

## Technology Transfer to Local Construction Industry through Foreign Contractors: Barriers and Enablers

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**Abstract:** Sri Lankan construction industry has developed considerably during past few years due to ongoing infrastructure development projects and post war reconstruction and rehabilitation projects. These will further trigger a construction sector boom over the next few years. Construction industry boom has invited more foreign construction firms into the local construction industry. Technology Transfer to local construction industry is one key benefit from the foreign construction firms' involvement. Technology Transfer is a crucial and dynamic factor in social and economic development and has been transferred intentionally or unintentionally from one party to another when right conditions are provided (Li Hua and Greenwood, 2001). The development of a construction industry of a certain country can be enhanced through the involvement of foreign construction firms. However, authors' initial investigations raised question is, whether the Sri Lankan construction industry is ready to acquire the possible construction technology through foreign firms. This paper identified enablers and barriers of Technology Transfer and suggest local construction industry to create a suitable conditions to acquire construction technology more dynamically through foreign firms.

**Key words:** Technology Transfer, Learning Environment, Enablers, Barriers

### 1. BACKGROUND

Sri Lankan construction industry contributes about 8 per cent to the country's GDP and ranks seventh among the thirteen major sectors contributing to the country's GDP (ICRA industry report on Sri Lanka, 2011). The end of destructive conflict in 2009 has revived the economic activity and resulted in a strong focus on infrastructure development. With the construction boom, the presence of foreign construction firms has increased considerably in Sri Lanka. It is evident that the involvement of foreign construction firms within a construction market of a certain country, improves capacity of construction industry of that host country. When foreign contractors are invited, host country expects technology transfer to the local construction industry through their involvement which encourages the flow of new technology to the local industry to upgrade the capabilities of local contractors (Ofori and Lean, 2001). According to Ofori et al, (2002) foreign contractors have generally shown their ability to deliver higher quality of work with timely completion. The process of technology transfer requires a recipient industry should possess a suitable mode of gaining knowledge (Ganesan and Kelsey, 2006). Thus, the local construction industry should have an appropriate environment to grab and absorb suitable technology and knowledge from foreign construction firms. But the question remains, is whether the present situation of Sri Lankan construction industry is prepared to acquire advance technologies and knowledge. It is essential to understand the barriers and enablers to create such cohesive environment.

