Country Paper

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1. Introduction and Country Context

Sri Lanka is an island with 1,700 km long coastline, which is situated in the Indian Ocean towards the south east of India having a total land area of 65,610 km^2 and out of that 27,000 km^2 are cultivable and 2,905 km^2 areas are under water. Its terrain is mostly low, flat to rolling plain, with mountains in the south-central interior.

The population of the country is estimated to be almost 21 million (CBSL, 2011). Sri Lanka is administratively divided into 09 provinces and 25 districts. During the past thirty years the economy of Sri Lanka has shown a shift from agricultural to industrial. Agriculture contributes 11.2% to the Gross Domestic Production (GDP) while Industry and Services add 29.3% and 59.5% respectively to the GDP and Per Capita Income is around US$ 1,969.

Sri Lanka is basically an agricultural country with a tropical climatic condition. The rainfall pattern is influenced by the monsoon winds of the Indian Ocean and Bay of Bengal and creates four seasons. Sri Lanka is rich with 17 percent of evergreen forest cover, large rivers, minerals, fertile soil in almost all parts of the country and ample amount of oceanic resources around the country. Energy requirement of the country basically comes from biomass (46%), hydro power (12%) and fossil fuels (41).

Sri Lanka had an agriculture based economy in the past and converted to industrial based economy in early part of 1980 after introducing free trade economy. Tea and rubber processing factories were introduced during the British colonial period. In 1960s several large scale government owned factories were established such as cement, sugar, fertilizer, pulp and paper, petroleum and petroleum by products, mineral, textile weaving and finishing, steel, fly-wood, etc. After introducing of free trade economy the government encouraged private sector and foreign investors to invest in local industries and provided industrial estates (12 export processing zones under BOI and 20 zones operated by Industrial development Board) with some infrastructure facilities. Even though industrial estates are available with infrastructure facilities most of investors are set of factories outside these zones due to availability of human resource (labor), easy access to local raw materials, water and government tax concessions for factories in remote areas, etc.

Most of isolated factories faced a lot of social and environmental issues later due to discharge of waste such as wastewater, solid waste and industrial emissions.

2. Eco-Industrial Measures and Practices in Sri Lanka

Industrial ecology is defined in different ways as below.

- The interactions between industrial and ecological systems
- The study of material and energy flows and transformations

- A change from linear (open) processes to cyclical (closed) processes
- Integrated industrial activity into ecological systems

The Eco-Industry (EI) aims to achieve the essential goals of optimizing use of resources and minimizing environmental and social impact, while targeting at the success of triple bottom lines namely Economy, Ecology and Society which are also identified as main pillars of Sustainable Development.

Unsustainable production and consumption patterns leading to increasing poverty thus imbalances in economic development opportunities and deterioration of the environment are a high concern today in Sri Lanka. It has been accepted that environmentally safe production practices facilitate improvements of productivity thereby reducing the cost of production too. In this regard, the national policy and strategy on cleaner production in Sri Lanka has been developed by the Ministry of Environment and Renewable Energy in collaboration with the relevant authorities. Under these policy principles will be applied to improve the efficiency use of natural resources such as land, air, water etc. while maintaining and improving environmental quality. Hence, national policies aim at achieving sustainable development, enhanced environmental quality, improved eco-efficiency, improved living standards and efficient poverty alleviation.

Based on the concepts of EI, collaborative strategies not only include by-product synergy ("waste-to-feed" exchanges), but can also take the form of wastewater cascading, shared logistics and shipping & receiving facilities, shared parking, green technology purchasing blocks, multi-partner green building retrofit, district energy systems, and local education & resource centers. This is an application of a systems approach, in which designs and processes/activities are integrated to address multiple objectives.

Industrial ecology (industrial symbiosis, Eco Industry) is identified as one of the efficient resource and waste management approach which can be applied for industries, municipal councils and local authorities.

Sri Lanka has already taken measures to improve resource efficiency at industry and facility level by applying techniques and tools like resource efficient cleaner production, energy efficiency improvements, green productivity, integrated solid waste management, business process reengineering and other resource efficient improving measures.

Industrial ecology has been promoted among industrialist to improve resource efficiency and waste minimization. Several industry clusters have been identified to implement industrial symbiosis and are listed below.

- Sugar industry with a distillery, combined heat and power plant (CHP), mini dairy farm and cattle feed manufacturing, organic fertilizer manufacturing and carbonic farming. Jaggery and treacle production using sugar syrup is also possible industry attach to sugar plantations.

