MODEL OF RENEWABLE ENERGY TECHNOLOGY TRANSFER TO DEVELOPING COUNTRIES: A PLAUSIBLE APPROACH FOR SRI LANKA

A. S. Withanaarachchi, L. D. J. F. Nanayakkara and C. Pushpakumara

Department of Industrial management, University of Kelaniya, Sri Lanka.
Email**:** amila.green@gmail.com

ABSTRACT

In today's context the technology behind renewable energy has been evolving so rapidly and the advancements gained by many developed and rapidly developing nations like China and India provide good examples of developing countries like Sri Lanka. The two countries have seen technology transfer as a cornerstone in reaching a global solution to climate change. The lessons that Sri Lanka can learn from these two counties provides us immense opportunities to foster the renewable energy sector of the country. Accordingly the objective of this study is to propose a plausible technology transfer and cooperation model to foster the renewable energy sector of Sri Lanka. To effectively address the objective of the study, two different cases pertaining to the development of the wind power sector in India and China were analysed. Taking the stated cases as examples, this paper will look into different channels and technology transfer & collaboration. As the outcome of the study we will present a plausible technology transfer and collaboration approach to Sri Lanka.

Key words**:** Developing countries, Renewable energy, Sri Lanka, Technology transfer

1. INTRODUCTION

Energy is undoubtedly the basic need for continuity of economic development and human welfare. In modern societies, electrical energy proves to be one of the crucial forms of energy used by human in manufacturing products and providing service. As the human societies grow, the amount of electricity usage grows as well. Though the price of fossil fuels continues to drop in the recent past, emission of greenhouse gasses, the price volatility and political instability of Middle East countries have forced the developing nations to be in search of energy independence. Most of the time, though developed nations have the capacity to involve themselves in R&D, most of the developing countries are not in a position to engage in research as it is beyond their resources. Accordingly, international environmental law documents, such as the United Nations Framework Convention on Climate Change and the Kyoto Protocol, identify the transfer of Technology and knowledge from developed countries to developing countries as a cornerstone in reaching finding a global solution to climate change.

According to the Bennet (2001), there are two types of technology transfers: vertical technology transfer and horizontal technology transfer. The vertical technology transfer refers to the technology transferred from research to development to production. It follows the progressive stages of invention, innovation and diffusion. Thus, vertical technology transfer can be within one organization or there may be an intermediate transaction between, a research institute and a manufacturing company to continue up to commercialisation. In contrast, horizontal technology transfer the established technology is transferred from one operational environment to another. The purpose of horizontal transfer is not to commercialise the technology, but to disseminate the technology and extend its application into other contexts [1].

As a developing nation, Sri Lanka is still depends on renewable energy technologies which primarily imported from foreign countries. With a certain amount of technology adoption and value addition the country engages in a vertical transfer of technologies. In terms of technology diffusion governmental organizations like Sustainable Energy Authority and NGOs such as Practical Action, actively engages in disseminating technological know-how to a larger audience (horizontal transfer). However the existing technology transfer that is already taking place in the renewable energy sector in Sri Lanka (both vertical and horizontal technology transfer) have failed to diminish our dependency on fossil based energy sources. Rather the country is trying to sail against the renewable energy wavers that are rising in many other developing nations such as China and India.

Under the given backdrop, the objective of this study is to propose a plausible technology transfer and cooperation model to foster the renewable energy sector of Sri Lanka.

2. METHODOLOGY

To effectively address the research question, two different cases pertaining to the development of the wind power sector in India and China were analysed. Taking the stated cases as examples, this paper will look into different channels and the gradual steps of China and India. As the outcome of the study we will present a plausible technology transfer and cooperation approach to Sri Lanka.

3. WIND POWER DEVELOPMENTS IN CHINA AND INDIA

The advancements of the renewable energy sector in rapidly developing nations (specifically China and India) are becoming frequently studied topic in many scholarly articles. As few of the rapidly booming economies; China and India use coal to fuel most of their electricity generation, and both countries have plans to expand their coal power capacity considerably in the coming decade. Thus China and India are perhaps two of the least likely places one might expect to find an escalating renewable based power industry. Nevertheless, today India and China are both home to firms among the leading global renewable energy technology manufacturing companies. India currently leads the developing world in the manufacturing of utility-scale wind turbines, and China leads the solar PV sector.

