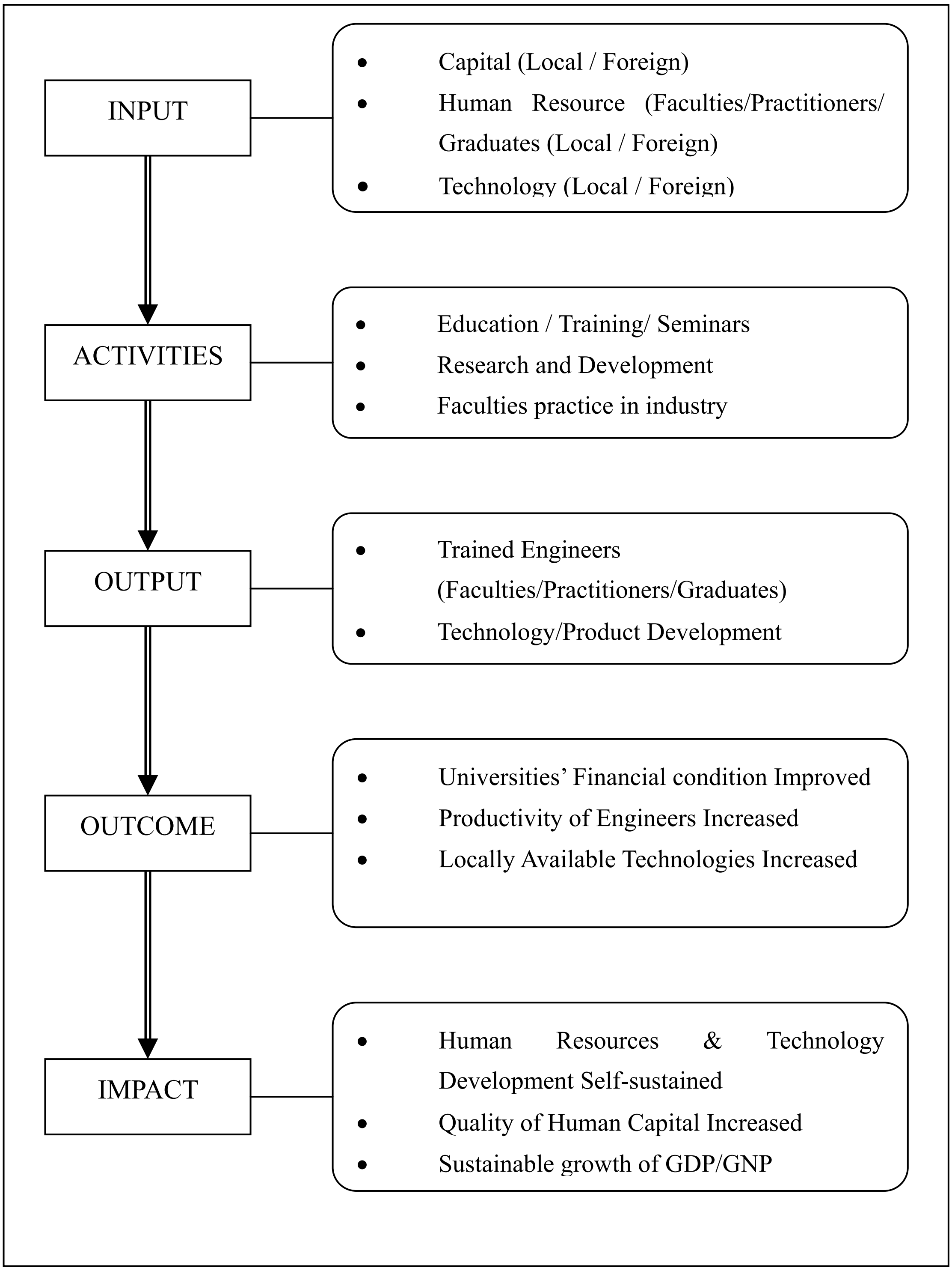


Figure 7.1: Basic Logic Model of the Integrated System

7.2.2 Efficiency of the Proposed ISHID System

Cost of training and change in skill index were used to analyze the efficiency of the proposed system. The cost of training in the existing Japan's ODA system was taken as reference for comparison. The cost of training using the local faculties who were trained through universities collaboration was calculated based on prevailing cost of resource persons in Nepal and Cambodia. The two costs were compared and discussed below. Similarly, skill index—index of the education and training was used to compare the expected output from the civil engineers in the Nepalese construction industry. Skill index of the Nepalese civil engineers in three different systems: i) existing university education system, ii) with JICA training system, and iii) with the proposed system were compared and discussed below.

7.2.2.1 Alternative Cost of Training in Nepal / Cambodia (Group Training Cost in the Recipient Countries)

Since the Nepalese and Cambodian construction industry was in need of the human resources and technology for the construction materials (concrete and others), infrastructure analysis & design, and construction management, the cost of a training on "concrete technology, infrastructure design and construction management was calculated on the basis of prevailing rate in Cambodia.

Name of Training: Advanced training on "Infrastructure planning & Design, Construction materials, and Construction Technology and Management".
Number of Participants: 10
Target Group: University Faculties and the Industry Practitioners

<u>JICA experts' cost:</u>
Living expenses (average): 400,000 Yen per month
Accommodation (average): 3,500 US$ per month (approx. 402, 500 Yen; @ 1US$ = 115 Yen)
Salary (average): 403,000 yen per month
Total = 1205,000 yen per person per month excluding family allowances.

<u>Japanese University Faculties Cost:</u>
Lecturer = 583,000 Yen per month (7,000,000 Yen per year)
Asst. Professor = 750,000 Yen per month (9,000,000 Yen per year)
Professor = 958,000 Yen per month (115,000,000 Yen per year)

<u>Local Cost:</u>

Local professional's Cost for one month (22 days @ 6 hours a day) = 20 * 22* 6 =2640

US$ (Assuming cost of lecture per hour = US$ 20)
Operation cost for 10 people = US$ 2,000 per month (Operation cost per person = US$ 200 per month)
Local cost (sub-total) = 2640+2000 = US$ 4640 for 10 person per month.
Allowances for local transportation, field visits cost = US$ 1000

Local cost US$ = 4640 + 1000 = 5640 (approx. 648,600 Yen)
Say 650,000 Yen

If computers and other equipment were provided through "provision of plant and equipment" in the ODA project, the training cost would be
Local Cost: 650,000 Yen

Training cost per person per month = 65,000 Yen, which is nearly one tenth of the cost required in the JICA training as discussed in 7.1.2 above. This implies, if local faculties and professionals were trained, the training cost would be reduced to around one tenth of the existing cost i.e. 10 times more number of people could be trained with the similar amount.

In addition, when the faculties were trained and educational & research facilities were established, the students would receive the quality education without significant increase in the cost. In such situation, universities need only operation cost of the facilities. In this way the quality of education in the developing countries could be improved.

7.2.2.2 Training Cost for Faculties: KUT experience

For Ph.D. /Dr. Eng. Program (for 3 years)

- Living Cost (minimum) = 12 * 100,000 = 1,200,000 Yen (100,000 Yen per month)
- Tuition Fees (annual) = 1,240,000 Yen (private university); 620,000 Yen (national university)
- Operation cost (annual) = 200,000 yen

Total cost (minimum) in private university = 3* (1,200,000 + 1,240,000 + 200,000) Yen
= 7,920,000 Yen per person

Taking the average per year cost of training in Infrastructure sector for Nepalese participants from the table 4.5, it was found that average numbers of participants per year were 13 and the cost per was 49,930,000 Yen. The amount spent for 13 trainees would be sufficient to pursue Ph.D/Dr.Eng.

for 6 faculties from the recipient countries through the universities collaboration as seen in the KUT experience. The influence of the 6 faculties after completion of the study will be much higher than the 13 trainees because the trained faculties are continuously involved in the educating/training the new human resources and universities collaboration would facilitate technology transfer and development locally. Thus, it can be said that the proposed system is efficient than the existing human development system under Japan's ODA.

7.2.2.3 Comparing the expected effect of the New System in terms of Skill Index

7.2.2.3.1 A Case of Nepal

a) Existing Scenario

Production of the Civil Engineer/ year

Bachelor: 800

Masters: 100

Assuming 50 % of the master degree student come from in-service.

Net flow of undergraduates: 750

Total net flow of the new engineers (bachelor and master) = 850

Skill Index

Skill index is the index to represent the level of education and training of labor force. In Nepal, consultants use index recommended by the Society of Civil Engineering and Architectural Firms in Nepal, to use for the estimation and bidding for the consulting services. Higher the index higher is the price. The skill index recommended by the SCAEF are, Bachelor degree = 1.0, Masters degree = 1.05, and Ph.D. = 1.1 (SCAEF). The author has also adopted the skill index as recommended by the SCAEF to adjust the changes in education and training of the civil engineers. Further, it was assumed that the 30 credits equivalent for the master degree is equivalent to the skill index 0.05.

Skill index of the new engineer without proposed system= (750*1+100*1.05)/(750+100) = 1.0058

b) JICA Training Case – Infrastructure Sector (refer table 4.5)

Number of trainees from year 1994 – 2002 = 119

Money spent for the training = 449378 thousand Yen

Approximate training period for 119 people = 6.29 person-month (assuming the training cost per person per month is 600 thousand Yen.)

Average number of people trained a year = 13 (119 people in 9 years)

Average money spent for training a year = 49930 thousand Yen

Assuming, 6 months training can offer 30 credits i.e. the rise in skill level will be 0.05 after 6 months training.

If the similar JICA training is continued, the skill index of the work force will be equal to
(13*(1.0058+0.05) + (850-13)*1.0058)/ (850) = **1.0066**

% Increase in skill index of the new workforce =(1.0066-1.0058)/1.0058*100 = **0.0795%**

c) With the Proposed System

Training cost per person per month = 65 thousand Yen
If the same amount of money that was used a year for JICA training (49930 thousand Yen /year), the number of people can be trained in Nepal would be equal to (49930/65)= 768 person-month. It means that all the new undergraduate engineers could be trained for 1 month with the same amount of money used for 13 people a year in average in JICA training in Japan.

If all the undergraduates were trained for 1 month, the new skill index of the new engineer would be equal to
((750* (1+0.05/6)) + (100* 1.05))/850 = **1.01324**

% Increase in skill index of the new workforce =(1.01324 - 1.0058)/1.0058*100 = **0.739%**

The skill indices, assuming the 75% of the new engineers enter to the construction industry, of the Nepalese civil engineers projected in three different cases are shown in the figure 7.2. The skill index in the year 2006, 2010 and 2015 without training and improving education will be 1.00577, 1.00578 and 1.00579 respectively.

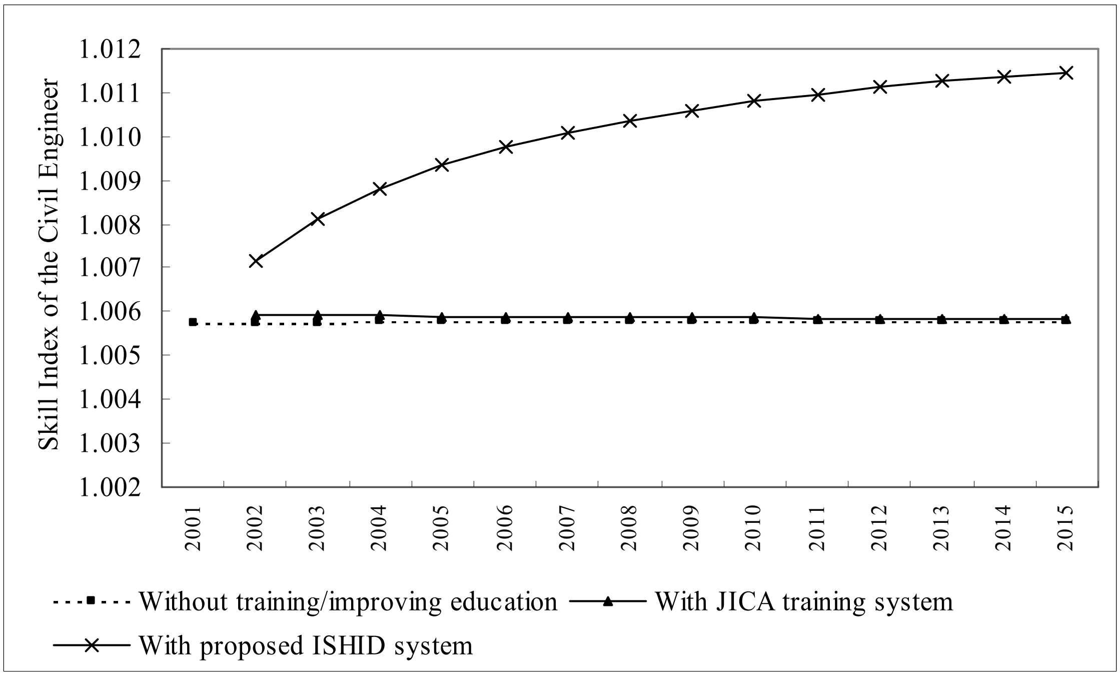


Figure 7.2: Skill index of the civil engineers in Nepal.

The skill index, with continuing JICA system, in the year 2006, 2010 and 2015 will be 1.00588, 1.00586 and 1.00584 respectively. Similarly, with the proposed ISHID system, the skill index in the year 2006, 2010 and 2015 would be 1.00976, 1.01080, and 1.01147 respectively.

7.2.2.3.2 Effect of Skill Index in Productivity

The Cobb-Douglas production function that is one of the representative production functions is expressed as follows.

$Y = A * K^{\alpha} L^{1-\alpha}$ ……….. (1)

Where, K is the quantity of capital, L is the quantity of labor, and A is the total factor productivity. α is the elasticity coefficient of K and $(1-\alpha)$ is the elasticity coefficient of L. And, the sum of both coefficients equals to 1.

The equation (1) can be written as

$\text{Log } Y = \text{Log } A + \alpha \text{ Log } K + (1-\alpha) \text{ Log } L$ …………(2)

And

$Y/L = A * (K/L)^{\alpha}$

Also, $\text{Log } (Y/L) = \text{Log } A + \alpha \text{ Log } (K/L)$ ……………(3)

Now, A and α can be calculated from Y/L and K/L.

The time series data from 19988/89 to 2000/01 were used to estimate the A and α. The data of GDP from Construction was take from the economic survey (2003/04) of Nepal. The capital investment was derived from the total development expenditure. The linear depreciation can be used to calculate the capital at the rate of 0.05 a year (Ganev, K. 2005)

.

