EFFECTIVE AND SUSTAINABLE UTILIZATION OF RESOURCES IN SRI LANKAN INDUSTRIES: CHALLENGES FOR AND BENEFITS OF AN INTEGRATED APPROACH

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ABSTRACT

Industrial revolution in 18th & 19th centuries marked a significant transformation in the ways and means people carried out their routine tasks. The new technological inventions along with the ample availability of resources, paved the way for novel production mechanisms redefining the productivity, human beings had experienced till then. Entrepreneurship was at heart of the process and focus was mainly on maximizing shareholder wealth, due to the new risks identified. However with time people started realizing the augmented decrease of resource availability and a parallel impact on the environment was observed. Hence the necessity to focus on all 3Ps of Planet, Profit & People was realized. Accordingly, today it is observed the sustainability being discussed widely in the industrial sectors.

Due to the increasing depletion of resources, sustainable and responsible consumption and production are prioritized. According to the statistics by United Nations Environment Program (UNEP) (2013) the annual total waste resources dumped amount to 2.12 billion tonnages. The International Bank for Reconstruction and Development (IBRD) expects this figure to get triple by 2100, at the current pace of waste disposal. The world is increasingly facing additional challenges arising from malpractices in waste handling and disposal. Hence in addition to cleaner production, waste minimization and management, an additional focus is on utilization of waste resources for better purposes and increasing the life cycle of the resources thereby.

Industrial Symbiosis, a concept introduced by UNEP and currently being promoted worldwide by International Synergies Ltd. (UK) via the National Industrial Symbiosis Program (NISP), focuses on identifying novel destinations for waste resources and investigating the ability to utilize them as raw material for another production process. The program has been introduced to Sri Lanka by NISP and National Cleaner Production Centre (NCPC), Sri Lanka is working as the facilitator of the program.

The initial workshops on investigating the ability for its effective adoption have been conducted. A number of organizations, from both manufacturing and service sectors attended the workshop and the resources required by them and the waste or idling resources of their organizations were identified. Accordingly potential synergies were identified. The author participated in the process as a facilitator.

In addition to the direct results of the program from this workshop, it was possible to identify common types of waste resources generated and services required, for waste management by Sri Lankan industries. Furthermore, potential challenges in implementing a program similar to Industrial Symbiosis and necessity for a centrally coordinated and integrated approach to manage the process effectively to overcome the challenges were identified. Accordingly recommendations to successfully implement Industrial Symbiosis program for the Sri Lankan industries were derived at.

In general, an analysis of the environmental, technological, socio-economic benefits, the program would bring to the country in short and long term were generated.

***Key words*:** Cleaner Production, Industrial Symbiosis, Sustainable Consumption & Production, Sri Lankan Industries, Waste Utilization & Management

1. INTRODUCTION

At the inception of industrial processes waste management was of minimum concern. This was partly due to the ample availability of resources, ample available means of disposing waste and

less stringent rules and regulations by relevant authorities, as then the focus was on encouraging industrial practices. As the magnitude and the frequency of the waste generation increased, due to increased industrial processes, the impacts on environment due to malpractices with respect to waste management began to be visible. This led the industries reconsider especially their waste disposal practices, and waste management practices such as wastewater treatment, solid waste segregation, air pollution controls came into being. As these practices were non-value adding to the industrial processes, later under the guidance of UNEP, the concept of cleaner production, focused at waste minimization, was introduced, and began to be practiced. However, now still even the firms with good track record for waste management generate a considerable amount of waste. Although 3Rs suggest the waste to be reused and recycled, if reduction is not any longer possible, often firms find the waste not in the composition to be reused in place of the raw material, due to the changes undergone in the process. Hence, recycling or enabling the resources be reused by a different firm, has become the feasible solution, before considering dumping.

Industrial Symbiosis, enters its role at this juncture, as a method of finding novel destinations for the waste resources, and thereby enabling them being effectively reused and recycled, if further reuse is not possible. The primary focus is however on enabling the reuse of the waste resource.

2. METHODOLOGY

The program involved gathering professionals, employed in different industries where a considerable amount of raw materials used and waste generated. Then, they were divided into groups to ensure the effective implementation of the workshop.

Thereafter, they were asked to brainstorm about the resources that were required by them as input or raw material for production processes. The resources could be both physical material and services, such as consultancy. These were identified as the resources, the industries "WANTED". Then the members of the group read out the resources each of them wanted, and if another member in the group was capable of providing that resource, the information was put in the same paper, the required resource was mentioned. After the possible synergies were identified within the group, the sheets of paper with resources in demand, were passed among the other groups in search for potential synergies. Once the other sheets of paper arrived from other groups, they were read out and potential synergies were identified.

Thereafter, similar to the previous step, the members were asked to mention in the respective sheets of paper the resources they had, either idling or in excess. It was possible these to be even an idling space of land, labor hours or a waste resource. These were identified as the resources, the industries "HAD". Similar to the previous step, once the resources were read out within the group, potential industries who were in need of those resources were identified. Thereafter, the sheets of paper were distributed among other groups, in search of more possible synergies.

After the conclusion of the workshop, a summary of resources the Sri Lankan industries have in excess and want was prepared. Then, the types of waste resources frequently generated by the participated industries and the types of resources, especially services required by them were identified.

Furthermore, the gaps in achieving and managing an effective sustainable approach to resource utilization, and areas that could be improved are discussed, based on the observations of the author.

