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Economic, Social And Environmental Implications Of Urban Solid Waste And Need For Valorization Of Waste

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47. ECONOMIC, SOCIAL AND ENVIRONMENTAL IMPLICATIONS OF URBAN SOLID WASTE AND NEED FOR VALORIZATION OF WASTE

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ABSTRACT

"Source reduction is, on the face of it, perhaps the most appealing
of all the possible approaches to solid-waste management"
- William Rathje and Cullen Murphy

Waste poses a threat to public health and environment and hence it should be properly collected and disposed. Managing municipal solid waste is a pervasive problem for any urban area and the Singara Chennai is no exception to it. Admitting that it is one of the best managed city, but still problem of dealing with solid waste generated in the ever expanding Chennai city is an uphill task. The materialistic world has been sustaining, so to say, by transforming natural resources into garbage. This is an unnatural behavior because mother nature does not throw stuff away – dead trees, birds, beetles and for that any natural material including human being are pretty quickly recycled by the earth system. Our perception of waste as an unwanted material with no intrinsic value has to change because of the fact that the waste generated is a resource with transformed material. Hence, to extract value from this science, technology and attitudinal changes are the need of the hour for converting the ever increasing waste into wealth.

For a long time our economy has been linear but there is a positive shift to the circular economy which has changed the way we look at the urban solid waste which no longer remains a waste but is a resource now. The paper deals with the environmental and health implications of the urban solid waste and its impact on society if a timely intervention to make it a part of circular economy is not attempted seriously. The paper brings out the economic, social and environmental benefits of treating solid waste as a resource.

INTRODUCTION

Every Indian is proud that the country is on the path of rapid progress. The rapid development and industrialization is forcing an unprecedented change in the social and economic fabric of the country and has its own impact on the environment in which we live. With a population of about 1.3 billion (almost 18% of world population) and with a share of only 5% of the world's area the task of managing resources, including human resources, is uphill because a delicate balance is to always to be maintained. India is one of the fastest growing economy and is moving steadily to achieve a GDP of 10% in a decade or so. The growth of the country and its emergence as a world power has also resulted in high expectations of the people in terms of quality of life. However, the fact remains that this change has forced migration of rural people to urban areas in search of better livelihood and hence life. The negative side of this migration, from rural to urban areas, is the stress on urban infrastructure (like water, electricity, roads etc.) on one hand and adverse impact on environment on the other. One of the recent estimates puts that only 70% of the solid waste generated by urban population is collected and that in terms of quantum works out to a whopping 62 million tonnes per year with about 10% of this being plastic waste and another 12% other hazardous waste.

Our resources which include water, energetic resources, agricultural land, fish stock, minerals and forest to name some, are limited. Also inefficient use of these resources will in the longer run have impacts like deforestation, desertification (soil erosion), pollution of water soil and air, loss of biodiversity, reduction of natural capital which will lead to conflicts in the society on one hand and migration of people on the other. Hence, all the discussions in this paper is on the premise, which is the well known and accepted reality of life, that the natural resources are limited and some of them are close to finish. Also that we are consuming these natural resources fast and that the time has come to use them efficiently because so far we are using them inefficiently. Another dark reality is that we are producing too much waste and only a very small portion of waste produced go back to the economic cycle. It is the last part, that recycling is very meagre, which is to change and that change has to come fast. Valorization of the waste is the way forward and we all must try our best for the social and economic benefit of the society on one hand and protection of the environment on the other.

Swatchh Bharath (Clean India) is a recent initiative of Government of India, where in

the awareness and corrective measures are being encouraged and in some cases made mandatory. Tamilnadu, as expected performs better in comparison to other parts of the country. When we analyse the scenario for metro cities, Chennai stands out in managing solid waste. It is heartening to note that Chennai has approximately 465 Hectare of landfill area, which is almost double of the other three metros viz Delhi, Mumbai and Kolkata put together. The difficulty with the landfill is that these are to be located outside the city which increases the cost of transportation as the cities expand. Rapid growth of city means frequent relocation of landfill areas and that will mean more cost towards the transportation. This economic burden is what makes the work of corporation unenviable.