The equation for the production function with the skill index of the labor can be written as, when labor index (Q1) of the labor input is used then the equation can be written as

$$Y = A * K^{\alpha} * (L*Q_l)^{1-\alpha}$$

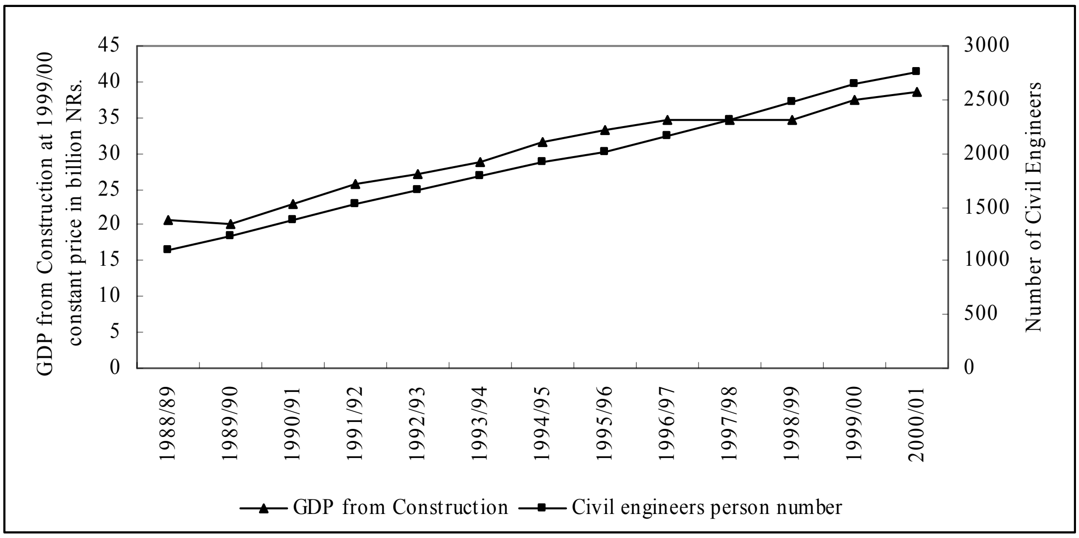


Figure 7.3: GDP from Construction and the Civil engineers in Nepal

For the construction industry, the inputs and out put are

Y = GDP from construction (Output)

K= Capital input

L= Labor input

Q_l = is the index of the labor composition adjusted for changes in the education and work experience of the employed person.

7.2.2.3.3 The Effect of ISHID in the Construction Output

As such the ISHID has been proposed to improve the human resources and technology development, it will improve the skill index as well as technological development which result to increase in output. The change envisaged in construction production through the ISHID can be shown through the production function, using the equation (1)

$Y = A * K^{\alpha} L^{1-\alpha}$

$Y/L = A * (K/L)^{\alpha}$

Where, (Y/L): productivity of the civil engineer (GDP from Construction per civil engineer)

(K/L): the investment per civil engineer (construction investment capital per civil engineer)

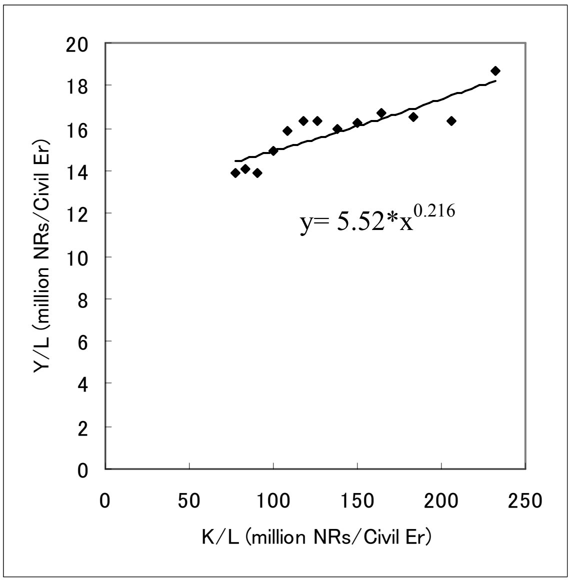


Figure 7.4: Analysis of construction productivity of Civil Er. using the production function of $Y = A * K^{\alpha} L^{1-\alpha}$

The time series data from 1988/89 to 2000/01 were used to calculate the A and α. The number of civil engineer was adjusted for the corresponding skill index. The production equation; productivity (GDP-construction output per civil engineer) was found to be $(Y/L) = 5.52 * (K/L)^{0.216}$. Thus, in the existing environment, the share of labor input in output is 0.784 which is higher than capital share (0.216). Therefore, the skill index (Ql) of the civil engineer will significantly affect the construction output. The change in the output multiplier due to the change in the skill index through the proposed ISHID compared to the existing JICA training system, based on $Q^{0.784}$, would be 0.30% in 2006, 0.39% in 2010 and 0.44% in 2015.

Thus, the proposed system would improve the production through the enhancement of the quality of human resources. As such the proposed system incorporates the technology transfer and development, it would improve the technological advancement in the developing countries resulting to increase the total factor productivity. Similar, system could be utilized in other technical institutes to improve the overall quality of the technicians and skilled workers. In such case, the universities that acquired the enough capacity through the proposed system can collaborate in similar manner with the other local organizations to improve the quality of the human resources produced from the organizations.

7.2.3 Candidate Countries to implement the proposed system

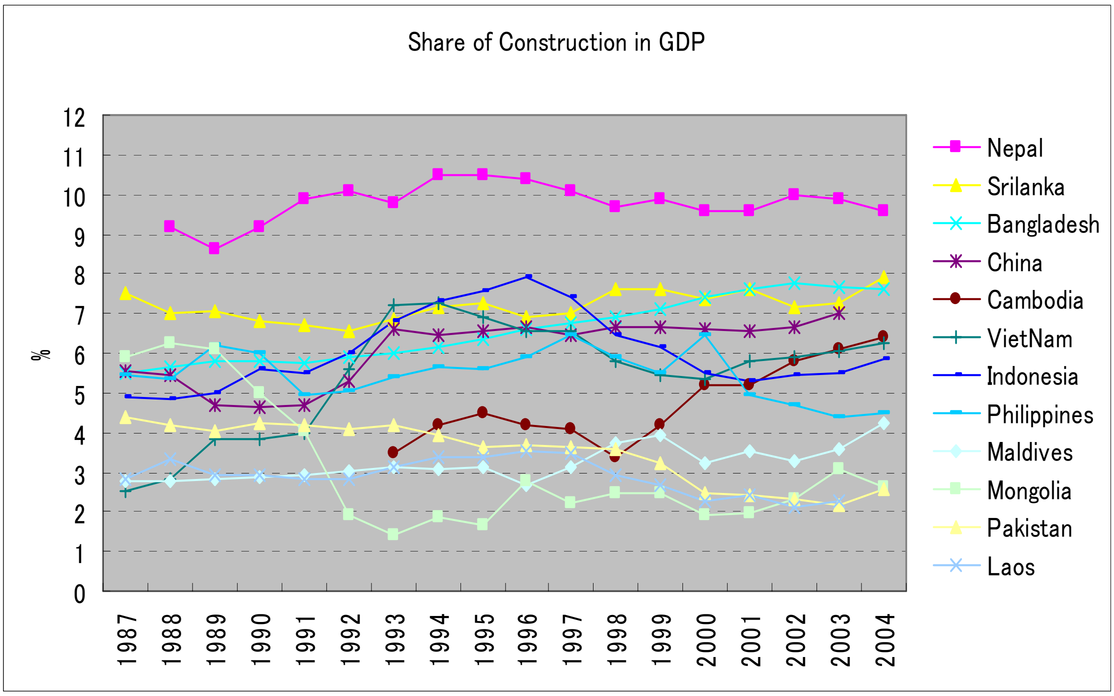


Figure 7.5: Share of Construction to the whole GDP in some Asian countries

Since construction sector contributes almost 10 % in the whole GDP in Nepal. And, there is also rising trend of construction share to the GDP in Cambodia. The share of construction to the whole GDP in 2004 in Cambodia was 6.4% (figure 7.5). Thus, a change in the construction GDP would influence the national economy in these countries. Cambodia had been selected to implement the proposed system at first, and Nepal and Mongolia are selected for the next potential countries.

7.3 Productivity (Construction Productivity) Analysis

Extant data on construction industry productivity are conflicting and incomplete, and no aggregate productivity measures are maintained by either government or industry (Haskell, P.H. 2004). Productivity is defined as output created (in terms of goods produced or services rendered) per unit input used. Thus productivity can be measured in terms of quantity produced or the value of services rendered. In this study author tried to analyze the productivity in terms of quantity as well as value added per unit worker in the Japanese, Korean and the US construction industry. In order to study and compare the construction productivity in terms of value addition, the author used the macro-economic data of the respective countries. The construction industry productivity of Japan and Korea was believed to be indicative for the improvement of the construction industry productivity of the developing countries, and the US industry was compared with Japanese and

Korean industry. The data identified to be indicative and useful for the analysis were the construction investment, construction employment, construction value added (Construction GDP).

7.3.1 Construction Productivity in the Japanese Construction Industry

The historic construction investment data as discussed in chapter 4 were taken from MLIT's statistics, and other macroeconomic data from the institute of statistics, Japan. Regression analysis was done for the civil engineers in Japan from the civil engineering investment and the number of the civil engineers. The numbers of civil engineers were taken from the paper "Thoughts on a reduction in the number of civil engineering students, pp15" (Oshima, K. 2004), and linear interpolation was done for the years in the interval. The civil engineering investment amount was converted to at 2000 constant price. In order to relate with the growth of Nepal and Cambodia, the data were divided in the four groups based on the availability of data and the growth period of Japan (figure 7.6). The first interval represents the postwar growth period of Japan which was similar to the middle-income country under the World Bank present classification. The second period is the upper-middle income stage. The year 1983 was the turning point for Japan to enter into the developed country (Kusayanagi, S. 2004). The third period was the bubble economy period which was lasted until 1991. The fourth interval was the economy slowdown period.

The investment per civil engineer in between 1965 to 1972 was sharply increased. The civil engineering investment and the investment per civil engineer were steadily grown in the postwar period. However, the decrease in the investment per civil engineer was observed since 1972. The effects of the two oil crisis were also reflected in the construction industry of Japan. It compelled to lower the construction investment, but the production and employment of the civil engineer was

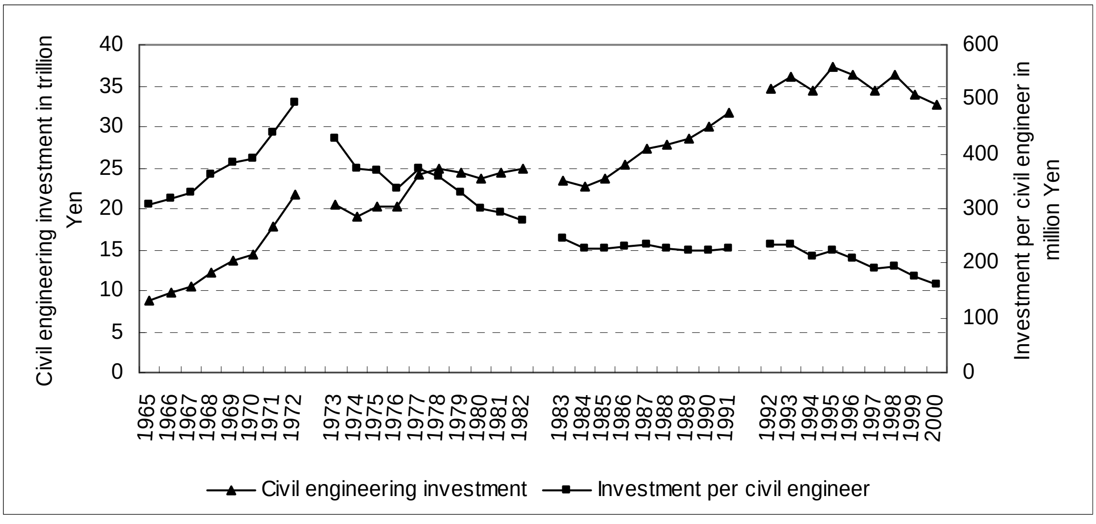


Figure 7.6: Civil engineering investment and Investment per civil engineer in Japan

continuously rising. There was little fluctuation in the investment in between 1983 to 1991.

However, there was more decreasing trend in the investment per civil engineer in Japan in the recent years.

The civil engineering investment and number of the civil engineers in Japan in the developing stage of Japan (1965-72) showed that the number of the civil engineer (Ner) had larger impact to the investment as seen from the equation drawn from the data

Civil engineering investment (y) = 6295934.28 * $(Ner)^{2.147}$

However, the effects due to the number of engineers were decreased in the later period.

It was found that the private investment in construction was sharply increased in the post-war rehabilitation as well as in the bubble economy period. The total construction investment from the private sector as well as government in Japan is shown in the fig 7.7.

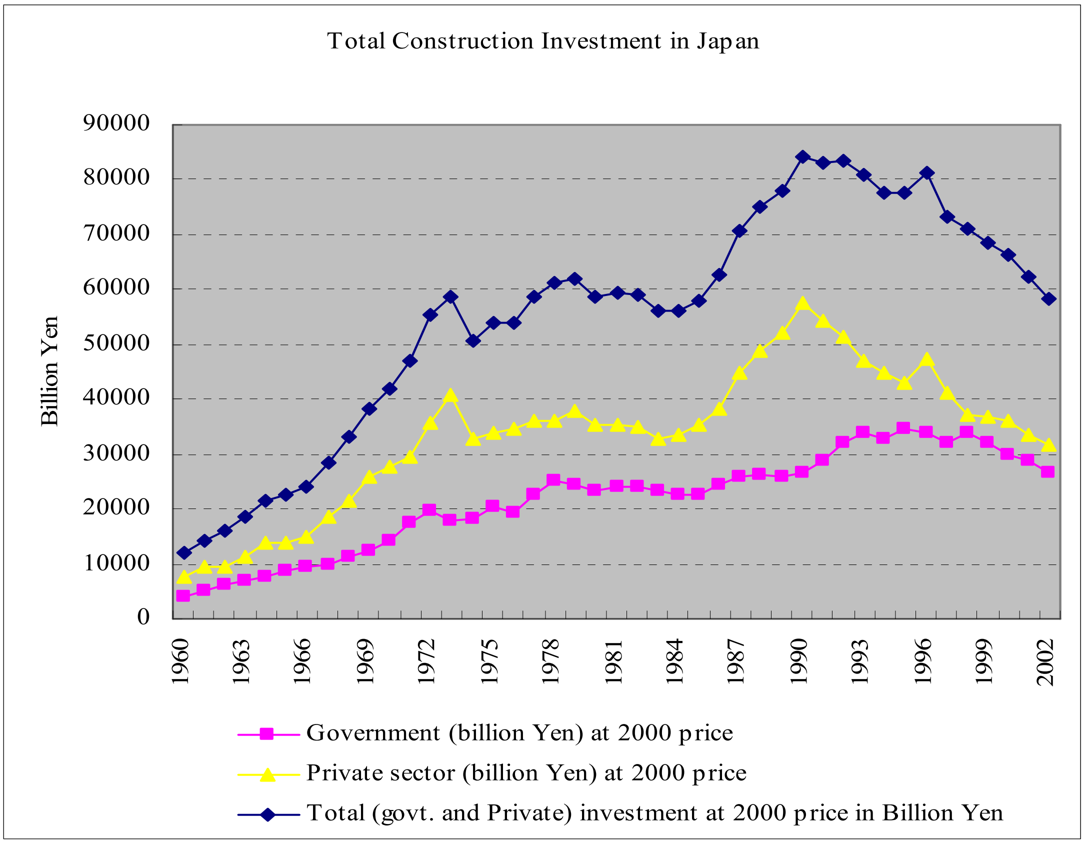


Fig 7.7: Total private and Government investment in Construction in Japan

Similarly, the construction employment was grown in similar manner with the construction