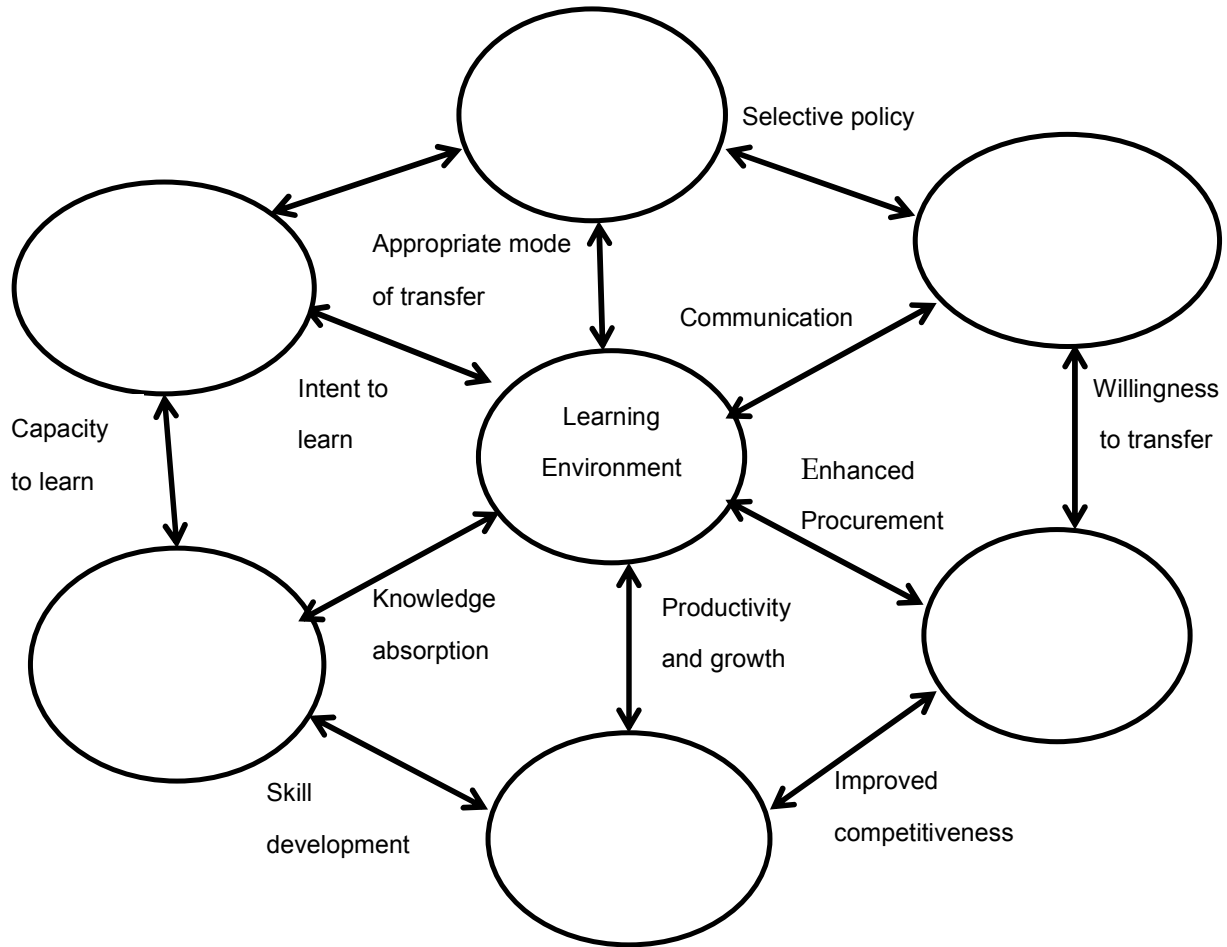
## 1.1. Technology Transfer

Technology Transfer (TT) is a crucial and dynamic factor in social and economic development. Abbot (1985) defined TT as “the movement of the science from one group to another, such movement involving its use”. Simkoko (1989) defined the TT for construction industry as “the planned conveyance and acquisition of technical knowledge and techniques of construction firms”. This implies that there is no true TT until the technical knowledge received from the donor has been put into effective use. Technology Transfer involves a two way process which can succeed only when both the donor and the recipient work together in deciding what needs to be transferred and implement (Sridharan, 1994). Moavenzadeh and Hagopian (1984) suggested foreign contractors’ involvement as a key requirement for the development of local construction industry and shown that local contractors progressively enhance their capability by working with foreign contractors, until eventually they become able to export their services. It is evident with Singapore construction industry, that the local contractors’ capacity and ability have been enhanced as a result of their involvement with foreign firms (Lam, 1994). UNCTAD (1990) suggested that effective transfer occurs when the technology is requested, transmitted, received, understood, applied, diffused widely and improved. Construction technology may be transferred through joint ventures between foreign and local companies which may either be project specified or of a long-term nature (Ofori, 1994). International joint ventures and subcontracts employed in building material and construction can be serious vehicles of TT provided it contributes to provide high quality inputs into the wider industry (Ganesan and Kelsey, 2006). Shrestha and Kumaraswami (2000) shown that technology transfer can takes place in various ways, such as direct use of technology, use of technology with modification, and the reverse use of technology.

## 1.2. Technology Transfer Barriers and Enablers

Technology transfer has been advocated as a catalyst of the change or improvement required in many construction industries; however free transfer of technology from one country or region or firm to another has been restricted by various barriers (Shrestha and Kumaraswami, 2000). They identified few technology transfer barriers such as: (i) Organizational culture, (ii) Lack of time, (iii) Capacities of individuals (e.g. Training skills) (iv) Attitudes of individuals (e.g. Reluctance), (v) Lack of clear policy, (vi) National /ethnic culture differences, (vii) Lack of clear agreements (viii) Lack of clear procedures, (ix) Lack of funding provisions, and (x) Language. According to their findings related to Hong Kong construction industry, organizational cultural barriers, lack of time, capacities and attitudes of the individuals and lack of clear policy are the major barriers.

Steward and Waroonkun (2007) developed a conceptual framework which included four technology transfer enablers namely, transfer environment, learning environment, transferor (foreigner) and transferee (host) characteristics. The performance and interrelationship between, these enablers contributes to the degree of value added to the host country construction sector in three main areas, namely, economic advancement, knowledge advancement and project performance as shown in Figure1.



**Figure 1: Seven proposed perspectives for benchmarking Technology Transfer (Source: Stewart and Waroonkun, 2007))**

**Transfer environment:** Construction projects incorporating technology transfer are mainly produced by turnkey systems, direct licensing agreements, management contracting or joint ventures. For large or complex technology transfer projects alternative modes may be adopted such as licencing-cum joint ventures, turnkey-cum-licensing etc (Calantone et al, 1990). According to Calantone et al (1990), host government's policies, regulations and enforcement practices can impact greatly on the effectiveness of technology transfer initiatives, especially with their international political system and domestic political structure. Those government policies should provide initiatives to transferor to transfer technology pro-actively to local competitors (Kumaraswamy and Shrestha, 2002).

**Learning Environment:** Cultural characteristics and the distance between the technology transferor and transferee is a major concern of technology transfer process (Fisher and Ranasinghe, 2001, Kumaraswamy and Shrestha, 2002). Effective technology transfer process required the parties involved in the process to build a culture of mutual trust through effective communication (Malik, 2002). Devapriya and Ganesan (2002) suggested strong commitment from the senior management teams of both the host and foreign firms to establish this culture.