Different times and different urban areas have tried out various techniques and so far it is believed that source segregation is the best way to deal with it. Releasing this, solid waste management rules 2016 have made segregation mandatory for every waste generator but unfortunately, its implementation is very poor. As of now most of the garbage of urban India remains untreated. One research group predicts that if India continues to dump untreated garbage at its current rate, then it will need a landfill of size 66,000 hectares which is 10 metres high and can hold 20 yrs worth of waste. Municipal solid waste management (MSWM), a critical element towards sustainable metropolitan development, comprises segregation, storage, collection, relocation, carry-age, processing, and disposal of solid waste to minimize its adverse impact on environment. Unmanaged MSW becomes a factor for propagation of innumerable ailments (Kumar et al., 2009). High population growth rates, rapidly varying waste characterization and generation patterns, growing urbanization and industrialization in developing countries (Troschinetz & Mihelcic, 2009) are the important reasons for paying attention towards MSWM as more area is required to accommodate waste (Idris, Inane, & Hassan, 2004).

This paper deals with analyzing the present scenario and suggesting ways to deal with the solid waste generated in the country. The paper makes a case of implementing valorization of solid waste as a management strategy for better social, economic and environment impact.

Municipal solid waste is one form of the manifestation of unsustainable consumption of natural resources by humankind which has led to, and continues to lead to, the depletion of natural capital and environmental degradation (Berg, et al., 2013; Taylor, 2000; Zaman & Lehmann, 2013). Cities have for a long time been 'swallowed' in garbage as dump sites mushroom in all corners, blocking drainages, contaminating water sources, causing disease among the population and impairing the aesthetic value of the landscape (Wright & Boorse, 2011).

URBAN SOLID WASTE COMPOSITION

India has different geographic and climatic regions (tropical wet, tropical dry, subtropical humid climate, and mountain climate) and four seasons (winter, summer, rainy, and autumn) and accordingly residents living in these zones have different consumption and waste generation pattern. However, till date, no concrete steps had been taken to analyze regional and geographical-specific waste generation patterns for these urban towns and researchers have to rely on the limited data available based on the study conducted by various agencies (central, state, NGO etc.) (Rajkumar Joshi and Sirajuddin Ahmed, 2016) Solid waste is anything that is not a liquid and which is thrown away because it is not wanted. Urban solid waste is Municipal Solid Waste (MSW), commonly known as garbage is a waste type consisting of everyday items that are discarded by the public after their use. Major sources of solid wastes in urban areas include residential sources, commercial sources, institutional sources, open area, industrial sources, health facilities (hospital etc), construction and demolition, agriculture sources, electronic and electrical waste (e- wastes).Among these residential wastes contributes little over 50% and commercial waste another 25 %. Another way of looking at the urban solid waste can be by classifying it as biodegradable solid waste, i.e. the waste which can be broken down into their constituent elements by bacteria and other micro organisms and non biodegradable solid waste where in bacteria cannot decompose this waste. Yet another way of classifying them may be hazardous and non hazardous wastes.

LINEAR AND CIRCULAR ECONOMY

There could be three ways economy can work. First, the linear economy in which raw materials are used to make a product and after its use any waste is thrown away. Second, reuse economy, in which the material is recycled and reused. Third, in which a new raw material needed is obtained sustainably so that natural and human environment is not damaged. Hence, a circular economy is an alternative to a traditional linear economy in which we keep resources in use for as long as possible, extract the maximum value from them while in use. Hence, a circular economy is an economic system where products and services are traded in closed loops or cycles. This ensures long life, optimal reuse,

refurbishment, remanufacturing and recycling of products and materials. According to Winkler (2011, p. 244) "studies show that the share of reused or recycled materials can be increased up to 80% by closing process chains (instead of 1% with unclosed process chains)."

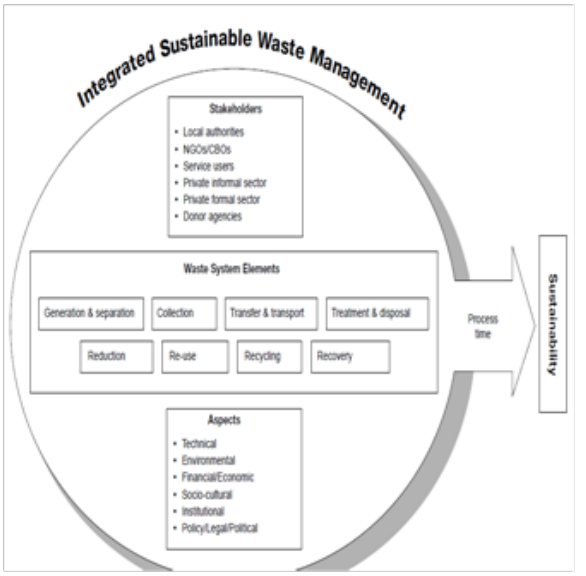
A circular economy preserves the value added in products for as long as possible and virtually eliminates waste. It retains the resources within the economy when a product has reached the end of its life, so that they remain in productive use and create further value. It may involve (http://ec.europa.eu/environment/circular-economy/index_en.htm) :