3. RESULTS

3.1 General Results

The workshop was attended by 39 organizations from different sectors, including manufacturing, chemicals and pharmaceuticals, finance, beverage and food, healthcare, hotels and tourism, land and property, plantation, services and telecommunication. In total, over 320 resources were identified to be idling and over 120 resources were in demand by the organizations, present at the workshop. About 400 potential synergies were identified after listing and analyzing the resources.

3.2 Waste Resources Available

It was observed that a lot of organizations in the manufacturing sector continued to generate a lot of biodegradable waste including food, paper, wood, fabric and cotton waste. Some organizations had taken the extra effort in producing natural soil conditioners and fertilizers

such as compost. However, no proper use were taken from those waste resources within the organization premises, and the organizations either were unaware of potential industries that could utilize the resource or the organizations were reluctant to take the extra step in transferring the waste resource, to a more useful destination, as it was not perceived to be cost effective.

There were still a number of organizations generating e-waste and non-biodegradable waste such as polythene, plastic, ceramic and glass. The organizations generating these resources were not currently involved in recycling or reusing them, and were potentially unaware of possible destinations for those resources.

A few organizations, especially from healthcare organizations generated hazardous waste, and were seeking for ways of safely disposing them. They were willing to afford for the processes as well.

In addition to the above waste resources, it was observed that the output from the waste treatment facilities such as treated water with high conductivity and sludge had no identified destinations. Hence, they were becoming a burden to the organizations, due to the additional space and effort required to accommodate them. The congested landfill sites and the available amount of sludge, exceeding the demanded quantity by organizations who utilized them, was another identified problem.

3.3 Resources in Demand

It was observed in general the organizations were in search for cost effective, clean and sustainable energy solutions. Furthermore, effective ways of managing food and organic waste, water treatment, efficient methods of cooling and expertise in safe toxic waste disposal were in demand.

There was observed a significant demand for biomass and biofuels for combustion. A notable demand was observed for recycled paper, which was adequately responded within the duration of the workshop. Furthermore, the demand for compost was well responded, and the organizations were able to identify possible sources for compost.

4. CONCLUSION

4.1 Challenges & Recommendations

It was observed an overwhelming response to the workshop on Industrial Symbiosis. As the author was involved in the process, from the inception, in organizing the workshop in Sri Lanka, it was surprising to note the positive response received from not only manufacturing sector but also from various other sectors such as telecommunication industry. This proved how badly the industries were in need for an approach similar to Industrial Symbiosis. The response was encouraging for the promoters of the program as well
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It was furthermore surprising to see how environmentally conscious the organizations were, and the extent to which they were already implementing effective resource utilization practices. The enthusiasm the professionals involved in the practices had, in order to improve the practices and to further their scope was notable. The discussions with the professionals proved that the magnitude of the investment in these environmentally friendly practices were considerably significant.

However, the workshop proved that most of the professionals were not adequately aware about the potential value in the waste resources and better destinations for them. The Industrial Symbiosis approach was appreciated to have filled this gap, in creating the platform for exchange of the waste resources.

This workshop was able to only attract 39 organizations. However, this number is not exhaustive of all the organizations capable of contributing to a program similar to Industrial Symbiosis. A nation-wide program would contribute to identify more resources and more synergies. Furthermore, due to the existence of the program in foreign countries, international synergies too could be identified, during the course of the program.

The waste resources generated, even if a potential use had been identified, were not readily usable as raw material, without any conversion process. As there is a high amount of resources generated daily from the industrial practices, a stronger need for research exist. Ample areas for engineering solutions exist to ensure the required composition for the raw material is obtained from the waste resource.

Furthermore, a lot of entrepreneurship opportunities could be identified within the process, including waste collecting, transferring and converting.

However, this is not achievable solely by the effort of the promoters. The involvement of a varied range of stakeholders including the private and public business organizations, consultancy providers, academia, policy makers and bureaucrats is much required for effective implementation of the program. A policy level intervention would be required to ensure that the practices receive the due recognition, and all the potential stakeholders are encouraged to actively contribute to the successful implementation of the program.

4.2 Implications

Since inception in 1990s, Industrial Symbiosis has been gaining popularity in more than 25 countries. Many multinational organizations operating in diverse fields have witnessed the success of the program and benefited immensely from it. The success stories published online are supportive of the fact. Sri Lanka too, in becoming a part of the growing network could obtain a number of benefits as discussed below.

The industries would be encouraged to use resources more responsibly, and due to the access to the network new, responsible sources of resources could be identified. Due to effective transfer of the waste resources, the carbon footprint of the products would be brought down. The unnecessary landfilling would be saved. The ultimate reduction in environmental pollution would improve the conditions of the environment, while contributing to sustainable consumption and production practices.

The research that would be required in generating solutions to convert the waste resources to usable raw material, would contribute to innovations. Due to the access to international networks, new technology, currently absent in the country would be received. Due to the ever demanding necessity to improve the efficiency of the industrial practices, more technological innovations would be sought after, contributing to a larger increment in technological advancement.

The scarcity in resources would not be handled better, compared to Industrial Symbiosis, with respect to industrial resource utilization practices. The savings generated by the organizations would be pumped back to the economy, resulting in an effective increase in investment in industries, especially manufacturing sector. The interactions with the international community would contribute to economic development of the country. Due to generation of new employment opportunities the life styles of the citizens would be improved, reducing rates of unemployment. The entrepreneurship opportunities would strengthen the economy.

Similarly Industrial Symbiosis program would have numerous benefits to offer. Hence, at a decisive juncture in the human history, it is vital approaches for effective and sustainable utilization of resources be taken to ensure a better environment for future.

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