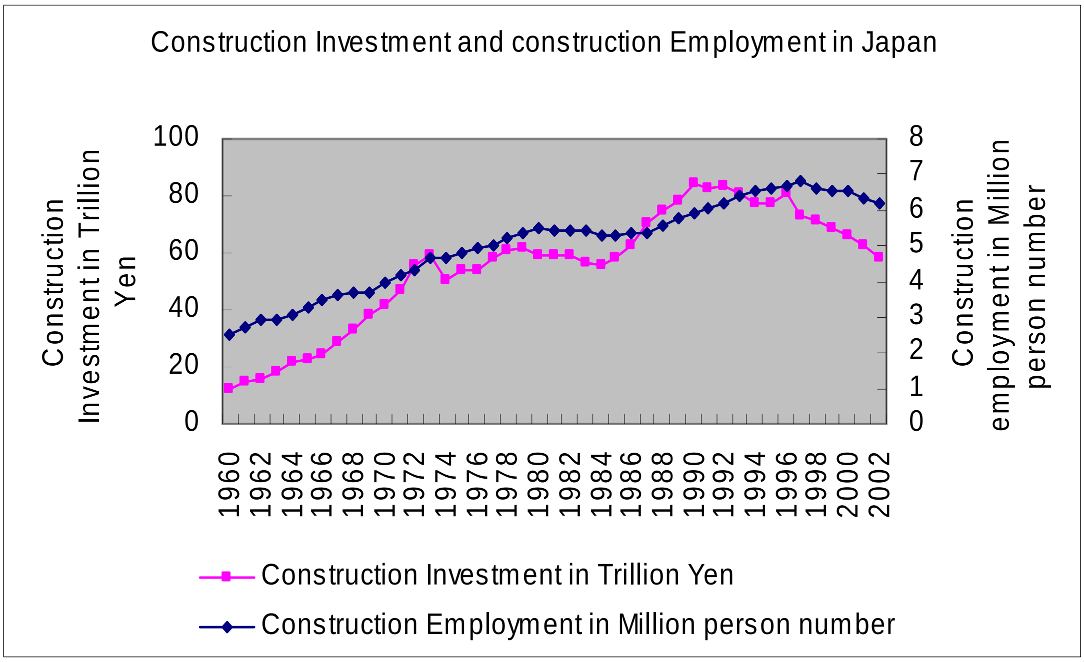


Fig 7.8: Construction Investment and Employment in Japan

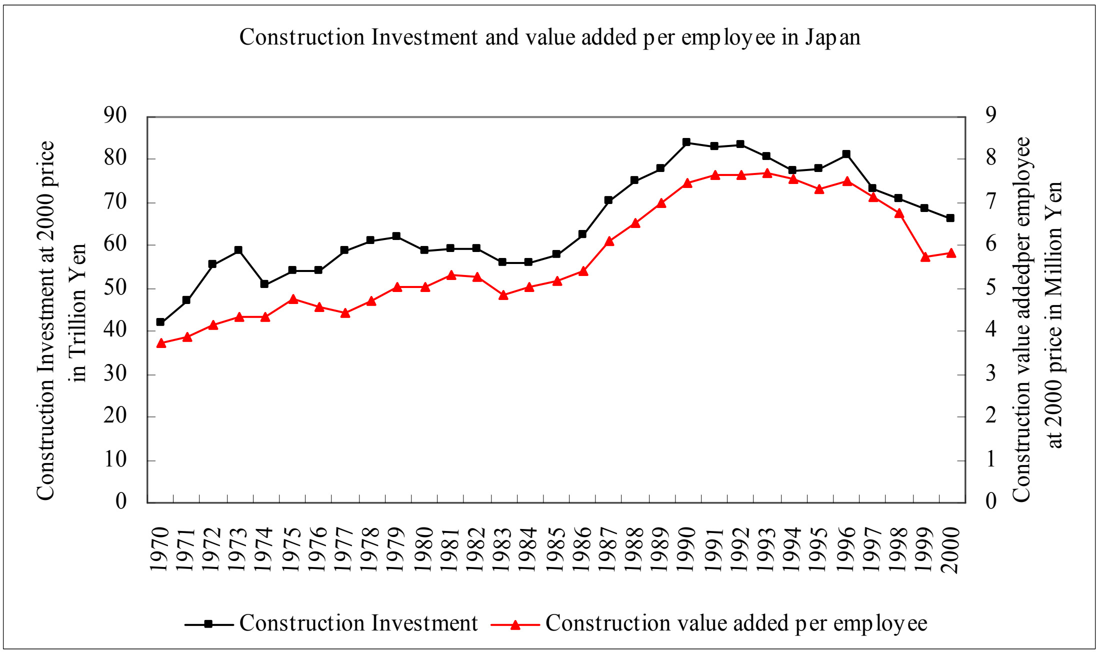


Fig 7.9: Construction Investment and Construction Value added per employee in Japan

investment. However, after the bust of the bubble economy the construction investment as well as employment is in decreasing trend. The construction investment and the construction employment are shown in the fig 7.8.

The productivity in terms of the value addition was calculated from the construction GDP and total construction employment. The time series data from 1970 to 2000 (figure 7.9) were used to analyze the productivity. It was found that the construction value added per employee (productivity in construction) was strongly correlated with the construction investment. The correlation coefficient was found to be 0.96.

As discussed earlier, the base of the engineering education was among the best and it could fully fulfill the demand for human resources in infrastructure development and industrialization. The civil engineering education, which had unique combination of the theory and practice, produced the engineering leaders who later promoted the engineering education in the post war rehabilitation and industrialization. The Japanese construction industry did not require foreign firms in the domestic infrastructure development. In addition, the Japanese industry could fully absorb, modify and internalize the western technology through the research and development in the industry. Thus, it can be inferred that the appropriate human resources and technology developed within the countries could attract the private investment (as seen in fig. 7.7). The investment in construction would make the capital availability for future production. Thus the Cobb-douglas production equation ($Y= A*K^{\delta}*L^{1-\delta}$) discussed before can explain the increased productivity in the high investment period. The good quality of education was responsible for the competent construction workforce development; the investment created capital input for the production and the technological development could enhance the production in addition to the capital and labor input. Thus, the appropriate human resources and technological development, as assumed in the ISHID, can attract the private and foreign (if necessary) investment for infrastructure development which was seen in Japan.

In addition, the productivity in terms of sales in the overseas construction business of the Japanese contractors from 2000 to 2002 was decreased and rise in the productivity was seen in the year 2003, as shown in the figure 7.10. The data for the amount of contract awarded to the Japanese contractors in the overseas and the total Japanese people employed for the works were taken from the Overseas Construction Association of Japan, Inc. (OCAJI-2004). The following regression line can be drawn for the 2000 to 2003.

$Pt = 352.216 – 48.359 * Ln (x)$,

Where x = t- 1991 for year t. For example, x = 1 for the year 1992, and so on.

Thus the productivity of the Japanese civil engineers in the overseas market is in decreasing trend. The decrease trend in the overseas sales of the Japanese construction industry can be explained by

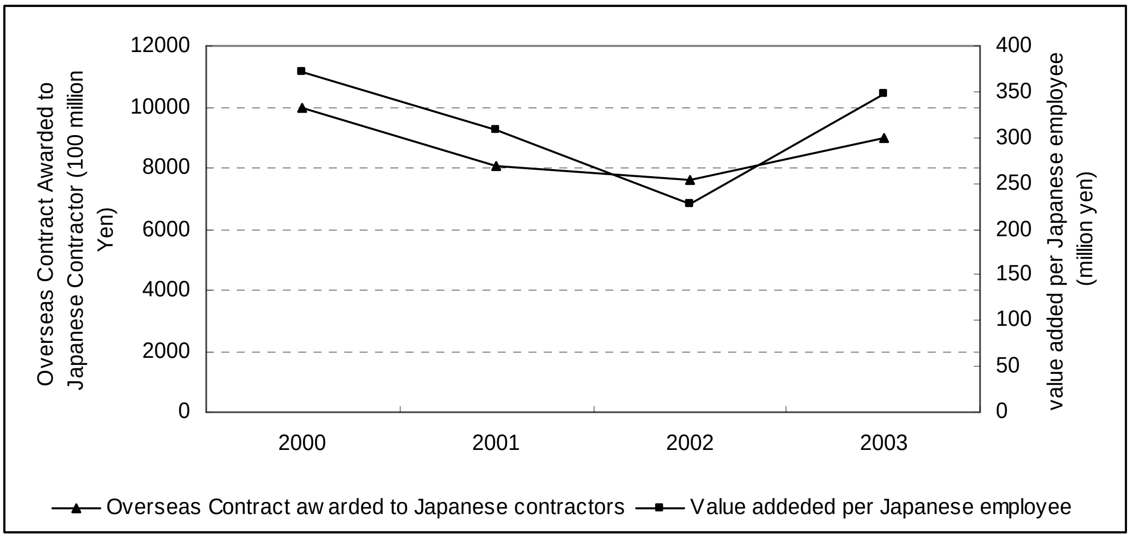


Figure 7.10: Overseas contract awarded to Japanese contractors and value added per Japanese employee in the overseas construction

the educational opportunities inside the country and the required quality of the human resources for international construction market. As discussed earlier, there are no enough opportunities for Japanese graduates to acquire the project management skills including communication, negotiation, dispute resolution, etc. which are required in the global construction market (Galloway, P.D.2005, Nielsen, K.R. 2005). Thus insufficient international project management education in the civil engineering is mainly responsible for the decrease in overseas business of the Japanese construction industry.

7.3.2 Construction productivity in the Korean Construction Industry

The construction investments at 2000 constant price and the total employment in the construction were obtained from the 'Construction and Economy Research Institute of Korea. The data plotted in the figure 7.11 shows that the investment in the Korean construction industry is positive until 1997, the Asian financial crisis. There is negative trend in investment after 1997. The regression equation for the investment in the Korean construction industry in different growth period can be written as follows.

Period	Regression equation
1970-79	It = 24.249 +0.910 * Ln (x), x = 1 for the year 1970
1980-88	It = 21.8 + 9.710 * Ln (x),

$x = 1$ for the year 1980

1989-97 $I_t = 48.37 + 3.50 * \ln(x)$,
$x = 1$ for the year 1989

1998-03 $I_t = 64.216 - 0.358 * \ln(x)$,
$x = 1$ for the fiscal year 1998

The Korean construction industry data showed that effect of the construction employment (Nem) to the construction investment in its developing stage was higher than in Japan. The equation for

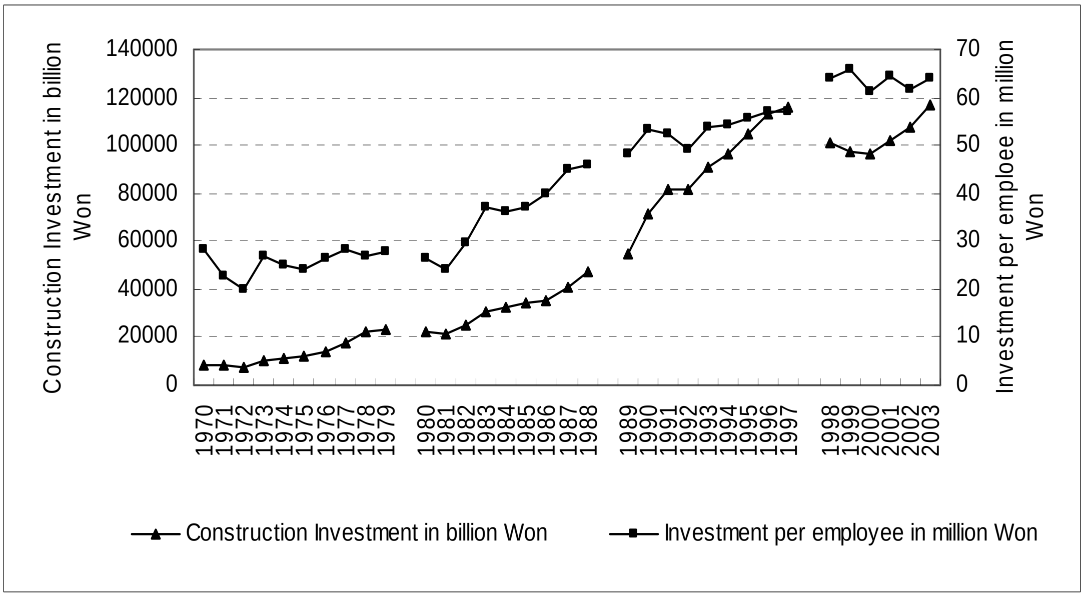


Figure 7.11: Construction Investment and Investment per employee in Korea

1980-88 period can be drawn as follow
The construction investment (y) = $33.838 * (Nem)^{3.039}$

The productivity in the Korean construction industry was also analyzed. The macroeconomic data were collected from the Asian Development Bank, ADB (http://www.adb.org). The macro-economic data from 1983 until 2004 were collected for the analysis. It was found that the domestic human resources could successfully utilize the investment until 1997, the Asian financial crisis, and the industry was also able to increase the investment even after the crisis. The construction value added per employee (productivity) was calculated and plotted against the construction investment as shown in the Fig 7.12.

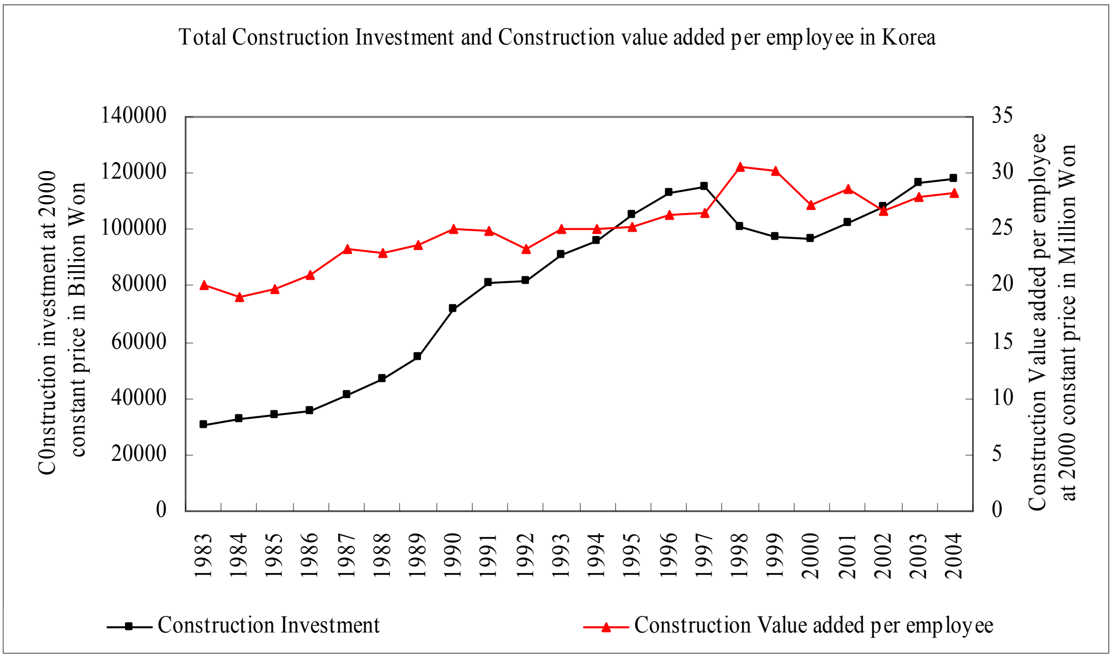


Fig 7.12: Construction Investment and Construction Value added per employee in Korea

The productivity of the Korean construction worker was in positive growth trend until 1997 and it is still heading upward even after the Asian financial crisis. Similar to the Japanese construction industry, the construction investment has strong relation with the construction productivity. The correlation coefficient in the Korean construction industry was 0.86.