- Increasing the time of products to deliver their service before coming to the end of their useful life (durability);
- Reducing the use of materials that are hazardous or difficult to recycle (substitution);
- Creating markets for recycled materials (standards, public procurement);
- Designing products that are easier to repair, upgrade, remanufacture of recycle (eco-design);
- Incentivising waste reduction and high-quality separation by consumers;
- Incentivising separation and collection systems that minimise the costs of recycling and reuse;
- Facilitating industrial clusters that exchange by-products to prevent them from becoming wastes (industrial symbiosis);
- Encouraging wider consumer choice through renting or leasing instead of owning products (new business models)"

Burnley, et al. (2015) and Cucchiella, et al. (2014) argue that using waste to generate energy in waste to energy plants, where systems to sort or reclaim materials from waste do not exist, was environmentally and economically sustainable than sending the waste to a landfill. Circular economy will also ensure that there is no burning of waste at landfill area which often leads to environmental and pollution related problems in the nearby urban settlements. Every metro city faces these problems at regular interval of time and with circular economy as a solution the practice of burning of landfill waste will become a thing of past as there will be value to the waste.

Waste management hierarchy arranges Reduce- lowering the amount of waste produced, Reuse- using material repeatedly, Recycle- using materials to make new products, Recovery- recovering energy from waste and lastly landfill- safe disposal of waste to landfill in order of decreasing priority. This means that landfill to be the last alternative however, in India this is most of often than not taken as the only option to treat the waste. This has to be changed and that can happen more suitably by adopting the model of circular economy. We should work on integrated sustainable waste management which could be a physical system and its technological components, sustainability aspects (social, institutional, political, financial, economic, environmental and technical) and various groups of stake holders involved Wilson, et al., 2012.

A schematic presentation of this model is presented in the figure below



Integrated Sustainable Waste Management Model (after Anschutz et al.,2001)

This system once adopted will ensure waste value chain based circular economy approach, which is expected to be sustainable while fulfilling aspirations of the society in terms of economic and environmental outcomes. A resource value chain may include should be redesigned from present

Producer- Wholesaler- Retailer- consumer/ waste generator- waste disposer (generally the municipal corporations

to

Producer- Wholesaler- Retailer- consumer/ waste generator- Collector- aggregator- processor – Producer

In this manner the cycle will start from Producer and end with Producer making it a Circular Process/ System.

VALORIZATION OF URBAN SOLID WASTE

World population is growing and to ensure there is enough food, water and prosperity for everyone, there is a need to switch from linear

to circular economy. One of the examples of circular economy and valorisation of waste is from food waste. Reducing food waste has enormous potential for reducing the resources we use to produce, manage, transform, distribute, store and cook the food we eat. World over food has been identified as a key sector where resource efficiency should be improved and called for ambitious action to tackle food waste. Circular economy plays a vital role in managing food waste and is the best example of it.

VALORIZATION OF FOOD WASTE

Ever increasing world population means increasing demand for food production and processing industry associated with it and consequently the generation of a large amount of food waste. This fact opens a plethora of opportunities for effective waste management and measure for proper treatment, reuse or disposal of waste. Food is store house of complex carbohydrates, proteins, lipids and lipids and so is the food waste. These could be raw material for various processes and which can be used for valorization of food. Food supply food chain can be analyzed and the waste generated could be used for production of biofuels, enzymes, bioactive compounds, biodegradable plastics and nano particles to name a few.

Let us consider the valorization of food waste by analyzing the food supply chain of the food waste. This supply chain can be divided into two major groups (i) Plant derived food waste and (ii) animal derived food waste.