- Thermal power plants and thermal energy using industries such as pulp and paper, ice plants using absorption heat technology, dried fish processing, etc.
- Animal husbandry, dairy products (liquid milk, curd, yogurt, ghee, etc.) manufacturing meat processing, processed food (sausages, meatballs, etc.) manufacturing, animal feed (rendering), organic fertilizer manufacturing, bio gas (methane) production from animal waste for energy generation
- Textile and apparel industry and other by products manufacturing cottage scale industries to produce door mats and carpets, cotton rags, etc. from off cuts of garment factories.
- Vertically integrated agro based production processes (e.g.: rice cultivation: paddy is harvested and paddy straw is used as manure in the paddy field itself, pulp and paper industry and partitioning panel boards; at rice mills: rice is produced as the main product, rice husk is sent to cement plant to generate electricity. Bottom and fly ash is used for cement production. Rice bran is used to produce animal feed with rendered animal waste and other raw materials. Animal waste is used for biogas generation and organic fertilizer manufacturing.
- Green building also known as green construction or sustainable building denotes to a structure and using processes that is environmentally responsible and resource-efficient throughout a building's life-cycle. This practice includes use of waste materials of other processes to produce building materials such as bricks, roofing tiles, partitioning and ceiling boards, pantry cupboards and other wooden structures, etc.
- An Eco-City concept can be used for local municipal councils and local government authorities to practice industrial ecology concepts. Collected waste from municipality area can be segregated and used as raw materials for industries such as plastic recycling from waste plastic and polythene, composted manure and bio gas production from collected organic materials (bio degradable waste); building demolishing waste can be crushed and produce cement bricks for pavements and building construction; glass bottles can be sent back to the glass container manufacture (it saves energy usage of glass furnace, reduces excavation of silica sand and reduces environmental pollution); paper and cardboard waste can be used for waste paper recycling and packaging material production. Swage waste can be recycles and produced water and organic fertilizer for agriculture.
- Hazardous waste (also known as scheduled waste) material of some industrial processes and clinical waste from hospitals are sent cement factory for incineration at high temperature level.

  This type of waste exchange programme provides solutions for industries to dispose their hazardous waste and cement factory has additional income from waste incineration. This waste materials also used as an alternative energy source at cement kiln.

Central Environmental authority suggests industries to send their scheduled waste to this cement factory.

- One of the cement factories in Sri Lanka has done a waste sludge survey of industries with the technical support of the National Cleaner Production Centre to identify alternative raw material for their cement production. The aim of the project is to use waste materials of industries for cement production. It can be another initiative of industrial ecology concept.

3. Challenges faced in Integrating Industrial Development and Environmental Conservation Priorities and the Role being played by Knowledge Institute

Challenges faced in Integrating Industrial Development and Environmental Conservation Priorities

- Industries are set up in industrial zones and isolated places. Isolated industries have to bring all the raw materials from outside and take sufficient measures to dispose their waste according to the given standards by CEA. Some industrial estates have their own central treatment facilities. Bring compatible industry clusters to one location is identified as a challenge.
- Some industry sectors are located in areas with high population and those industries discharged pollutants with toxic chemicals. Each industry is not in a position to have their own effluent treatment facility because of high investment and running cost. Most of the tanneries are located in Colombo city limit close to animal slaughter houses. The main process of tanneries is tanning animal skin. This process uses toxic chemicals such as chromium (it is a carcinogenic material). As solution ministry if industry set up a central effluent treatment facility at Bataatha (in Hambantota District) with the financial and technical support of UNIDO and planned to bring all the tannery factories to this dedicated industrial zone. In Sri Lanka, most of the tannery owners are Muslims. Local population in Bataatha area protest against to bring Muslims to this area and total project was a failure. Social problems can be considered as a challenge to bring industries together.
- Local industrialist is reluctant to set up their factories in industrial zones. Actually industries are initiated at very small scale at their houses and gradually expanded with the demand. Small scale industrial estates are not established in divisional secretariat level to set up small and medium scale industries.
- Lack of measures has been taken to enforce environmental laws and regulations. There are set of strict laws and regulations but those are not implemented.

- Lack of knowledge and awareness about industrial ecology concept, waste exchange programmes among industrialists and they are reluctant to expose their process to others even though the process technologies are freely available.
- Lack of knowledge and awareness about applicable environmental laws and regulations and emission standards. (This is mostly experienced in Northern and Eastern Provinces).
- Still most of the local industries are profit oriented and have high competition with imported products. Cost of waste management (which prevents environmental pollution) is sometimes an additional cost for them and makes the business economically not viable.
- Lack of resources (both trained personnel and equipments) is available in the country to analyze wastes and provide solutions to use them for another production process.
- Insufficient coordination between local government authorities and relevant central Government authorities
- Insufficient infrastructure facilities are available at local government level to provide sufficient service to local industrialists.