There was positive growth in the investment in the construction industry in the initial economic growth period as seen in Japan and Korea. Since Japan's growth was faster than Korea, the negative trend in investment per civil engineer in the Japanese construction industry was seen earlier than in the Korean construction industry. However, there was decreasing trend in investment per civil engineer in Nepal even in the initial growth period. Since there was no appropriate human resources development system in Nepal as discussed earlier, which resulted to the inflow of untrained engineers in the Nepalese construction industry from the beginning. In the similar manner, the Japanese construction industry also facing the problem of decreased productivity in the overseas construction market. It indicates that the Japanese construction industry also could not able to develop the appropriate human resources compatible with the needs of the international construction market.

7.3.3 Construction Productivity comparison

In this study author tried to analyze the productivity in terms of consumption of the construction materials as well as value added per unit worker in the Japanese, Korean and the US construction industry.

7.3.3.1 Productivity in terms of the construction materials

The construction industry uses various types of construction materials, and it is required to measure the productivity of the industry in terms of all the materials in order to distinguish the superiority of the construction industry of one country to other. However, time series data regarding all the construction materials used the industry were not available. The author tried to analyze the data in terms of cement and steel consumption.

a) Cement Consumption

Cement is the most common construction material in the construction industry. Cement is primarily used in making concrete, mortar and soil stabilization. Although the cement consumption data did not indicate for what purposes the cement was used, the consumption data showed that Japanese construction industry consumed cement at faster rate until 1972 than the US and Korea for the same period as seen in the Fig.7.13 (data source: Dr. M. Ouchi, KUT). It indicated that the infrastructure development speed in Japan was faster than in the US and Korea. Although the US industry had higher consumption of cement until 1972, however Japan consumed similar quantity of cement with US until 1995. The consumption of cement in Japan after 1995 is in decreasing order. However. The US and Korea has still in increasing trend. In present year, the Japan and Korea consumed the similar quantity of cement. It can be said that since the decrease in infrastructure development works in Japan, the consumption of cement has also decreased. However, cement consumption in the US and Korea is still in rising trend. As such, the US has larger infrastructure and the infrastructure are already aged compared to Japan, which are in maintenance phase and consequently it consume larger quantity of cement. Similarly, Korea is still developing infrastructure which requires significant amount of cement. In terms of gross quantity of cement consumed, the US has higher consumption ability than Japan and Korea.

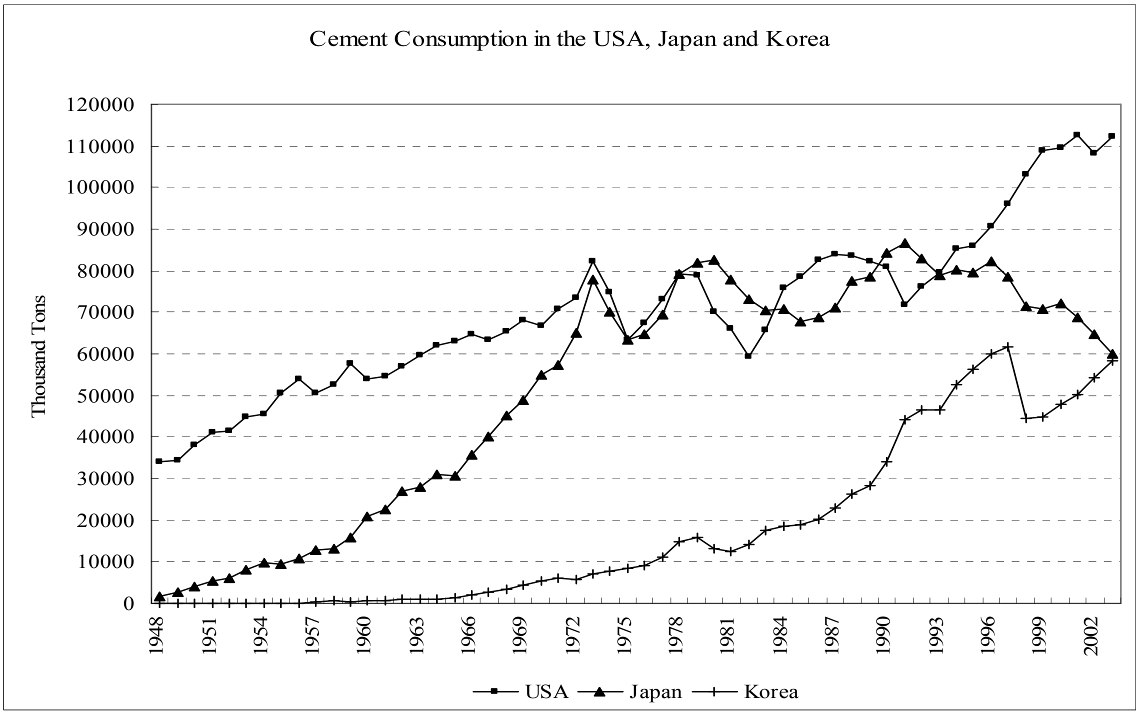


Fig 7.13. Cement consumption in the USA, Japan and Korea

However, if the whole cement consumed in the country is supposed to be used through the construction industry, the cement consumption per construction worker gives different idea. The Korean construction worker has highest productivity than the US and Japanese construction worker in terms of cement consumption as shown in the fig 7.14. The Japanese has the lowest consumption of cement per worker. The productivity of the US and Japanese construction worker in terms of cement consumption is in decreasing trend since the middle of the 1970s. However, the Korean construction worker has ever increasing productivity in cement consumption.

It was also found that the Korean construction industry consumed higher quantity of cement than that of the US and Japanese in a fixed construction investment amount. Cement consumption in proportion of the construction investment in the US and Japanese is the more or less same since the late 1980s. However the proportion of the cement in the Korean construction investment is about 4-5 times higher than that of in the US and Japan as shown in the fig 7.15.

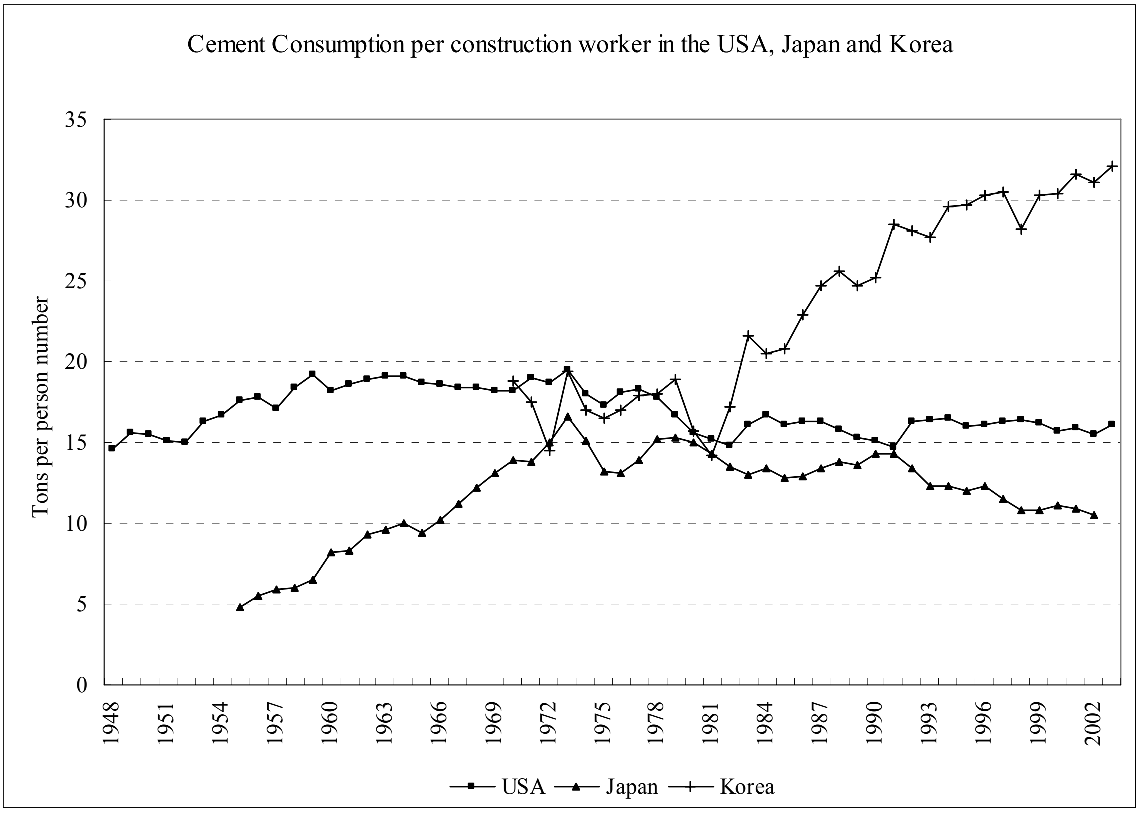


Fig 7.14: Cement consumption per construction worker

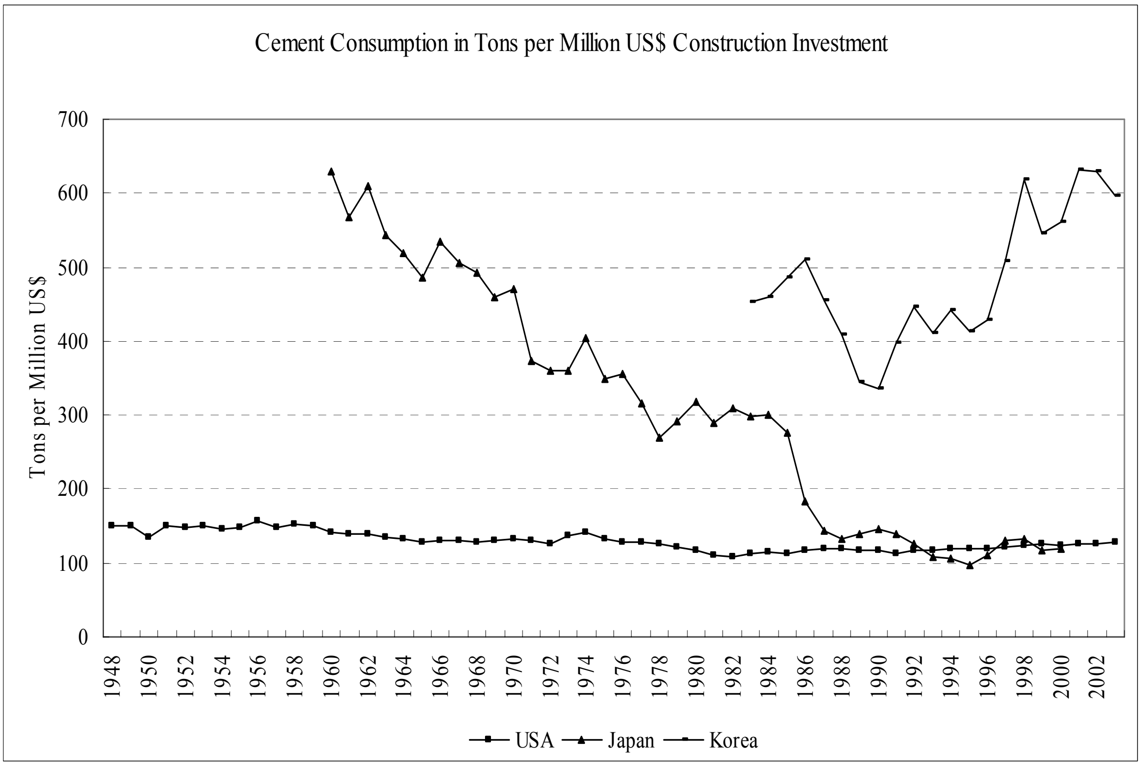


Fig 7.15: Cement consumption in Tons per Million of the US$ construction Investment

b) Steel consumption

Steel has been used widely used not only in construction but also in manufacturing industry. However, the comparable data regarding the consumption of steel in various industries was not available. It was, therefore, not possible to compare the steel consumption in the construction industry of different countries. However, in the country as a whole among the US, Japan and Korea, the US has the highest among these and Japan has higher consumption than Korea as shown in the table 7.1.

Table 7.1: Apparent consumption of steel

Apprent Consumption of Crude Steel (Thousand metric Tons)			
Year	USA	Japan	Korea
1995	113,017	84,000	37,300
1996	119,867	84,400	39,400
1997	124,017	85,500	39,900
1998	135,145	72,500	25,800
1999	127,857	71,000	35,200
2000	133,262	79,600	40,000
2001	114,386	75,200	39,700
2002	118,257	73,600	45,400
2003	105,767	76,400	46,300
2004	123,803	80,500	47,500

Source: International Iron and Steel institute, Steel statistical yearbook 2005, http://www.worldsteel.org.

Thus, it may not be wise to say the construction industry of a country has better productivity than the others in terms of the single construction material consumption. The author further studied the productivity of the construction industry in terms of the construction value added per employee.

7.3.3.2 Productivity in terms of the Construction Value added

In order to study and compare the construction productivity in terms of value addition, the author used the macro-economic data of the respective countries. The data identified to be indicative and useful for the analysis were the construction investment, construction employment and construction value added (Construction GDP).