**Transferor and Transferee Environment:** To achieve a successful technology transfer the transferor should transfer the appropriate technology and the transferee should have every intension to adopt it. Moreover, the degree of international experience of both parties and the nature of experience can impact significantly on the technology transfer process. The capacity to transfer and adopt technology will also depend on each individual existing knowledge base and the gap between this knowledge level and the level required utilizing the transferred technology (Steward and Waroonkun, 2007). Kumaraswamy and Shrestha (2002) showed the appropriateness of the transferor and transferees culture for working in partnership to embarking on the TT process. Capacity of the local construction industry to assimilate, adapt, modify, and generate technology is critical to an effective transfer of

technology. This capacity building cannot be done only by importing technologies from foreign countries but also through advanced man power and management training, domestic production of materials, tools and equipment, and individual innovation focused on construction industry. Ganesan and Kelsey, (2006) shown the need for opportunities for acquiring knowledge about designs and construction planning, and education and training programmes to formulate within construction joint ventures in order to train local firms on newly established construction technologies and construction knowledge. Participation of local design and or construction firms at early stages will facilitate the absorption and implementation of appropriate construction technology. Open and positive attitudes among the parties involved may encourage transfer technologies from foreign firms to local construction firms.

**Economic Advancement:** A predominant reason to encourage international TT initiatives by governments of developing countries is to improve living standards and economic prospect of people (Steward and Waroonkun, 2007). Therefore host workers and professionals should be performed at a higher level and become more competitive in the domestic and international market to achieve this objective (Fisher and Ranasinghe, 2001). It should be noted that to gain economic advancement transferred knowledge has to be absorbed and applied on a number of projects across the host country.

**Knowledge Advancement:** As sited by Gilbert and Cordey-Hayes, 1996, beyond the quantitative economic benefits achievable from TT, host construction firms may also experience knowledge advancement at the individual and organizational level (Steward and Waroonkun, 2007). This knowledge which can be transferred as implicit and tacit knowledge should lead to improve working practices in the immediate term and hopefully become the norm over the long term (Steward and Waroonkun, 2007)

**Project Performance:** Financial performance, schedule performance and quality performance are generally accepted as major objectives of a construction project. The effective TT should improve the performance of these key areas (Devapriya and Ganesan, 2002).

Language and cultural barriers seems to be significant factor which affect the level of TT to Sri Lankan construction industry. Most of the time host workers and foreign workers use different languages which decrease the mutual understanding between the parties due to lack of effective communication. Within the host country environment a system for effective communication should be established in order to channel the required construction knowledge and technology in an effective way. Capabilities of individual firms should be identified before form the agreements for joint ventures so that to understand which technology is to be transferred and which technology to be absorbed.

## 2. DISCUSSION

As sited by Ganesan and Kelsey (2006), the capacity to assimilate, adapt, modify, and generate technology is critical to an effective transfer of technology. This capacity building cannot be done only by importing technologies from foreign countries but also through advanced man power and management training, domestic production of materials, tools and equipment, and individual innovation focused on construction industry. If absorptive capacity of a certain country is higher that country has that country is more capable of assimilate the technology from foreign countries (Roshanthini et al, 2011). Therefore, a key to effective technology transfer is to develop absorptive capacity of Sri Lanka construction industry by adopting well established guidelines.

Planning for technology transfer in foreign funded projects is a critical need (Ganesan and Kelsey, 2006). Opportunities for acquiring knowledge about designs and construction planning, and education and training programmes should be formulated within construction joint ventures in order to train local firms on newly established construction technologies and construction knowledge. Participation of local design and or construction firms at early stages will facilitate the absorption and implementation of appropriate construction technology (Ganesan and Kelsey, 2006).

Clear policies and initiatives should be established by the Sri Lankan government to ensure the transfer of suitable technology and knowledge to the Sri Lankan construction industry from foreign construction firms. Therefore Sri Lankan government and responsible authorities should take initiatives to address and monitor the total process of technology transfer between local and foreign firms. It is evident that during last few decades Institution for Construction Training and Development has been developing proposals to upgrade domestic contractors, but only limited success in increasing work opportunities for domestic contractors (Ganesan and Kelsey, 2006). Therefore the proposals should be target the development of local construction industry in aid of technology transfer through foreign construction

firms. Clear agreements should be established to form successful joint ventures and subcontracting agreements to have successful technology transfer to foreign firms. The diffusion of construction technology gained from foreign firms can be ensured by organizing training sessions for the local firms to make aware them on newly established technologies.

Planning for technology transfer to local construction through foreign funded, or through foreign contractors involved projects is a critical need. Clear agreements should be established to form successful joint ventures and subcontracting agreements to have successful technology transfer through foreign firms to local counterpart. Therefore, appropriate governmental organizations should develop and monitor the total process of technology transfer between local and foreign firms. Absorptive capacity of Sri Lankan construction industry also to be enhanced by adopting well established guidelines. Further research need to be done to make aware how local firms and authorities should promote commitment from partners to encourage the frank communication between parties, organize interactive training sessions to exchange and understand the language and culture between organizations. It is also time to realize the mechanism of diffusion of construction technology gained from foreign firms and adopt them for local use without restrictions. Unless industry is ready to take some risk and do experiments Sri Lankan construction industry never gain anything through technology transfer. It is time to review some unacceptable conditions and practices on pre-qualifications and experiences stipulated by certain foreign contractors before selecting them as contractor for certain construction projects by which acquisition and adaption of technology is encouraged.

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