This study analyzes empirical cases of successful energy technology "leapfrogging." Energy leapfrogging has been described as a strategy for developing countries to shift away from an energy development path that relies on traditional energy sources, such as fossil fuels, and onto a new path that incorporates the broad utilization of advanced energy technologies generally those that have been developed within more industrially advanced countries. As a means of climate change mitigation, observers have argued that developing countries need not adopt the dirty technologies of the past rather, they can "leapfrog" over them, opting instead for modern, clean technologies as an integral part of capacity additions [2].

Advocates of the leapfrogging concept generally give the notion that leapfrogging is viable without any barriers. However, it should be noted that, optimistic picture of leapfrogging is not true as it is and therefore obtaining clean energy technologies are undoubtedly more complex and challenging than many would lead us to believe [3]. This study weaves together insights from a range of literatures to identify the facilitating conditions for energy technology leapfrogging in developing-country contexts.

3.1. Case 01: Wind industry context of India

Both as a market and in terms of wind turbine manufacturer India played a key role in the world wind industry [4]. In the early days turbines were imported through international trade. As India adopted a trade policy in which it imposed higher customs duties for key components and whole turbines in order to attract FDI and encourage domestic manufacturing. Thus by mid 2000s the share imports drastically reduced in the of wind components industry [5].

Several of the globally leading firms have made foreign direct investments in India, including Vestas, Games and Enercon. The experience with wind in India began when Danish firms Vestas and NEG Micon (now a part of Vestas) first entered India as joint ventures in 1987. However, both firms later detached from its partners to become wholly owned subsidiaries in 1996. Enercon entered India in 1994, also initially through a joint venture.

Several smaller domestic wind turbine firms such as BHEL, Global Wind Power, Reegen Powertech, Siwa Wind Turbine have licensing agreements for turbine designs from firms such as Norwin (Denmark), Nordex, Vensys Energy (Germany) and Lagerway (Holland). The Indian flagship firm Suzlon also followed a route of technology licensing not only for wind turbine systems but also for key components such as blades and gearboxes from the mid-1990s through the early 2000s [6]. As Suzlon advanced, the company increasingly abandoned licensing and developed local technology through in-house research and development in India and abroad [7]. Gradually, and especially after 2000, Suzlon has become an indigenous manufacturer of own technology

3.2. Case 02: Wind industry development in China

The Chinese wind power adventure began in the1980s with trade as a dominant feature. Turbines were imported from Europe, primarily through bilateral aid projects. Joint ventures

emerged, encouraged by government directed market-access, including between Nordex (Germany) and Xi'an Aero Engine Corporation and between Acciona Energy (Spain) and China Aero Engine Corporation. Foreign direct investments (FDIs) became important and all major wind companies, including Vestas, GE Wind, Gamesa, Suzlon and Nordex. Thus, by 2005, Chinese wind power demand started to rise very rapidly due to foreign suppliers rising interest. However, due to a 70% local content requirement policy and to some extent rising customs duties, market access was largely restricted to foreign companies [8].

Supported by government policies, the domestic Chinese firms overtook foreign firms in terms of market share in 2006. The majority of Chinese wind manufacturers initially produced turbines based on license agreements with foreign technology developers [9]. Several of the leading manufacturers in China, including Goldwind, Dongfang and Windey, have all acquired wind turbine licenses from one German company, REpower Systems. A number of Chinese companies including Gold-wind and Sinovel have now also begun to develop local technology by investing own resources in R&D and jointly with foreign partners.

4. A PLAUSIBLE APPROACH FOR SRI LANKA

The first two cases, which represents the leading wind power manufactures from two developing countries that play crucial roles in today's energy and climate debates. Interestingly, the two cases illustrate certain similarities. Due to the scale of energy use and expected future growth in these countries, these cases represent perhaps two of the most important applications for technological leapfrogging if this model for acquiring wind power technology has wider applications within other industries and sectors in these countries. Consequently, the technology transfer mechanism of the two countries may provide useful lessons for Sri Lanka to follow.