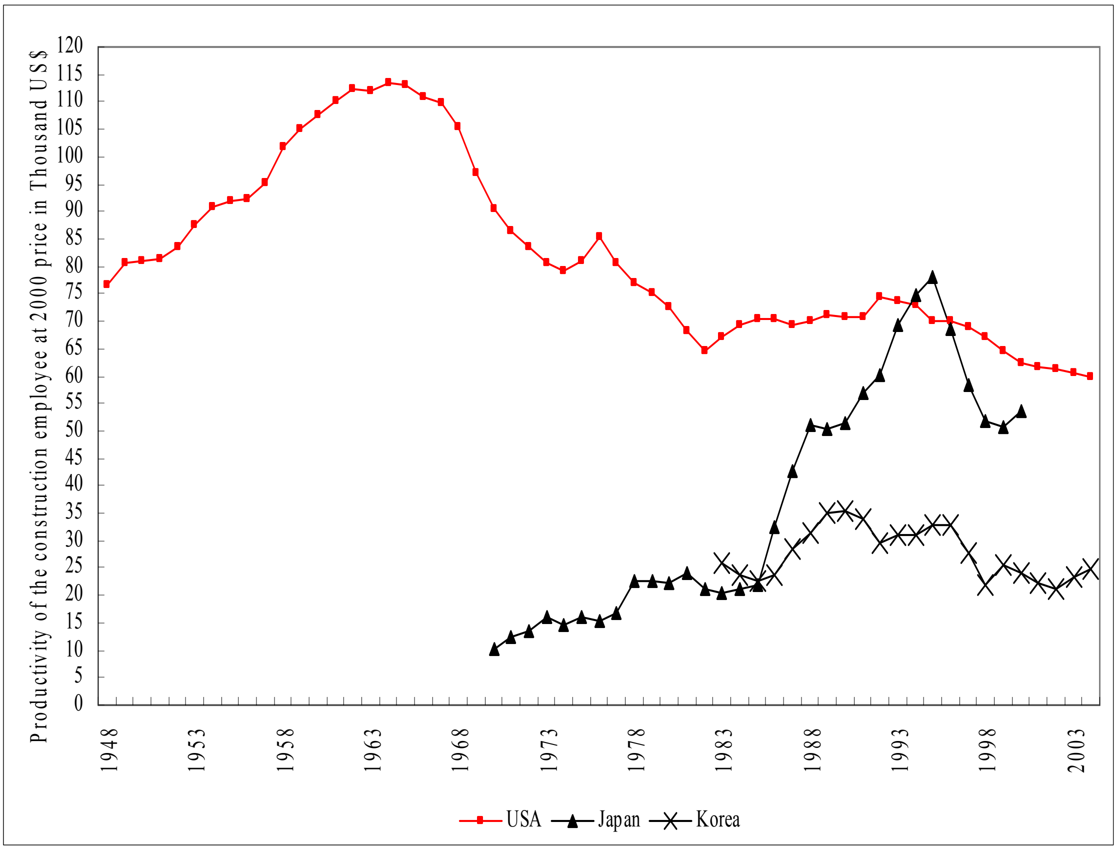


Fig 7.16: Construction productivity Comparison

The construction value added per employee in the US, Japanese and Korean construction industry was converted to the US$ at 2000 constant price. The comparative construction value added per employee of the US, Japanese and Korean construction industry is shown in the figure 7.16. It was seen that the construction productivity was increased sharply during infrastructure development period of the US, Japan and Korea. The US had the construction boom until 1965 which showed that there was sharp rise in the output. Similarly, as discussed above, rise in the productivity was observed in infrastructure development period of Japan and Korea. In addition, the sharp rise in the construction productivity was seen in bubble economy period. The graph shows that the US has still higher productivity rate than Japan and Korea. The lower productivity in the Korean construction industry may be due to the low wage rate in the industry compared the US and Japanese construction industry. Improving the quality of human resources would lead to increase the wage and consequently the value addition. So, Japan and Korea still need to improve the competency of their construction worker in order to compete the US counterparts. The appropriate construction education and training, and efficient technologies are essential in order to improve the competency of the construction workers.

7.4 What are the changes essential to make the system effective?

Since the existing system of human resources and infrastructure development system in Nepal and Cambodia could not develop appropriate human resources and technology required for the domestic infrastructure development, changes in the human resources development and infrastructure implementation system are inevitable to improve the situation. The following changes in human resources, infrastructure implementation and ODA system are essential.

i) Human Resources Development

Tertiary education is the major source of skilled workforce. The existing theoretical knowledge imparting system in many least-developed countries including Nepal and Cambodia cannot meet the growing diversified needs of the industry and society. The applied tertiary education system should be strengthened in order to provide the students opportunities to acquire hands on knowledge and skills theory and practice. At the same time trainings are equally important to maintain the competency level of the practitioners.

Since faculties are the heart of the education (NAE 2004), the faculties should have hands on knowledge and skills in theory and practice in order to deliver appropriate education. The faculties should know the activities, needs and growth of the industry so that they could feed in the education to make the graduates productive in the industry. In addition, involvement of the industry practitioners in the educational activities would enable the universities to integrate the needs of the industry with the education in the real time.

Technology cannot be developed or innovated without research. However, the industry and universities in the least developed countries lacked researches. Industry and the universities do not have research and development infrastructures. Further, the universities were underfinanced, and the quality of education was ignored. The following changes in the human resources development sector are essential:

- Establish the university education system that offers opportunities to acquire hands on knowledge on theory and practice together. Theory and practice in education can be combined through appropriate curriculum development, and involving the graduates in the development works (internship) as discussed in the proposed system.
- Provide the faculties opportunities to acquire advanced degree and hands on knowledge on practical skills in order to address the needs of the industry. The developing countries can train their university faculties through appropriate university collaboration as done in KUT-ITC collaboration.
- Encourage the faculties to practice in the industry. This can be done by utilizing the professional services and products of the universities in the development works through

COE&R as proposed in this study.

- Provide the industry practitioners to involve in educational activities to input the industrial activities and needs in to education at the real time. Industry practitioners would have the opportunities to involve in the education and training activities if the COE&R were established as proposed in the new system.
- Establish research facilities at the universities to conduct research and develop appropriate technology for materials, construction and management necessary for the infrastructure development. Since, the governments of the developing countries were not able to establish, ODA should be utilized in order to enable the universities able to establish research and development facilities.

ii) Infrastructure Implementation

Infrastructure implementation system needs strategy to improve the capacity of the domestic construction industry. However, capacity improvement of the domestic construction industry was neglected in Nepal and Cambodia. The ever deployment of the international contractors/consultants make a country more dependent to the developed world. Technology transfer, absorption and internalization opportunities are needed in the domestic construction industry. In addition, project delivery system should be chosen in order to enhance the capacity of the human resources and the performance of the construction industry as well. The following changes are essential in infrastructure implementation:

- Integrate the infrastructure development project cycle with the human resources and technology development as proposed in the implementation of the new system.
- Since the traditional project delivery system could not deliver projects efficiently, integrate the Construction Manager's services in the project delivery, as discussed in the chapter 8.
- Deploy the construction management services of the international contractors incorporating human resources development and technology transfer in the foreign assisted project instead of utilizing the full execution services of the international contractors.
- Deploy the universities services and products in the development works so that they would be encouraged to develop and deliver more services and products. This would help the universities to be self-financed and able to deliver education at the reasonable cost.

iii) ODA System

ODA is the major resources for infrastructure development in the developing countries. Large amount of the assistances had been in flowed in the developing countries. However, for instance, despite the large investment in development sector, there was no significant economic growth in Nepal (Mihaly E.B. 2002). In addition, poor utilization of the local resources in the development works in the developing hindered the expansion of the economic activities in project influence area. Further, the insulated project execution and inefficient human resources development system in the Japan's ODA could not transfer the Japanese technology and management, and develop appropriate human resources in the developing countries.

Although Japanese ODA have been utilizing since four decades ago, the international competitiveness of the Japanese engineer could not grow as the ODA value grew. In effect, the ODA execution system could provide neither the Japanese engineers opportunities to acquire hands on skills like communication, dispute resolution required in the global construction market, nor the developing countries to absorb and internalize the Japanese technology and management for efficient infrastructure development. The human resources development system further could not transfer the technology and improve the capacity of the construction industry in the developing countries. The following changes are essential to improve the situation:

- Provide the Japanese engineers opportunities to work in the multinational team. This can be done by changing the insulated project execution system to the construction management system. The existing cost of project construction could be decreased if the local contractors cost and local resources were incorporated for the construction. The money saved can be utilized for other projects, and thus Japanese engineers would have opportunities to involve in more projects with more multinational teams. The incorporation of the construction management services of the Japanese engineers enables the local construction industry to acquire modern technology and management, and the Japanese engineers to enhance their communication and management skills.

- The industrial need oriented human resources development system should be established. As such, the human resources development under Japan's ODA, for instance JICA training, is generic in nature, and does not address the country specific problems especially in the infrastructure development sector. University function should be incorporated in human resources development under the ODA program.

- Support developing countries to establish educational and research infrastructure at the universities and train the faculties instead of financing some clients' employees for the training, so that the developing countries would enable to develop appropriate human resources and technology domestically. This could be achieved through the university collaboration as proposed in the new system. Allocate certain amount of the infrastructure and human resources development cost for the capacity improvement of the local universities in the developing countries.

7.5 Conclusions

The prevailing execution system for the grant aid could not give the effective result on human resource and technology development in the developing countries. Large sum of money is used every year for training a few people however there is inflow of hundreds of untrained people in the construction industry. Further, the existing training system under JICA program does not effectively incorporate the transfer of seed technology (such as technology for specific needs of a country like high strength pre-stressed/pre-cast concrete for bridge rehabilitation in Cambodia) and development of the products in the local industry. The group-training courses were not country specific. As a result, the training might not able to train the participants to address their local industry problems.

A training program incorporating technology development and local university education in developing countries would enable the local university able to develop appropriate human resources and technologies locally. At least 10 times more than the existing people could be trained on the industry specific needs in the developing countries if local faculties were trained and local resources were utilized with the supports from the universities from the developed country as proposed in the new system.

The civil engineers have major role in infrastructure development. The productivity of the civil engineers (or construction workforce) has larger impacts to the construction value added in the development stage of a country as seen in Japan and Korea. The appropriate human resource and technology development would attract the private investment in infrastructure development. The increased investment would lead to the increased capital for production, for better social environment and improve the economic condition. Similarly, increased construction productivity would influence the socio-economic condition.

The Japanese and Korean construction industry need improve the value addition ability of the construction worker in order to compete the US construction worker. The appropriate education and training is essential to improve the competency of the construction worker. The Japanese as well as Korean construction industry could train their human resource through the proposed system (ISHID) in order to improve their competitiveness in the global construction market.

The impact of the system can be measured in terms of number of people trained, technology developed and the increase in productivity in the construction industry. Further, the impacts of the proposed system can also be observed from the i) employability and salary differential of the new trained engineers, ii) early/timely delivery of the projects due to increased productivity of the engineers and locally availability of required technologies for infrastructure development. These all factors will underpin the sustainable growth in GDP/GNP. The proposed system would enable a developing country to increase the productivity of the civil engineer and consequently higher GDP.

Chapter 8

8. Some Knowledge Areas for Improving Efficiency in Infrastructure Delivery and Civil Engineering Curricula Development

8.1 Traditional (Design-Bid-Build) Project Delivery System

Design-Bid-Build (DBB), the traditional project delivery system in which the client makes contracts separately with a consultant/designer and general contractor (Figure 8.1), consists of three linear phases of the work. Client creates a project plan and the designer prepares the necessary construction documents. Fixed-price bids are then requested from qualified contractors based on lowest responsive bid through competitive bidding to execute the work. The client then makes a contract with a contractor to execute the work in accordance with the plans and specifications.

Thus client will have a complete construction document and a fixed price for a project before execution, provided there are no changes in plans and design. Another benefit to the client is that the most of construction risks are transferred to the contractor assuming the design risk oneself (Nielsen-Wurster 1999). This method is fine in many cases where the project is clearly definable, well and completely designed, not necessary to complete in less time than the standard process will take, and unlikely to change during construction. However, owners must determine the type of skills and experiences they would need to handle the contracting systems and should only choose ones they feel comfortable with (Gorden, C.M. 1994).

8.1.1 Disadvantages of the Traditional Project Delivery (D-B-B) System

a) Longer project implementation period

The traditional Design-Bid-Build system consists of three distinct linear phases of work: design, procurement and construction. Procurement cannot be done until the design and drawing are 100 percent complete, and the set of construction document is fully prepared. Further, construction cannot be started until the contract is awarded to a contractor. Thus, there is no overlapping of the phases which could shorten the project implementation period. However, other project delivery methods like Design and Build, and the Construction Management can provide opportunity to overlap the design, procurement and construction to shorten the project implementation period.

b) No constructability input

Constructability is the integration of construction knowledge and experience in the planning, design, procurement, and construction phases of projects consistent with overall project objectives

(CII, www.constructioninst.org). A constructability analysis is performed from the construction standpoint, not the design standpoint.

Bidders are not involved in the design and procurement stage so that there is no enough opportunity to review the design and drawings from the construction and contractors perspective, and consultants, if employed, for supervision will have less opportunity to correct any defect in design before construction. Since the contractor is hired for the construction only and not all the legal provisions stipulated for the construction do accept alternative proposals/technology, the D-B-B method does not offer enough opportunity to incorporate input from the construction contractor adequately on construction materials and methods that could improve the design, functionality and cost

c) Client gets involve in more claims and disputes:

One major source of conflicts in a project execution is errors and omissions in the working drawings and specifications prepared by the designers. In the traditional system, a client prepares design, drawing and the complete construction document with the help of the hired consultants and /or in-house staffs. However, as stated earlier, there is less opportunity to identify the error and omissions in the design and drawings from the construction viewpoint. Further, the client is the guarantor of the completeness and accuracy of the designer's work. This draws the clients into disputes between the designer and contractor and frequently subjects the clients to significant liability.

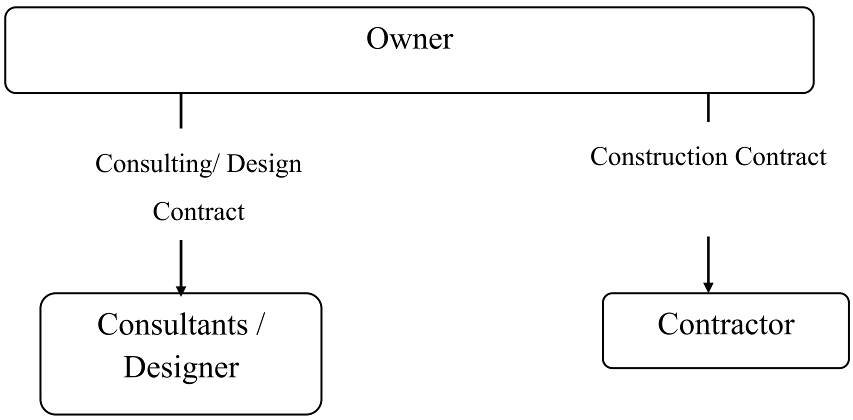


Figure 8.1: Traditional Project Delivery

d) Clients need more technical staffs

The traditional Design-Bid-Build project delivery system requires full completion of the set of construction document including the detailed drawings and specification before the bids are requested. Further, it requires considerable supervision and control during construction to ensure quality and timely delivery of the project. Thus, a client may need substantial number of technical manpower to manage larger Design-Bid-Build project which create a long-term financial burden for the client to hold the employees. This characteristic of the traditional project delivery system has created financial burden for the least developed countries to hold larger number of technical manpower and governments of the least developed countries are not able to provide higher salaries to employees.