1. PLANT DERIVED FOOD WASTE:

a. Extraction / Processing: we can use the technology for extraction of Lipids, Hemicellulose, Bioactive compounds/ nutraceuticals, Pectin, Starch, Phytochemicals, Phenols, Biodiesel, Activated carbon. All these can then be used as raw materials for various applications.

b. Incineration: converting the food waste in to Fly Ash and then to Hydrogels for various applications.

c. Pretreatment and Hydrolysis: under this, the od waste is converted to sugars which is then fermented and finally used as raw material for conversion to Bioethonol, Butanol, Enzymes, Bioydrogen, Bioplastics etc.

d. ***Anerobic Digestion:*** this is a process in which using bacteria the food waste is converted in to heat, power and finally bio fertilizer.

2. ANIMAL DERIVED FOOD WASTE:

a. Anerobic Digestion: this is a process in which using bacteria the food waste is converted in to heat, power and finally bio fertilizer.

b.Extraction / Processing: processing of food waste to get Collagen, Chitosan, Protein Hydrolysate, Bioactive peptides, Cosmoceuticals, Insecticides, enzymes, fertilizers, soil nutrients etc.

The food waste valorization could be seen as one of the examples and similar systems/ processes are being developed for wastes from other streams. We should work on enlightening fellow citizens on the importance of valorization of waste.

It is heartening to note that in response to Government of India policy on start up, there is good response for valorisation of waste. Some of the notable start-ups which use waste as a resource (raw material) are:

Vermigold: Vermigold is an on-site organic waste recycling Systems Company which combines advanced vermiculture biotechnology with cutting edge engineering to enable end users to Recycle organic waste in a trouble free and eco friendly manner.

Eco-wise: Headquartered at Noida, India. Ecowise waste management provides comprehensive waste management services to a variety of establishments including residential, commercial and industrial entities.

Synergy Waste Management (P) Ltd. :It is one of the leading service providers for Bio-Medical waste management in India. They are generally operators of Common Bio-medical waste treatment facilities, part of urban infrastructure in India.

Timarpur-Okhla Waste Management Pvt Ltd. : Timarpur-Okhla Municipal Solid waste management project is the first commercial waste-to-energy facility in India that aims to convert one-third of the Delhi garbage into the much needed electricity, enough to serving 6 lakh homes. The project is CDM is registered with United Nations Framework Convention on Climate Change for earning Carbon Credits.

Attero, Electronics Asset Management Company: Attero aims to increase value for all electronic inventories, right from end of life electronics to surplus and seconds electronics, while ensuring a safer and more secure future for the planet. It is mainly concerned with E-waste mining.

Antony Waste Handling Cell Pvt. Ltd. : Antony waste handling cell, is one of the leading players in the field of Solid waste management services in the country. It has features as Engineered Sanitary land filling., Refuse Transfer stations, etc.

UPL Environmental Engineers Ltd. : Shivalik Solid Waste Management Ltd. : this startup is providing services forTreatment, Storage and Disposal Facilities, Multiple effect evaporator, Empty used drums, Environmental monitoring and laboratory analytical services, Waste oil/used oil, Paint Sludge, e-waste and CFL, Used lead acid batteries and Waste water management consultancy.

Greenobin : It is a Gurgaon based startup that is focussed on collecting paper waste and market the same to paper recycling plants for further use.

GreenPowerSystems: It is a waste management technology firm. GPS custom builds units for an un-segregated waste ecosystem. The inaugural products, BioOrja and Biowaste Shredder, are arguably the first waste-to-energy solution for urban India.

Let's Recycle: It is an initiative of NEPRA Resource management Pvt. Ltd., a social enterprise that operates in segment of Dry Waste Management and Recycling, where it collects Dry Waste from Waste generators and segregates the recyclables and sends to authorized recyclers.

CONCLUSION

Waste valorisation is an attractive approach of increasing popularity which can offer a range of potentially useful alternatives for dealing with residues other than disposed or land filling. Valorising waste components could infact lead to numerous possibilities for the production of valuable chemicals, fuels and products that society currently does not appreciate.Basic valorisation strategies including composting, recycling and burning(for energy recovery) are largely accepted practises worldwide which however are able to recover or convert waste into useful products.Advanced valorisation strategies based on green chemical technologies are more appealing from both the practical, economic and sustainability view points in that these can diversify the generation of multiple products from a single feedstock.

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