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Research Article

Advance in Environmental Waste Management & Recycling

Circular Economy Scenario in India

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Introduction

With the dawn of the Industrialisation period, the economic entire ecosystem started to shape in a linear system with our lifestyles catered around use-and-throw products. Due to the rapid increase in population and change in lifestyle since the mid-20th century, the once thought sustainable linear economy ("take, make, dispose") could no longer support the huge demands of mass production and consumption along with the associated environmental and social impacts. In lieu of this, the concept of circular economy was considered as a viable model for sustainability. The notion of Circular economy (CE) originated with the idea of minimizing waste which could be either reused, recycled, remanufactured or refurbished, thus resulting in emergence of closed loop economy [1-4].

In a developing country like India, with rapid industrial development since last few decades, waste production has increased at an alarming rate. The booming economy and rapid urbanization, quantities of municipal, industrial as well as e- waste generated have accelerated significantly. According to the "Swachhata Sandesh Newsletter" by Ministry of Housing and Urban Affairs, Govt of India, as of January 2020, 147,613 metric tonnes (MT) of solid waste is generated per day, from 84,475 wards across the country [5]. The huge quantity of waste generated in most of the urban centres are directly dumped on open dumping grounds (so called landfills) without adequate treatment. Studies have proven that countries worldwide, including India follows a linear model of waste management (take→make→waste). This means extraction, processing, utilization (a very small percentage) and then disposal through incineration or landfill [6]. Such materials can no longer be re-evaluated for their economic benefits and are discarded. This results in massive resource loss and increase in the requirement of virgin materials in the market. Hence, circularity in every aspect has become an urgent need in present scenario [7].

Urban waste management- Circular economy model

In India, waste management, be it municipal solid waste, e-waste or construction & demolition waste, are in a deplorable state. Although in recent years, steps have been taken by government to improve the entire waste management scenario, much is left to be achieved. Across most policies enacted towards waste management, reduction at source doesn't get considerable importance. Majority of the management strategies are end-of-pipe solutions i.e. related to post the usage of materials on what can be done to divert from landfill disposal. Urban waste management in India is conducted by the municipal boards of the respective area. Due to lack of excellent urban infrastructure for its operation and maintenance, such as challenges in collection, transportations, segregation of different types of wastes (e.g. dry and wet) as well as final disposal, management of solid waste is inefficient in major urban centres across the country.

According to the traditional waste hierarchy model, the order for managing waste is to minimize its usage at source which involves steps such as reduce, reuse, recycle and compost. Least desirable and the last step involves disposal of wastes at landfills, especially for materials which couldn't be treated in any of the above mentioned steps [8]. A paradigm shift in the entire hierarchy of solid waste management strategies from government, producers and consumers perspective should be the focus.

The concept of circular economy (CE) can play a pivotal role in minimising the waste generated which aims to extend the life of materials in use and promote reuse as well as recycling to maximize material service per resource input while lowering the environmental impact and resource use (G. Velvizhi et.al 2019). With recent studies majorly focussing on specific countries, regions and their existing MSW practice and applicability for CE, specific fraction of MSW and their resource values, for recycling, Waste to Energy (WtE), integration of other fields like Life Cycle Analysis (LCA), environmental degradation, economy, etc. CE granular understanding and analysis of the sustainable supply chain along with sustainable business models to reduce material and resource intensity of production, products and wastage through resource efficiency is the need of the hour [9-11]. A closed loop supply chain (CLSC) is one such approach which in combination with the concept of CE can enable to design, control and operate a system to maximize value creation over the entire life cycle of a product with dynamic recovery of value from different types and volumes of returns over time [12-15]. Rather than looking for end-of-pipe strategies to reduce the waste produced, we need to undertake steps at the source itself by improving the supply chains across varieties of daily used products. Studies in the European nation showed that

the implementation of the circular economy may reduce the greenhouse gas emissions by 70% as well as increase the workforce opportunity by 4% [16].

Case studies

In Indian context, with recent advancement in research on business models related to CE, five distinct types of models could be adopted by various organisations [17].

Business models				
Circular Supply chain	**Recovery & Recycling**	**Product Life extension**	**Sharing platform**	**Product as a service**
Complete replacement of a single lifecycle input (e.g. renewable energy)	Recover and recycle value-based components from disposed products or by-products	Extend lifetime of a product by increasing its efficiency or reselling	Enable shared access and ownership	Offer product access and retain ownership to internalise benefits of circular resource productivity

In India, Attero was first of kind integrated end-end e-waste recycling facility launched in 2007 which work on recycling and extracting valuable materials from e-waste. They also offer refurbished and reconditing services to extend the life of electronics and have developed a robust reverse logistics network across 22 states in India.

Apple Inc. is one such manufacturing company who have adopted the trade-in scheme where the customers can get a discount on the newly purchased iPhone (depending on the return quality of the iPhone) in exchange for an old iPhone using the recovery & Recycling and Product life extension CE business model. Apple announced in 2017 that it wants to implement a complete closed loop supply chain model and hence aggressively promoted the trade-in scheme since then. It is believed to have solved two key problems that Apple as a manufacturer was facing: a) improving the slowing iPhone sales in a saturated market and b) reduce the longer upgrade time with users waiting longer to be upgraded due to its steep price. With the introduction of the scheme, it allowed to reduce the device's price and allowed more users to upgrade sooner. With the already used iPhone at Apple's disposal, it first checked the condition of the devices as to their degree of reusability. Depending on the degree of usability, they are either refurbished and sold in emerging markets at a lower price or are dismantled to recycle the valuable rare earth materials. iPhone 12 is the first smartphone to be made from 100% recycled rare earth materials [18]. Cisco is another organisation which implements the Product life extension model where 90% of Cisco products are repaired to current product and sent back to market [17].

Conclusion

In the entire system of circular economy, customers/consumers play a pivotal role [19]. There needs to be a shift in perception among consumers in regarding wastes as a form of resource and accept the circular products [20]. However, studies have shown that consumers feel that such products lacks qualities in comparison to the existing available product and performance or are expensive [21]. In a developing country like India where costs of major environment friendly products are more as compared to the existing ones, the consumers prefer to cheaper ones. One such example is the cost of reusable bio-degradable sanitary napkins for women. Due to its high cost (60-70% more than the existing price), women will prefer the one-time use napkins. A normative change in customers behaviour and perception towards green products is essential. Moreover, further research on various consumer behaviour consumption patterns in Indian context is crucial to understand their needs, costs of such products as well as awareness required at various social levels of the community.

India has a huge potential to gain from adoption of circular economy business models. With the advancement of technology and positive changes in the policy scenario, more companies should adopt such models across different sectors which will enable mainstreaming efficient utilisation of resources and switch from the present linear model. A competitive environment among business should further create a robust adoption of such policies. Change in perception among consumers regarding acceptance of circular products/services will definitely have a positive impact on the environment.

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