8.2 Alternative Project Delivery Systems

There are other project delivery systems: Design and Build (DB), construction Management (CM) and Build Operate and Transfer (BOT) which are used for public as well as private infrastructure development in the developed as well as in some developing countries.

8.2.1 Design and Build (DB)

A client contracts with a design-builder firm for the design and construction of a facility as shown in Figure 8.2**.** This is the simplest contracting method which offers a single point of responsibility for the owner. DB system allows the client to transfer some or all responsibilities for design and construction onto a third party. Unlike in the traditional project delivery system, the design and construction are integrated in the DB system.

The DB system offers the benefits like more design options, and innovative and cost effective design for the owners. The owner will not need to mediate disputes between the designer and the constructor as the DB firm is contractually accountable and responsible for the entire project. Similarly, there will be no change orders or claims arising from errors and omissions in the

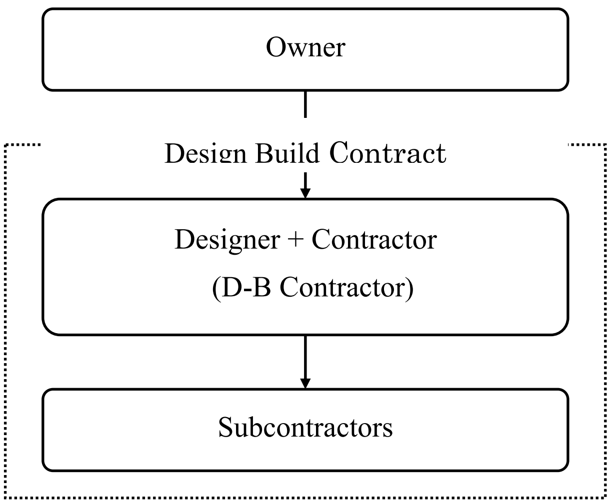


Figure 8.2: Design-Build (DB)

drawings since the designer and builder are under one contract. This system also allows fast tracking to shorten the implementation period.

However, the owner will have limited assurance of quality control and there will be no opportunities for checks and balances from the third party in the DB system. Since, the DB contracts mostly are awarded based on qualification and experience, the small contractors will have limited access to the DB system. The DB system, thus, requires contractor's own experience and capacity for the efficient delivery of a project, and the contractor will not have opportunity to receive professional services and advice for efficient delivery of a project as there is no involvement of the other professional party in the execution. Thus, the DB system will not provide opportunity to enhance the capacity of small and less experienced contractors.

8.2.2 Build-Operate-Transfer (BOT)

The build-operate-transfer (BOT) system is an integrated project delivery system in which the private sector is contracted for the design, construction, operation and maintenance of a single facility or a group of assets. BOT system has been widely used in developing and privatizing infrastructure in the developed as well as developing countries.

A builder-contractor in the BOT system requires enough financial, technological and managerial capability to design, build, operate and maintain a facility. However, the construction industry in Nepal and Cambodia consists of large number of small contractors with low financial, technical and managerial capability. In such environment, if all infrastructure development sectors were opened for BOT, local firms could not compete with foreign firms, and consequently the local construction industry would deprive from work. Further, the local firms may have opportunities to execute small petty works in the BOT projects, but foreign firms' services would not be directed to enhance the capacity of local contractors. Thus, the BOT system does not address the problems of the Nepalese and Cambodian construction industry, and would not provide local industry opportunities for human resources and technology development

8.2.3 Construction Management

Construction Management (CM) is a project delivery where the client contracts individual construction manager or a construction management firm during the design stage of a project. This method was developed to provide significant constructability input during the design stage of a project and help the client supervise the project during the execution. Construction management service normally includes but not limited to design review, constructability input, value engineering, estimating, scheduling, budgeting and cost forecasting, selecting and coordinating contractors, construction supervision, progress reporting, documentation and so forth. Two common variations of the Construction Management: General Contractor/Construction Manager (GC/CM or CM@R) and Construction Manager as Advisor (CM as Advisor) are usually employed.

8.2.3.1 General Contractor/Construction Manager (GC/CM)

In the General Contractor/Construction manager (GC/CM) method, the owner contracts with the design team and simultaneously procures a GC/CM to provide constructability input in design and then to build the facility (Figure 8.3). The maximum allowable construction cost is negotiated with the GC/CM once the designs are sufficiently complete. The GC/CM then guarantees the final maximum price, the guaranteed maximum price (GMP). The GMP includes construction cost, the CM's fee, and the CM's contingency. Cost overrun except for contractual change orders are the responsibility of the GC/CM. All the construction work is subcontracted in phases as necessary through the GC/CM. The owner typically reimburses subcontractor costs to GC/CM, and the GC/CM pays the subcontractors when paid by the owner. During design stage, the GC/CM

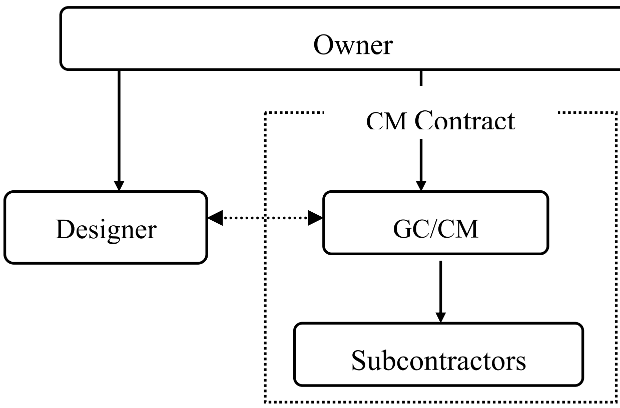


Figure 8.3: Construction Management (GC/CM)

becomes a collaborative member of the project team along with the designer to provide constructability input, cost, schedule and specifications reviews. The GC/CM, in the execution stage, continue to provide constructability review of plans and specifications, performs value engineering, coordinate subcontractors, help client supervise work, prepares and updates schedule, reports the work progress and helps client to ensure the quality.

8.2.3.2 Construction Manager as Advisor (CM as Advisor)

Under the CM as Advisor system, the owner contracts with a construction manager, in addition to the designer, to assist in the management of the construction program to control time, cost and quality. Thus, the owner will have three separate contracts with the designer, the construction manager and contractor as shown in Figure 8.4. In effect, the expertise of the construction manager is intended to enhance the effectiveness of the underlying project delivery system, whether it be the traditional D-B-B or DB. The construction manager is only acting as the owner's advisor or agent, and does not hold the subcontracts. The construction manager usually does not take the responsibility for the design fault but reviews the design and feeds back to the designer. This method was developed to provide significant constructability input during the design stage of a project and help the client make schedule, budget and supervise the project during the execution. The contractors can be selected during the design stage or after the completion of whole design through the competitive bidding.

Similar to GC/CM, the CM as Advisor provides the construction management services but it does not hold trade contracts. The specific role of the CM as Advisor during the pre-construction and construction stages are dependent on the needs for the project as determined by the owner. In addition to the construction management services, the construction manager's services can also be utilized to train the client's employees and contractors, as necessary, to acquire hands on skills during the construction.

The more important advantage of the construction management system is the early introduction of construction knowledge such as constructability assessment, value engineering and so forth while maintaining separate process to procure design and construction parties, thus maintaining a system of checks-and-balances, which does not exist in traditional system. The participation of a construction manager in design stage inputs the perspective of practicing contractors to provide greater accuracy in estimating, budgeting and scheduling. This helps in higher quality of construction documents, a value engineered design, and defects in design can be detected early in the process. The CM method facilitates fast tracking to accelerate a project delivery and more

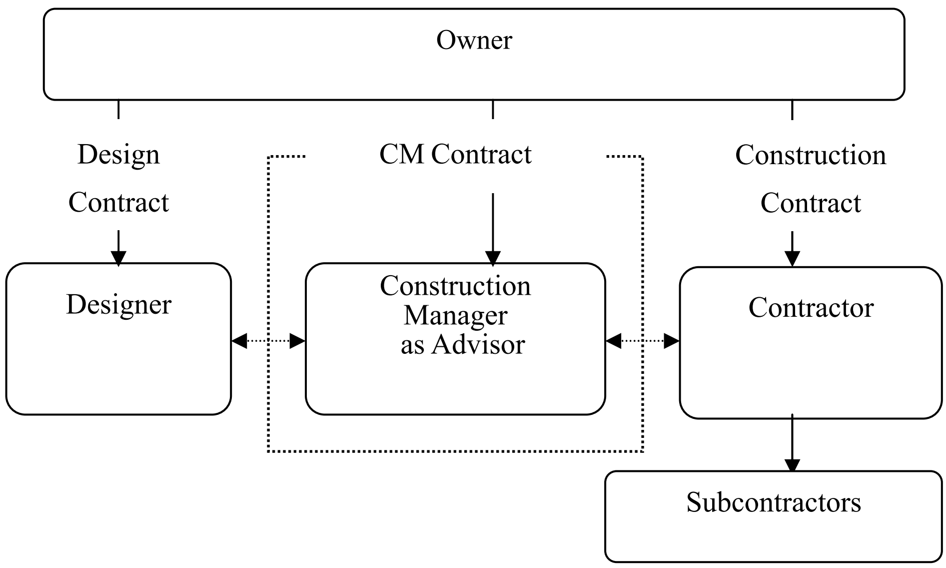


Figure 8.4: Construction Management (CM as Advisor)

flexibility in scheduling. The construction cost can be determined very early in the GC/CM method since they are based on a guaranteed maximum price. Since the CM as Advisor has similar contractual arrangement to the DBB, the client does not need additional capacity to administer the contract.

The CM method would improve the existing decision making system. The construction manager directly supervises the project and feeds the clients so that project manager can make decisions efficiently with consultation of designer, if necessary. Moreover, the CM system enables the clients to implement the decisions immediately through the construction manager. Thus CM method helps improve quality of supervision and efficiency in decision-making by eliminating layers of supervision in project execution (Figure 8.5).

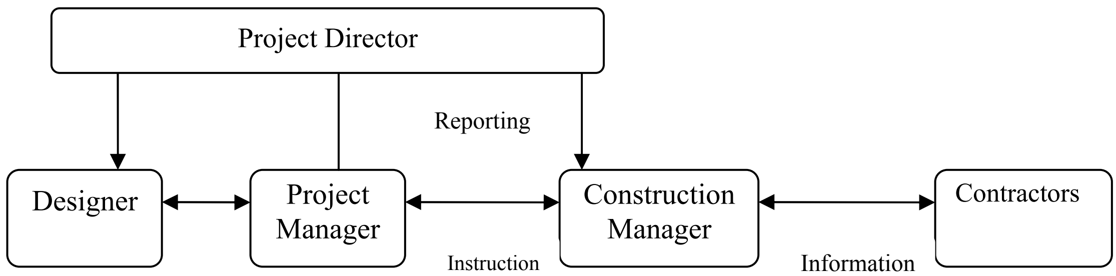


Figure 8.5: Decision Making in Construction Management Method

The project 1, one of the two projects considered in this study, with the Construction Manager as Advisor showed encouraging performance over the traditional method in the project delivery and human resources development. Salient features of the projects are shown in table 8.1 below.

The project 1 was implemented through the CM method which comprised, in addition to the designer, a construction manager (CMR) having sufficient construction management experience. The CMR was entitled to advise and help client make practical estimate and schedule, select contractors, add necessary constructability in design, perform value engineering (VE) and supervise works. The daily involvement of the CMR and continuous site monitoring and work evaluation made it possible to introduce VE, ensure quality of daily works and check any divergence from the original plan. VE proposed by the CMR in the project 1 for foundation during the construction resulted in foundation size reduction, thus helped decrease the cost. The designer was also consulted to confirm the VE. There was regular progress meeting with clients, contractor and the CMR. The project was completed within the stipulated time and in less than the contracted amount without any difficulties and disputes. Further, the Kochi University of Technology provided students opportunity for the construction supervision which enabled the students to acquire construction management skills from the Construction Manager's services.

On the other hand the project 2 consisted of a Total Design Manager 'TDMR' and a construction manager for the planning and administration of the project. The TDMR does not exist in the CM contract. Although the project 2 included the construction manager, the actual execution system of the project was similar to the traditional execution system of the Japanese building projects.

The TDMr and CMR could neither add constructability nor envisage the complexity of the design in translating it to the field. The project was continuously revised. As a result, the project has undergone divergence from the original plan and the client was compelled to close the project at 2 storey (initially it was intended for 3 storey) with increased cost (+11.75%) after 5.5 months from the initial intended completion date.

The project 1 showed that the CM contract with the inclusion of true functions of CMR would help complete a project within the planned resources without deviation, and at the same the system would enable the client and contractors to train their human resources through the construction manager's services.

Table 8.1: Salient Features of the Projects (source: Sano, T. 2004)

Particulars	Project 1	Project 2
Owner	Kochi University of Technology, Kochi prefecture	Miyako Town Office, Miyagi Prefecture
Type of Project	Building Construction	Building Construction
Parties involved	Client, Designer, Construction manager, Contractors	Client, Total Design Manager, Construction manager, Contractors
Total floor area (initial) / number of storey	6196 m^2 / 5	6114 m^2 / 3
Total floor area (final) / number of storey	6236.3 m^2 / 5	5376 m^2 / 2
Initial intended Construction period	12.5 months (from February 2003)	12 months (from March 2002)
Actual Construction period	12.5 months	17.5 months
Special feature	Construction manager, VE	Total design manager
Contract amount (initial)	1700 million ¥	1565 million ¥
Contract amount (final)	1550 million ¥	1749 million ¥
Change in cost	-8.80%	11.75%

Thus, the CM as Advisor project execution method in Nepal and Cambodia would enable the clients and contractors able to deliver a project efficiently and to train human resources during the execution of the project to improve the performance of the construction industry.

8.3 Civil Engineering Curricula Development

Educationalists advocates that students must understand the societal activities, development and needs, and be capable of becoming responsible contributors. Curricula and quality of learning materials affect the productivity of graduates which ultimately influence the performance of industries. What is needed is a clear definition of what industry currently desires in engineering and engineering technology students. Once this is achieved, curricula must be reformed to give students the skills they will need to be successful, and provide the graduates who will be productive in industry (Lahndt, L. 1998). Integration of needs of industry, society and universities through a practical project would help develop appropriate curriculum (Badiru, A.B.). This would enable university to incorporate hands-on experience into the engineering curricula.

Civil engineering has more direct impact on national welfare. The civil engineers help plan, design, construct and maintain national infrastructure. However, there is decreasing relevance of the civil engineering curricula to the actual practice. As stated in previous chapters that infrastructure development projects in Nepal and Cambodia have been suffering from delays, variations and poor quality of works. Almost 90 percent of the civil construction engineers are the undergraduates, and are not familiar with modern tools and techniques for time, cost and quality management. Further, the civil engineering education in Nepal and Cambodia cover mainly elemental design of infrastructure; however, do not incorporate the necessary knowledge areas of construction and project management.