The role being played by Knowledge Institute

- **The Ministry of Industry and Commerce (MIC)** is responsible for the development of Industries and Commerce including Industrial Cluster. Besides it enters necessary agreements in the field of international trade seeking suitable investment. So that MIC makes necessary policies, programmes, projects and strategies for the same.
- **The Ministry of Environment and Renewable Energy (MERE)** holds the responsibility for environmental aspects of the Industry and other fields as well. Hence the MERE seeks measures to address the issues related to the environment in the industrial cluster in consultation with relevant stakeholders. In addition to those, the MERE takes charge of setting up regulations on phasing out ozone depleting substances, site recommendations for new industries, regulations on vehicle and industrial emission standards, regulations on noise control standards, implement climate change mitigation and adaptation measures, declaration of environmentally protected areas, and other regulations pertaining to the environment.
- **The Central Environmental Authority (CEA)** established in 1981 under the provisions on national Environment Act No: 47 of 1980, which is under the purview of the MERE, perform a major role in the process of industrial establishment. One of the main roles of the authority is to act as a regulatory agency to implement all environmental related laws and regulations. CEA issues Environmental Protection License (EPL) to industries that discharge pollutants to the environment and regulate the discharge of scheduled wastes.

  Presently each and every investor or donor give priority to the environmental aspect of the industry or project thus Environmental Impact Assessment (EIA) is a must to initiate proposed industry or project.

The CEA conducts the EIA process upon applications submitted by the proponents. Besides it covers environment pollution aspects and other related activities as well.

- The Environment Management Department of the **Board of Investment (BOI)** is committed to address and resolve environmental issues pertaining to BOI projects. In Sri Lanka the concept of Industrial ecology is being practiced by some of the BOI industries. The BOI has established 12 Export Processing Zones (Industrial Estates) so far.
- **The Industrial Development Board (IDB)** is entrusted with the responsibility of promotion and development of the Small, Medium Industries in Sri Lanka. The Industrial Estates program is one of its major schemes to promote and develop Industries in Sri Lanka. Industrial Estates have been already set up at various places throughout the country.
- **The National Cleaner Production Centre (NCPC)**, Sri Lanka is the foremost cleaner production solution provider in Sri Lanka which was established in early 2002 by the UNIDO under the Ministry of Industry and Commerce to assist enterprises in adopting CP. NCPC provides technical assistance to industries to minimize their waste at the point of generation and recover resources by applying cleaner production, provide technical support to develop cleaner production national policy and sectoral policies (eg: tourism, agriculture, plantations, health and fisheries). Addition to that NCPC has capacity to provide technical assistance to identify and set up Eco industrial clusters, promote industrial ecology among local industries by doing training and awareness programmes.
- **Sri Lanka Standards Institute (SLSI)** implements EMS & TQM, Eco-Label certification and Forest & Timber Certification. The government also introduced Competition driven practice Environmental Management Conformities & certifications/tools & techniques such as ISO 14000 certifications, TQM (ISO 9000) & TPM practices, Green globe 21, LEED, CP/GP implementations
- **University of Moratuwa (UoM)** is a leading technical university in Sri Lanka. Faculty of engineering provides possible engineering research and development solutions to implement eco industrial clusters in the country.
- **Industrial Technology Institute (ITI)** provides all the testing and measurement services to industries. ITI has the capacity to test the parameters of waste discharge from industries and develop industrial processes to use waste materials of other industries
- **National Engineering Research and Development (NERD)** centre has capacity to do research and development activities to identify eco industrial clusters and provide technical assistance to develop zero emission industrial clusters
- **All the industry and commerce chambers** where all the industrialist are organized according to their business, cluster, region, etc.

4. Specific Financing and Capacity Building Activities Required for Implementing Eco Industrial strategies

Basic and most important step to develop eco industrial clusters is a comprehensive central and regional database of industrial sectors, no. of industries, geographical location, raw material and energy usage and specifications, characteristics and quantities of waste generation in all three forms (solid, liquid and gaseous). This type of central database must be in public domain and have easy access to everybody with the provision to update their available waste resources and required materials and energy.

All the concepts indicated above are introduced to Sri Lanka during last last decade and therefore the policies, programmes, projects and strategies have been recently introduced and implemented and so results are pending. To strengthen up these kinds of projects, more attention should be given to conducting awareness programmes to industries, training of relevant officers involved in these fields, providing modern equipment to carry out research and other activities and constructing suitable laboratories and other facilities. Being a developing country, Sri Lanka cannot afford to drive enough resources to these fields and therefore external financial support and technical assistance is highly required.

In this context capacity building programmes need to be designed to train the officers at central, provincial and local levels. A set of officers being trained as Master Trainers can conduct awareness programmes to the general public. Suitable inventories can be prepared with references to the laboratories that are used to conduct research and other activities of Eco projects and identify the required missing equipment and make necessary estimates for purchasing that equipment. Requirement of International Experts can be identified and enlisted for inviting them for workshops. As mentioned earlier, ADB or other donors can assist Sri Lanka to fulfill this requirement by providing financial support and technical assistance.

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