4.1. Review of case 01

Indian wind turbine industry initiated through international trade. However government trade policy which imposed higher customs duties for key components and whole turbines attracted FDIs from leading wind power of the world. Through these mechanisms India gradually entered into joint ventures followed by licensing agreements to develop wind turbine systems. Today companies like Suzlon has stepped into develop local technology through in-house research and development in India and abroad.

Thus we can illustrate the Indian technology transfer mechanism in five channels. Figure 1 illustrates the gradual steps of the channels used.

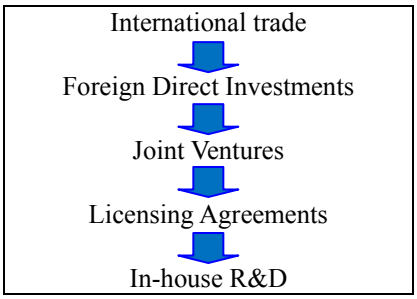

Figure 01: TT channels used in Indian wind turbine industry

4.2. Review of case 02

Chinese wind power sector initiated through international trade through bilateral aid projects. Joint ventures emerged, encouraged by government directed market-access and later Foreign Direct Investments (FDIs) became important. Today majority of Chinese wind manufacturers initially produced turbines based on license agreements. Such initiatives have extended to develop local technology by investing own resources in R&D and jointly with foreign partners.

Accordingly, technology transfer involved in the Chinese wind industry can be illustrated as follow (Figure 02).

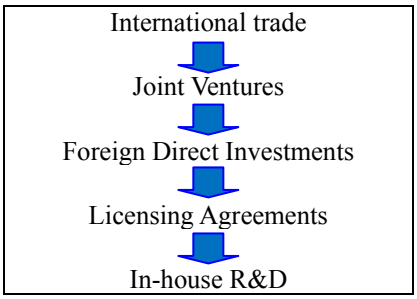

Figure 02: TT channels used in Chinese wind power industry

4.3. A plausible approach for Sri Lanka

The above two cases illustrate that Sri Lanka could also adopt similar pattern when transferring renewable energy technologies to the country. The gradual steps taken by the two countries have helped China and India to strengthen their

technological capabilities over time. Thus a plausible technology transfer and cooperation approach that Sri Lanka could adopt would be such gradual steps which will enhance our technological capabilities to climb the ladder till we develop our own technologies via research and developments.

Figure. 03: illustrate a plausible technology transfer approach for Sri Lanka. The state mechanism was drawn under the assumption that the country will strengthen its technological capabilities over time.

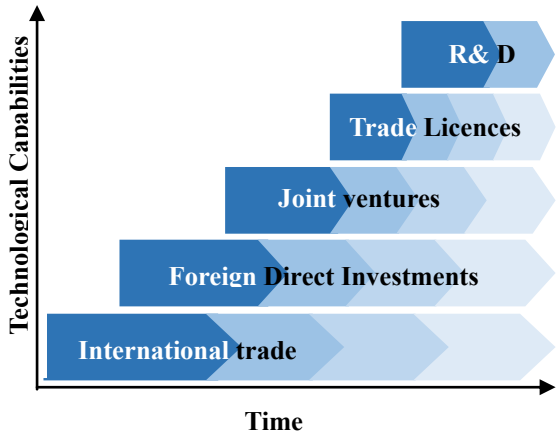

Figure 03: Plausible technology transfer approach for Sri Lanka

In the present context, Sri Lanka import most of the renewable energy technologies from abroad and the local value addition and adoption remain at very minor scale. However through FDI and joint ventures, the foreign counterparties will employ more local value addition to their investments. Strengthening through such experience, country can enhance its technological capabilities to develop required renewable energy components by mealy acquiring the design licenses. If the country can step up the ladder to develop our own technologies, we will be finally able to develop our own technologies via R&D.

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