The civil engineering knowledge would be incomplete if it did not cover the knowledge and skills areas required for the execution of a project. The civil engineering education should be compatible with the national infrastructure development and growth of the construction industry. The infrastructure development project, therefore, be the resources for the construction industry as well as academic organizations to fulfill their needs as shown in the figure 8.6. A continuous improvement approach in curricula development is essential in order to maintain the relevance of the civil engineering education with the national infrastructure development and growth of the construction industry. The existing curricula development system in Nepal and Cambodia is following spontaneous system-- improving in more than 10 years interval rather than in incremental steps. This system of curricula development in these countries had made the universities difficult to fulfill the demands of the construction industry. However, the integrated system proposed in this study will help the universities improve in incremental steps according to the national infrastructure development and growth of the construction industry.

A practical construction project management course should be introduced in the civil engineering curricula which would improve the construction and project management knowledge area of the construction engineers and consequently improves the efficiency in infrastructure construction. The construction project management curricula requires to incorporate knowledge areas and skills which are required for each life-cycle stage such as feasibility, planning, procurement, execution and operation of a project. Based on the curricula proposed by Kusayanagi S. (2004), a curriculum on practical construction project management has been developed through literatures review, survey and interviews with construction professionals and academics in Nepal and Cambodia based on the model shown in Figure 8.6.

The proposed curriculum covers sufficient technical and management aspects for the whole project cycle to address the existing problems in infrastructure development in Nepal and Cambodia. Infrastructure development, planning and assessment part of the curricula offer trend of infrastructure development, construction industry and economy, globalization, engineers' mission and ethics, and so forth. Similarly, project mission management covers the legal system, procurement system, risk management and project assessment areas of infrastructure development and management. These knowledge areas would help to improve the efficiency in project implementation including decision-making ability of the project managers and construction engineers. Likewise, project execution management and field management part offers to acquire hands on knowledge for construction project administration, management and field work which would help to improve time, cost and quality efficiency of a project execution. And, project operation and management covers management system for infrastructure operation and maintenance.

Thus, introducing the construction project management in the civil engineering education would enable graduates to visualize a project in a holistic way i.e. integrated from planning through execution to operation. However, the contents of the curricula need to be updated continuously with the industrial and contemporary development in related areas. The proposed curriculum for practical construction project management for the civil engineers is shown in the Table 8.2.

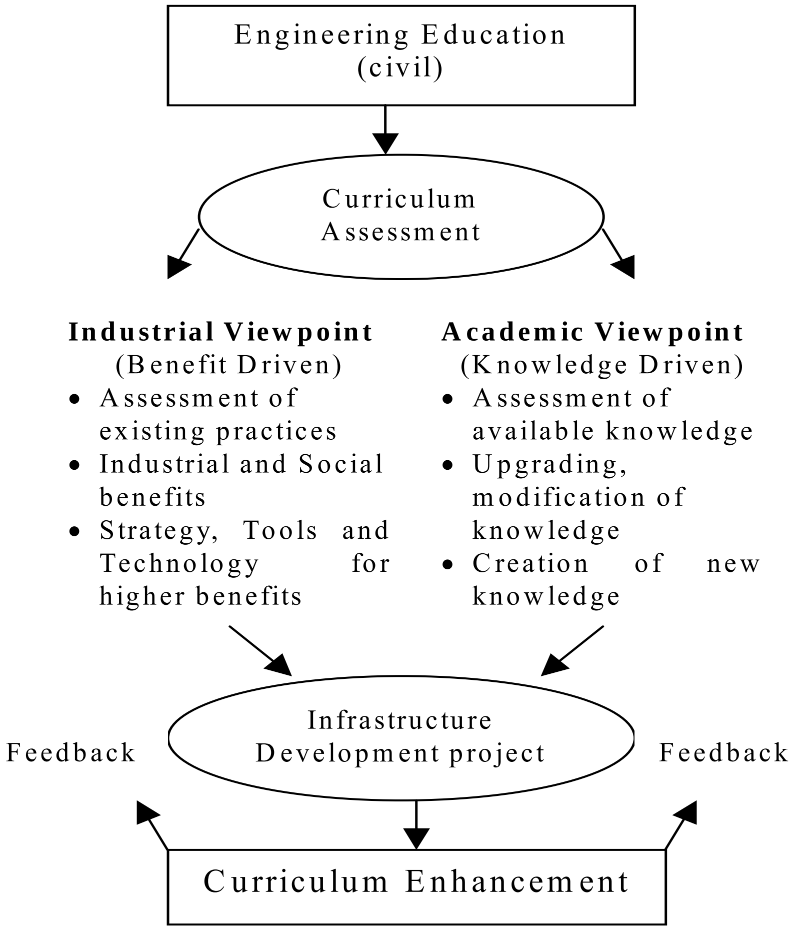


Figure 8.6: Integration of Industry and University needs in curriculum enhancement (modified from Badiru A.B.)

8.4 Conclusions

Alternative project delivery systems which incorporate human resources development would help improve the capacity of the Nepalese, Cambodian construction industry.

The DB and BOT system are not suitable in Nepal and Cambodia at present because the

Table 8.2: Curriculum on Practical Construction Project Management (recommended)

1. Infrastructure Development, Planning and Assessment	
Infrastructure Development, Planning and Assessment	Infrastructure Development in the world
	International Construction Industry
	Globalization, International Regulations & Standards
	International Issues in Construction
	Development Planning; National Infrastructure development (mission & policy);Master, Regional & District Plan
	Domestic Construction Industry and National economy
	Project Financing, Investment Appraisal
	People's participation in Infrastructure development
	Environmental Issue
Role of Civil Engineers	Engineers' mission, ethics, Leadership, Communication
2. Project Mission Management	
Laws & Regulation	Laws, Rules and Regulations related to Procurement, Construction, Arbitration, Audit, Tax, Environment, Property & others
Procurement	Project Delivery & Contracting System
	Conditions of Contracts for various type of Contracts
	International Standard Condition of Contracts
	Tendering, Evaluation & Contract Award
	Public procurement, Procurement standards of various International Financing Institutions
Risk management	Risk Evaluation & management
	Insurance
Project planning & Assessment	Roles and responsibility of Stakeholders
	Environmental assessment, Feasibility Study & Project Appraisal
	Engineering cost and Financial Management
3. Project Execution Management	
Construction Project Administration and Management	Partenering; Joint venture
	Construction Organization
	Human resource Management
	Construction planning, Scheduling
	Cost estimation
	Schedule control
	Cost Control
	Quality management
	Productivity in Construction
	Contract Administration, Reporting, Documentation
	Claim & Dispute management, Negotiation
	Tax & Accounting
	Technical Audit
	Security & External management, Public relation
4. Project Field Management	
Field work plan and control	Technology Transfer
	Capital & Labor-based Technology and Construction Equipment
	Construction environment, Stakeholders coordination
	Material Management
	Health & Safety
	Quality Control
	Productivity Improvement
	Personal control
5. Project Operation and Mmaintenance	
Operation and maintenance	Project Operation Organization
	Social Impacts
	Monitoring and Investigation
	Maintenance Plan, Methods

construction industry in the Nepal and Cambodia consists of large number of small and inexperienced contractors with low financial and technical capability, and the DB and BOT systems require high quality builder/developer with enough financial and technical capability, and the DB and BOT do not integrate human resources development while implementing a project. Further, the local industry in Nepal and Cambodia may not be able to provide the GC/CM services however they can be benefited from the construction manager's services as in CM as Advisor.

The introduction of the Construction Manager's services through the CM as Advisor method in a project delivery would help add constructability, value engineering to make practical estimate and schedule, and make enable the client and contractors to complete a project within prescribed time, budget and quality. On the other hand, the client and contractor could train their human resources through the construction management services of the CMR in similar way to the project 1 discussed above. Thus, the CM system incorporating human resources development would be appropriate to improve the performance of the construction industry through human capital development in Nepal and Cambodia (Niraula, R. et al 2005).

The civil engineering education should be made relevant to the national infrastructure development and growth of the construction industry. Infrastructure development projects are the resources for the curriculum improvement. The civil engineering education could be made compatible with the national infrastructure development and to the growth of the construction industry through the continuous incremental improvement in the curricula. A judicious combination of theory and practice in the engineering curricula would help produce more productive technical manpower. Incorporating appropriate construction management curricula in the civil engineering would enable the Nepalese and Cambodian universities to produce appropriate human resources required for infrastructure development efficiently.

Chapter 9
9. Conclusions and Recommendations

Human resources development system greatly affects the infrastructure development efficiency. Infrastructure development project goes through various stages of the project cycle. Not a single engineering knowledge is enough to deliver a project efficiently. Different stages of the project cycle require the construction engineers to be equipped with various knowledge areas and skills. The civil engineering, more than any other engineering, has more direct impact on national infrastructure development. A judicious combination of theory and practice in the civil engineering education enables the construction engineers to acquire hands on knowledge and skills required for infrastructure development. Further, the performance of the construction industry cannot be increased only by the mere rise in the number of engineers without having appropriate skills and technologies as demanded by the industry.

Human resources and infrastructure development environment in Nepal and Cambodia are in very dismal situation. Theoretical knowledge imparting is the domain in the university education. The graduates could not acquire practical skills from the university education, and universities could not significantly contribute the construction industry. Lack of appropriate training system resulted to the poor skills of the construction engineers, and lack of research and development for appropriate technologies development/innovation has lead to poor performance of the construction industry. The human resources and infrastructure development system in Nepal and Cambodia needs to reform based on the following situations:

- The construction industry was in need of own national standards for infrastructure design, construction and management,
- Infrastructure development projects are suffering from severe delay and quality problems,
- The construction engineers lack many of the construction and project management skills,
- The graduates could not acquire practical skills from the university education,
- The construction industry could not develop appropriate technology for material production, construction and management.
- The existing ODA system did not provide enough opportunities for Human resources and technology development for domestic infrastructure development.

The primary reason for the inefficiency in the project delivery is the lack of construction and project management skills in the construction engineers and unavailability of appropriate technologies in the construction industry. The poor skills of the construction engineers/graduates were resulted from the mere textbook education in the university. The universities lack qualified faculties, appropriate educational and research facilities, and financial resources. Since there was no evident linkage between the industry and the universities, there was no opportunity to feed the industrial activities and needs in to the education. The existing engineering education, therefore, could not fulfill the demands for human resources and technology required for national infrastructure development.

Existing ODA execution system could not sufficiently provide the recipient countries opportunities to produce required human resources and technology for infrastructure development. Further, the execution system of Japan's ODA did not provide the Japanese Consultants/contractors adequate opportunities to be familiar with international practices, and could not effectively transfer the Japanese technology, management and culture to the developing countries.

In order to overcome the problems in the human resources and infrastructure development, the author has proposed the integrated system which would enable developing countries able to develop appropriate human resources and technologies required for infrastructure development. The industrial need oriented universities collaboration helps the universities from the developing countries to improve their capacities through the advanced training and studies in the developed countries, and enable them to absorb seed technology for appropriate technology development. The study and research on the technology which could address the local industrial needs would enable the universities to acquire hands on knowledge and skills on appropriate technology development.

The establishment and functioning of the Center of Excellence for Education and Research would enable the local universities able to produce industry oriented human resources and technology for material production, construction and management. The center would be the medium for the linkage between the industry and the universities, so that the real time needs and activities of the industry could be fed in to the university education. This improves the relevance of the engineering education with the industrial growth. The involvement of the foreign advisors at the center would strengthen the lacking areas of the local universities.

The education and training function of the center would enable university to combine theory and practice in the university, and to deliver appropriate education and training for the graduates and the industry practitioners. This would reduce the loan burden and dependency of the developing countries for human resources development on the developed countries.

The research and development works at the center would enable the universities to produce special construction materials and technology for construction and management. The internship through the center would provide the graduates opportunities to acquire knowledge and skills in the diversified areas from the senior professionals while involving in the industrial works. The deployment of the faculties and the products in the development works enable the universities to be self-financed, and encourage them to develop more technologies and products necessary for the national infrastructure development.

Skill improvement of a few clients' people or practitioners cannot improve the overall productivity in the construction. Enhancing faculties' capacity, and improving educational and research facilities at the universities would result higher skill level of the workforce than from the training for a few practitioners. Incorporating university functions in infrastructure development would enable the construction industry able to improve the productivity. Since ODA is the only source for infrastructure development in developing countries, certain amount of the ODA should be allocated for strengthening the universities in the developing countries in order to fulfill the demands for human resources and technology for infrastructure development. The proposed ISHID would enable the developing countries able to produce appropriate human resources and technology domestically. The ODA should support to enable the ISHID implement and to run smoothly.

The proposed system would also be beneficial to the Japanese construction industry. The new system also provides the Japanese graduates to experience the integrated infrastructure development in the multicultural environments of the developing countries which were not available to observe in the domestic construction industry in Japan. The graduates involved in the international construction environments through the proposed system during the university education would have opportunities to improve their communication, negotiation and teamwork skills which are required to improve the competitiveness in the global construction market.

Until now, a part of the system was implemented in Cambodia. The university collaboration between the Kochi University of Technology (KUT), Japan and the Institute of Technology of Cambodia (ITC) had shown that industry oriented university collaboration would enable local university to enhance the capacity to deal with the industrial problems. 2 faculties from the ITC are being trained in the concrete technology and management at KUT which will fulfill the lack of faculties in the construction materials and management at the ITC. The ITC will then able to deliver the classes/training in the said areas for the graduates as well as the practitioners which would improve the material production and management skills and technology in the Cambodian construction industry.

In order to get the full impact of the proposed system, the Center of Excellence for Education and Research (COE&R) with research and development facilities for concrete products should be established at the ITC, and the impact of the whole system be evaluated in terms of availability of human resources and technology in the Cambodian construction industry.

Recommendation for Further Study

Since the study was able to develop the integrated system for human resources and infrastructure development, it is required to visualize the effects of the system to the socio-economic development of a country. It is recommended to implement the system in Cambodia through KUT-ITC collaboration, and measure the impacts in socio-economic development in Cambodia.

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APPENDICES

QUESTIONAIRE TO INDIVIDUALS

The correct answers to the following questions are thought to be helpful for a research work that I have been carrying out for my doctoral study at the Department of Infrastructure System Engineering in the Kochi University of Technology, Kochi, Japan. I would remain ever obliged and thankful for the help rendered by the respondents who despite their busy schedules choose to answer the questions.

Respondent Name:
Designation:
Name of Organization:

Address:

Qualification:

1) What type of service you have delivered until now?

Type of Work / designation	Years
Project planning and assessment	
Construction Supervision	
Infrastructure Design / Estimate	
Project Procurement	
Contract Administration	
Financial administration / management	
Law, Policy, Rule, Regulation Advisor	
Technology Advisor	
Trainer	
Researcher	
Director/manager of a public office	
Director/proprietor/ manager of a company	
Arbitration	
Others (please specify)	
Total years of Experience	

2. What type of project delivery systems have you experienced for infrastructure development works until now?

□Design - Bid – Build
- ○ Unit rate contract
- ○ Lump sum Contract

□Design and Build
- ○ Lump sum
- ○ Cost plus fee

□Turn-key

□Cost plus fee

□Construction Management
- ○ Construction manager
- ○ Construction management firm

□Build – Operate – Transfer (BOT) or Private Finance Initiative (PFI)

□Others

3. Have you experienced any problems as listed below in infrastructure development works? i)

Cost overrun	□Yes	□No
ii) Time overrun	□Yes	□No
iii) Quality not meeting the standards	□Yes	□No
iv) Insufficient benefit / return from the project	□Yes	□No
v) Others		

3.a) If 'YES', In your opinion, what are the probable reasons for such problems?

a) *<u>Project Identification, Planning and Assessment</u>*

□Project selected and planned without public consent

□Poor planning

□inadequate study (feasibility, etc) before implementation

□Not enough alternative assessed

□Economic matter was not considered or not properly considered

□Social / cultural matters were not considered

b) *<u>Project Design, Estimate</u>*

☐Poor design and estimate

○ Not enough data collected/available for design

○ Inadequate field investigation and consultation to the beneficiaries

○ Designer did not have enough technical knowledge/experience for design

○ No benefit, life cycle management cost considered/assessed during design

○ Carelessness of designer

☐Incomplete design

☐Inappropriate design

☐Inappropriate Technology selected

☐Owner does not have enough capacity to check the design/estimate

c) Procurement Stage

☐Poorly designed contract document

○ lack of clear contract clauses

○ lack of complete information of the scope of project and related matter

○ inappropriate contract clauses

○ambiguous contract clauses

○conflicting contract clauses

○irrelevant contract clauses

○lack of some of the relevant contract clauses

☐Contractors are not familiar with the contract clauses

☐Inappropriate project delivery system (like D-B-B, D&B, etc)

☐Inappropriate contracting system (Unit rate, Lump sum, etc)

☐Inappropriate contractor selection procedure

☐Inappropriate consultant selection procedure

☐Collusive bidding

☐Excessive low bidding

☐Lack of general standard procurement law, regulation, guidelines, etc.

Others

d) Construction Stage

☐Poor quality design drawings issued to the contractor

☐Large number of design changes

☐Insufficient inspection from the clients / consultants

○ Clients' do not have enough technical personnel

○ Clients' technicians are not familiar with the project/structure under construction

○ Clients' technicians do not want to go the construction site

○ Clients' do not have a habit of regular supervision of construction site

☐Weak monitoring and control

- ○ Supervisors are not familiar with contract administration
- ○ Supervisors lack
  - i) Schedule management skill
  - ii) Cost management skill
  - iii) Quality management skill
- ○ Supervisors are not serious about the quality of works

☐Incompetent contractor

- ○ Do not have sufficient capital
- ○ Project manager does not have
  - ｉ) enough technical knowledge
  - ｉｉ) enough management (management, contractual, social/cultural, legal and political) knowledge and skill
- ○ Key project personnel do not have
  - ｉ) Enough technical knowledge
  - ｉｉ) Enough management (management, contractual, social/cultural, legal and political) knowledge and skill
- ○ Key personnel are not familiar with local conditions
- ○ Inadequate number of key personnel
- ○ Inadequate use of equipment
- ○ Lack of skilled workers

☐Poor Field Management

- ○ poor team building and performance
- ○ lack of communication or poor communication among the craft persons / technicians,
- ○ inappropriate work distribution among craft persons
- ○ poor labor management
- ○ poor material management
- ○ poor plant, equipment management
- ○ lack of proper supervision
- ○Lack of specialized subcontractors
- ○Lack of reliable suppliers

☐Poor coordination among Clients/Consultants/Contractors

☐Negligence of Clients / Consultants / Contractor

☐No coordination from other local authority/organization

☐Poor cooperation from local residents / beneficiaries

☐Others (please specify)

4) Are you satisfied to the Cost-Benefit of the present Public Infrastructure? *Please tick or cross wherever applicable..*

	Highly satisfied		Satisfied		Uncertain		Not-so satisfied		Unsatisfied

5) In your opinion, what would have to consider for better infrastructure development?

i)

ii)

.6) Are (were) you satisfied with the performance of technical (Civil) personnel working with you? *Please tick or cross wherever applicable.*

	Highly satisfied		Satisfied		Uncertain		Not-so satisfied		Unsatisfied

7) What knowledge / skills are (were) lacking in the technical personnel working in infrastructure development project in your country?

□Overall management and Leadership

□Economics/Financial management

□Project planning and design (Technical capability)

□Project monitoring and evaluation

□ Project procurement (Project delivery, tendering, contracting, etc.)

□Project scheduling and control

□Quality control

□Modern information Technology and Computer application

□Legal system and Political knowledge

□Field management

□Supervising works

□Reporting, Communication and Negotiation skill

□Social / Cultural Knowledge

□Others (please specify)

8) What are the problems in efficient implementation of a project in your country?

□ Financial Problem

□Insufficient time and resources spent for project planning and assessment

□Difficulty in hiring plants & equipment during investigation and construction

□Difficult to find qualified technical personnel in the field of

- ○ Project planning and assessment
- ○ Project design

○ Project procurement

○ Construction management

○ Project operation and maintenance

○ Others (please specify)

☐lack of qualification system for Civil Engineers/Technicians / Construction Professional

☐Political problem

☐Legal problem

☐Difficult to get public consent / cooperation

☐Incompetent clients

☐Incompetent Consultants

☐Incompetent contractor

☐Lack of reliable suppliers

☐Lack of appropriate construction material

☐Lack of skilled workers

☐No coordination from local authority

Others (please specify)

9) Are you satisfied with the performance of contractors working in infrastructure development project? *Please tick or cross wherever applicable.*

	Highly satisfied		Satisfied		Uncertain		Not-so satisfied		Unsatisfied

10) What area should the contractor improve for efficient delivery of a project? Please list below.

11) A construction project is unique in nature and it cannot be replaced once constructed. It needs economic decision for selection and prioritization; engineering knowledge for efficient and appropriate design and maintain; project management and control knowledge for efficient implementation; modern/available technology, legal, political and social/cultural knowledge for efficient execution. Moreover, a civil engineer has been taking a leading role for infrastructure development in a country and carrying out all the activities mentioned above. It is, therefore, essential to make competent human resource in the construction industry for efficient infrastructure development and management;

i) In your opinion, what combination of engineering and project management knowledge is essential for efficient delivery of an infrastructure development project? Please write below.

Project Phases	Engineering	Project	Others	Total

		Management	(please specify	(100%)
Project Formulation, Feasibility Study, Strategy Design & Approval				
Planning & Design				
Procurement				
Construction				
Operation and Maintenance				

ii) How do you evaluate the fresh graduates to employ in the following field of an infrastructure development work under your organization? *Please tick or cross wherever applicable.*

a) Infrastructure Planning and Assessment

	Very good		Good		Uncertain		Poor		Very poor

b) Infrastructure Design/Estimate

	Very good		Good		Uncertain		Poor		Very poor

c) Project Management

	Very good		Good		Uncertain		Poor		Very poor

d) Construction

	Very good		Good		Uncertain		Poor		Very poor

iii) What should civil engineer study/experience at university to reduce the training cost and time, and make them ready-to-use graduates?

iv. a) Are you satisfied with existing Engineering Education in your country? *Please tick or cross wherever applicable.*

	Highly satisfied		Satisfied		Uncertain		Not-so satisfied		Unsatisfied

b) What essential parts are neglected / not included in Civil Engineering University education?

v) Until now, bachelor's degree is supposed to be sufficient to be eligible to enter private and public organizations. Moreover, there is little opportunity to get master degree once entered to a public/private organization. In such circumstances, what combination of a course structure would be appropriate for Civil engineering (Bachelor's of Civil Engineering) education?

Particular	Percentage of whole content	Remarks *(please put your opinion for the inclusion of the course)*

Science (Physics, chemistry) & Mathematics, etc		
Basic Civil Engineering in integrated field		
Advanced Civil Engineering in a specialized field		
Professional Practice Area (Construction & Project Management, etc.)		
Field Work (Internship)		
Others (please specify)		
Total	100%	

NB:

- ***Basic Civil Engineering in integrated field*** (Fundamentals of analysis and design for Reinforced Concrete, Steel & Timber Structures; Water Resource Engineering; Soil & Foundation Engineering; Transportation Engineering; Environmental Engineering; Architecture & Building Engineering; Surveying; Engineering and construction materials; Information Technology and Computer application in Civil Engineering)

- ***Advanced Civil Engineering in a specialized field*** (Advance course in above mentioned subject)

- ***Construction and Project Management*** (Fundamentals of management, Engineering Economics & Financial management, Legal system, Project planning & assessment, Project Procurement, Project Execution & Field management, Project Operation & Maintenance)

12) What area of specialization for a civil engineer is essential in future for efficient infrastructure development in a developing country? Please list according to the importance order.

Importance Order	Area / Subject
1 2 3	

13) Have you ever worked jointly with a University for an infrastructure development work?

i) If 'YES' what was the quality and reliability of professional services compared to local consulting organizations?

□Better than other private Organization

□Same as other private organization

□Poorer than other private organization

ii) If 'NO' what do you think about the quality and reliability of the services compared to local consulting organizations?

□Better than other private Organization

□Same as other private organization

□Poorer than other private organization

□Uncertain

14) In your opinion, what University should do to build new human resources competent and contribute in the development activities of a country?

15) In your opinion, what Construction Industry should do to build new human resources competent to enhance the capacity of the industry?

16) In your opinion, what should the clients do for efficient delivery of a project and enhance the capacity of local Construction industry? Please list below.

CONSTRUCTION MANAGEMENT EDUCATION

The following influencing factors/items for Construction management have been identified in the literature survey. Please kindly rate the significance level of each item necessary for the practitioners and formal Civil Engineering Education on a scale of '0' to '3' (with '0' being 'Not Important', '1' being 'Useful', '2' being 'Important', '3' being 'Very Important'.

<table>
<tr><td colspan="3" rowspan="2">Main items and Attributes</td><td colspan="3">Necessary for Practitioner</td><td colspan="2">Necessary to include in Formal Education</td></tr>
<tr><td>Project Manager</td><td>Engineer</td><td>Technicians</td><td>B. E. (Civil)</td><td>Vocational (10+)</td></tr>
<tr><td colspan="3">1. Infrastructure Planning and Assessment</td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td></td><td rowspan="4">Infrastructure development in the world</td><td>Infrastructure Development in the world</td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td></td><td>International Construction Industry</td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td></td><td>Globalization, international Regulations & Standards</td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td></td><td>International Issue in Construction</td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td></td><td rowspan="4">Domestic Infrastructure development</td><td>National Infrastructure development</td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td></td><td>Domestic Construction Industry</td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td></td><td>Master plan and Regional & District Plan</td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td></td><td>Environmental Issue</td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td></td><td>Role of Civil Engineers</td><td>Engineers' mission, ethics, Leadership, Communication</td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td colspan="3">2. Project Mission Management</td><td></td><td></td><td></td><td></td><td></td></tr>
</table>

	Laws & Regulation	Laws related to Procurement, Construction, Audit, Tax & others					
	Procurement	Project Delivery & Contracting System					
		Conditions of Contracts for various type of Contracts					
		International Standard Condition of Contracts					
		Tendering, Evaluation & Contract Award					
		Procurement standards of various International Financing Institutions					
	Risk management	Risk Evaluation & management					
		Insurance					
	Project planning & Assessment	Engineering Economics, Investment Appraisal Feasibility Study & Project Appraisal					
		Environmental assessment					
		Engineering cost and Financial Management					
3. Project Execution management							
	Construction Project Administration and Management	Construction Organization					
		Human resource Management					
		Construction planning, Scheduling					
		Cost estimation					
		Schedule control					
		Cost Control					

		Quality management					
		Productivity in Construction					
		Contract Administration, Documentation					
		Claim & Dispute management, Negotiation					
		Tax & Accounting					
		Security & External affairs					
4. Project Field Management							
	Field work plan and control	Temporary & Permanent works					
		Construction Equipment					
		Material Management					
		Health & Safety					
		Quality Control					
		Productivity Improvement					
		Personal control					
5. Project Operation and maintenance							
	Operation and maintenance	Monitoring and Investigation					
		Maintenance Plan, Methods					
6. Information Technology							
	IT in construction	Computer Application and Information Technology for Construction					
7. Others (please specify)							

Questionnaire for Applicability and Implementability of the ISHID

(A) Please give us following Basic Information related to **Your Organization**

(Q.1) Name of your Organization:

(Q.2). Type of your organization (*please select from the options below and write in the box*)

Answer for Q.2	

(i) Governmental organization

(ii) Educational organization :

(a) University

(b) Institute of Technology / College / Campus

(c) Other Technical Organization

(iii) Industrial organization

(iv) Others (please specify):

(Q.3) Your position: (*please select from the options below and write in the box*)

Answer for Q.3	

(i) Management of the organization

(ii) Executives (Department Head, Asst. Head, Prof., practitioners etc.)

(iii) Administrative staffs

(iv) Others (please specify):

(Q.4) In case that you are from the educational organization, could you please give the human resource (**full time faculties in the Civil Engineering**) strength of your organization?

Faculties	Qualification	Number
Professor	Ph.D. / Dr. Eng.	
	Masters	
	Undergraduates	
Asst. Professor	Ph.D. / Dr. Eng.	
	Masters	
	Undergraduates	
Lecturer	Ph.D. / Dr. Eng.	
	Masters	
	Undergraduates	
	Ph.D. / Dr. Eng.	

	Masters	
	Undergraduates	

(B) Your opinion regarding the **Proposed System**

(Q.5) Are you interested in the proposed system?

(a)Very interested(b) Interested (c) Not Interested

Answer for Q.5	

If you can describe reasons, please give us.

(Q.6) Do you think the system can be implemented?

(a) Implementable (b) difficult to Implement (c) Not Implementable

Answer for Q.6	

If you can describe reasons, please give us.

(Q.7) Do you think that this system is significant/meaningful for your organization?

Please tick or cross wherever applicable.

	Yes
	Yes, but don't have enough number of faculties
	Yes, but our faculties do not have enough time
	Yes, but don't have money for the proposed system
	Yes, but don't have research facilities
	No

(Q.8) Do you think that this system is significant/meaningful for your country?

(a) Very Significant (b) Significant (c) Not Significant

Answer for Q.8	

If you can describe reasons, please give us.

(Q.9) Does your organization alone can implement this system?

(a) Highly Possible (b) Needs extra effort (c) Not possible

Answer for Q.9	

If you can describe reasons, please give us.

(Q.10) This system has a concept of University Consortium within a country to implement the system effectively; do you want to participate in the University Consortium?

Yes No

Answer for Q.10	

If you can describe reasons, please give us.

(Q.11) Comments/suggestions (if any):

(Q.12) Can you provide more information?

i) Respondent's Name:

ii) Qualification:

iii) Name and Address of Organization: