## Circular Economy for Sustainable Development in India

### Nisha Rani Yaduvanshi<sup>1</sup>, Rupesh Myana<sup>1</sup> and Saravan Krishnamurthy<sup>2\*</sup>

<sup>1</sup>MBA ITBM, SCIT, Pune-411035, Maharashtra, India; nisha.rani@associates.scit.edu, rupesh.myana@associates.scit.edu <sup>2</sup>SCIT, Pune-411035, Maharashtra, India; saravan@scit.edu

### Abstract

Objectives: To explore current Waste Management practices in India and assess inadequacy; To assess successful WM practices examples and draw inferences for CE; To discuss CE as solution for WM inadequacy. Methodology: Semi-structured interviews and informal discussions with the experts in Waste Management (WM); Secondary data analysis collected from relative research papers and reports. Findings: Section 3 describes current WM practices, with insightful solutions from a case example of a for-profit waste management private company, VIVAM. Section 4 describes advancements in WM practices in three approaches: 1) Innovations in WM India, with two case examples. 2) WM practices in developed countries 3) Green consumerism. The inferences about inadequacy of above approaches lead us to propose modern advanced solution of Circular economy (CE). Section 5 infers CE as solution with insights from four case examples of successful CE implementations summarized in table3. The realignment of industry-government-citizen towards CE is demonstrated in these cases. In Section 6, CE is advocated as comprehensive solution aimed towards sustainable development in India. Useful inferences drawn from a total of seven case examples, including economies of China and UK. The contribution of this research to the existing body of sustainability knowledge is a renewed thinking for sustainable development in India. Drawing learning from developed economies infuses new thinking in future WM for India thus leading to sustainable development in India. Conclusion: Indian WM practices are less effective as performed in Silos. Adapting CE practices, educating/increasing awareness of effective WM methods goes long way towards accepting new sustainability policies and practices.

**Keywords:** Circular Economy, Consumer Behavior, Green Consumerism, Recycle, Sustainable Development, Waste Management, Zero Waste

### 1. Introduction

Due to rapid urbanization and high economic growth, Indian urban population is increasing, generating more waste. Current WM practices used by India are inadequate to manage large amounts of waste generated on a daily basis. The presence of waste is an indication of overconsumption, inefficient use of materials, and poor waste disposal mechanisms. Increased consumerism can be seen as the major cause of increased waste generation. This study explores current WM practices in India, and its current inadequacy. While some innovative WM practices demonstrate exceptional sustainability values, they remain as isolated examples and can be implemented nation-wide. The effectiveness of green consumerism as a comprehensive solution was explored, and realizing its inadequate effects on WM, we propose CE as a comprehensive approach to effective WM in India inferred from cases. Successful implementations of CE can lead to better sustainable development than many existing solutions. Figure 1, illustrates the flow of subtopics and this proposed transition from current to future CE approach of WM practices.

<sup>\*</sup> Author for correspondence



**Figure 1.** Transition from Current State to Proposed State of Waste Management (self-compiled).

## 2. Review of Literature

The World Bank defines municipal solid waste (MSW) as "non-hazardous waste generated in households, commercial and business establishments, institutions, and non-hazardous industrial process wastes, agricultural wastes and sewage sludge". In practice, specific definitions vary across jurisdictions.<sup>1</sup> Solid waste is increasing day by day due to population growth, industrialization, urbanization and economic growth.<sup>2</sup> More waste per capita is generated in high-income countries than in low-income countries as shown in table **1**. Increased affordability and urbanization have spread to middle-income countries such as India. A review of consumerism in India follows.

 Table 1.
 Per Capita urban MSW generation as per income of countries (Source: Worldbank report)<sup>1</sup>

|                         |                      | 1 /      |
|-------------------------|----------------------|----------|
| Country                 | Per Capita Urban MSW |          |
|                         | Generation (kg/day)  |          |
|                         | 1999                 | 2025     |
| Low income countries    | 0.45-09              | 0.6-1.0  |
| Middle income countries | 0.52-1.1             | 0.8-1.5  |
| High income countries   | 1.1-5.07             | 1.1-4.54 |

### 2.1 Consumerism

Cambridge dictionary defines consumerism as "the state of an advanced industrial society in which a lot of goods are bought and sold". Some of the factors leading to growth of Consumerism in India.<sup>3,4</sup>

- Rise in India's population and growth of middle class.
- Increase in the number of working people and purchasing power.
- Value for money, especially in the emerging rural markets.
- Interests of foreign retailers and relevant change in consumers' aspirations.
- Technological impacts, rising influence of social media on consumerism.

Consumerism in India has made it one of the lucrative markets for organizations to expand their scope of services and goods. To serve such a large consumer market and meet their dynamic demands industries expand into multiple product categories, into different geographies, use multiple channels to deliver products and services to customers. While industries attempt to capitalize on profit making, the need for equally dynamic WM practices is left to the government, local urban bodies and civil societies. Toxic wastes emanating from SMEs are highly polluting sectors.<sup>5</sup>

Figure 2 indicates Indian consumer market is increasing with 10.51% compound annual growth rate (CAGR) from 12.5 USD billion in 2015 to 20.6 USD billion in 2020. India is largest growing electronics market in the world with 21.97% CAGR.

The rise in consumerism has increased the dynamics of wastes produced and mounts massive pressures upon WM practices. Following the renewed sustainability agenda, responsible consumption and production<sup>6</sup> is an essential directive for renewing thinking on WM practices in India. The research objectives of current study are listed below.



Figure 2. Increasing Indian consumer market. (Source: IBEF).<sup>3</sup>

## 3. Current WM Practices in India

In India, the percentage of people living in urban areas are 37.7% in 2015 as compared to 17.29% in 19517 and due to rapid urbanization, it has become important to develop and propagate effective WM system by the government.8 Table 2 shows MSW generated in major cities of India. In most cities, municipal dustbins are installed for garbage collection but they are not cleared regularly by the municipality <sup>9</sup> resulting in people dumping household waste along roadsides, street corners, in vacant lands thus creating local unauthorized and unhygienic landfills.<sup>10</sup> Currently, the overall process of collection, transportation, and disposal of MSW in India can be considered to be in an unsystematic state with unscientific methods for disposals.<sup>8</sup> Steps of MSW management can be categorized into collection, transportation, processing and disposal.<sup>11</sup> In India, big cities collect around 70 to 90% of MSW generated, in comparison to smaller cities and towns that gather less than 50% of waste generated. The alarming WM practice is that upwards of 91% of MSW collected is dumped and abandoned in illegal landfills. A field visit to Vivam Agrotech, Pune was conducted to develop insights into current WM practices in Pune area, shown in case 1 below.

Table 2.MSW generated in major cities of India(Source: CPCB, 2011)12

| Sr. | Name of   | Municipal Solid Waste (MSW, (Tonnes |  |
|-----|-----------|-------------------------------------|--|
| No  | City      | per day)                            |  |
| 1   | Ahmedabad | 2300                                |  |
| 2   | Bangalore | 3700                                |  |
| 3   | Chennai   | 4500                                |  |
| 4   | Delhi     | 6800                                |  |
| 5   | Hyderabad | 4200                                |  |
| 6   | Kanpur    | 1600                                |  |
| 7   | Kolkata   | 3670                                |  |
| 8   | Lucknow   | 1200                                |  |
| 9   | Mumbai    | 6500                                |  |
| 10  | Pune      | 1300                                |  |

# 3.1 Case 1: VIVAM AGROTECH - Insights for Improving WM in Pune

VIVAM had developed the reputed 'Swarup Vermicomposting System', an active WM organization converting waste to energy. Led by Mrs. Nirmala Kandalgaonkar, VIVAM develops urban WM practices for organizations, aiding sustainable development of a city. Possibilities and insights for commercial WM industry sector are:

- Pune Municipal Corporation (PMC) should stop collecting wet garbage from societies, enforce rules to install wet waste WM systems for self-disposal by housing societies. Provide incentives to societies that install and follow.
- Impose strict fines on all societies that fail to provide segregated waste (minimum 3 types of segregation as wet, dry and e-waste).
- Install local WM system within the ward to ensure local waste is recycled within the area to reduce movement of waste and generate benefits to the locals.
- Wet waste can be recycled biogas production, used for household cooking purposes, electricity generation, and the sludge treated by vermiculture plant can generate local organic fertilizer production.
- For Dry and E-waste, local collection center within reachable distances can provide monetary value to citizens upon deposit of dry waste.
- Government and citizens can cooperatively work together to extensively adopt and apply 3R (Reduce, Reuse, and Recycle) philosophy.
- Enhance awareness of monetary values of WM and educate people about simple methods to convert waste into useful utilities. Providing them tangible (monetary) or intangible benefits (monetary savings, eco-friendliness) will play a major role in facilitating the change of attitude and enabling behavioral change of people.

## 4. Advancement in WM Practices

## 4.1 Innovations in Waste Management in India

There are a few exceptionally innovative WM practices demonstrated in India, narrated in below-mentioned cases of GIFT city, field visit report of PMC, and SWaCH.

### 4.1.1 Case 2: GIFT Smart City Waste Management

India has proposed 100 smart cities, 20 will be developed in 2016. In all the smart cities, India needs to adopt sustainable WM practices.<sup>13</sup> A Swiss technology recently implemented in GIFT city (Gujarat International Finance Tech City) Ahmedabad, for garbage disposal with minimum human interference. Solid waste generated is collected in a tower, then transferred to waste collection center using vacuum suction pipes at a speed of 110 to 140 km per hour. After waste segregation, organic waste will be sent for vermicomposting and inorganic waste disposed of by plasma technology incineration. Energy generated from incineration will be consumed within the city.<sup>14</sup> GIFT city is an appropriate experimentation opportunity for efficient urban WM. Similar projects need wide-spread replication.

### 4.1.2 Case 3: SWaCH – Example for Current Waste Management in Pune

SWaCH stands for (Solid Waste Collection and Handling or, officially, the SWaCH Seva Sahakari Sanstha Maryadit, Pune). Janwani (Charitable Public Trust formed as a social wing of Mahratta Chamber of Commerce, Industries and Agriculture [MCCIA]) along with PMC, Cummins India, SWaCH had initiated a Zero Garbage Project for reducing WM problems in Pune (zero-garbage-project, 2016). The objective is to reduce garbage sent to landfills to zero. SWaCH is India's first wholly-owned cooperative of self-employed waste pickers, waste collectors and other urban poor. They provide door-to-door waste collection (DTDC) at Rs.10 to 30 prices per household per month.<sup>15</sup> The scope of actions includes urban household waste collection, resource recovery, trade and waste processing.

SWaCH waste pickers segregate gathered waste, and wet or organic waste is handed over to the PMC system. Later, dry waste is sorted into categories (plastic, paper, metal, glass, leather etc). After further fine sorting by hand, any material with market value is sold. Based on the 3R philosophy, they developed V-collect services for newspapers, old clothes, and other household items like old electronic, electrical items, furniture, bicycles, kitchen utensils, etc. They repair and reuse what they can, and dismantle to recycle the rest. Clothes are segregated into categories as per age and size and sold to the poor at very low prices. Newspapers are used for the creation of disposable bags and eco-friendly carry bags.<sup>16</sup> Thus, SWaCH contributes significantly to WM and address social development i.e. employment for poor people.

Pune Municipal Corporation has developed plans for complete end-to-end automation and monitoring of waste collection and management. PMC is currently attempting to use cutting edge technologies like GPS, GSM, RFID, M2M, IoT Sensors. Along with innovative Mobile and web applications, they aim to improve ground-level mechanisms for waste collection, efficient recycling of waste.<sup>17</sup>

### 4.2 Waste Management Practices in Developed Economies

In developed countries, laws and strict regulations exist to prohibit eco-unfriendly practices and curb illegal dumping. Well-designed landfills are developed with appropriate construction methods and maintenance methods.<sup>18</sup> However, in developing countries like India, properly designed and maintained landfills are seldom found.<sup>11</sup> Some WM practices used by developed countries are:

- Imposing landfill tax on citizens to minimize landfill waste,<sup>19</sup>
- Use of waste reduction programs like Pay-as-You-Throw (PAYT) programs and Volume-Based-Waste-Fee (VBWF) programs. Under the PAYT programs, citizens are required to pay a flat fee for bins or trash bags and are expected to generate less waste.<sup>20</sup> Volume-Based-Waste-Fee (VBWF) programs<sup>21</sup> provide stringent WM insisting strong citizens' participation in WM.

#### 4.3 Green Consumerism

Every product that we purchase has an environmental impact, irrespective of its size and price. As consumers, we become tacitly involved in everything, starting from inputs of production, consumption, and final waste disposal. When the consumer bases of large countries like India with current population of more than 1.2 billion, expected to rise to 1.6 billion by 2020 one can imagine the exponential impact caused on environment.7 Instead of using regular products, adopting green consumerism seemed to be a promising approach to reduce the adverse impacts on the environment. According to Oxford dictionary, "Green consumerism is the practice of purchasing products which are regarded as environmentally responsible; environmentally conscious consumerism". Singh (2015) defines green consumerism involves people acting in an environmentally responsible manner, to protect environment and to promote ecoconsciousness by deliberately avoiding certain categories of products and services, that a) cause environmental degradation during the extraction of natural resources, manufacture, use or disposal, b) cause unnecessary waste, either because of over packaging or because of an unduly short life span.<sup>22</sup>

Green consumerism orients the demand of customers toward consuming healthier, eco-friendly, recyclable products thereby obliging businesses to develop products and services accordingly to achieve competitive advantage. In 1991, the Government of India (GOI) launched the eco-labeling 'Ecomark' scheme, to increase consumer awareness, for easy identification of environmentfriendly products.<sup>23</sup> Several corporate organizations in India had included green activities in their operations. For example, motorbike manufacturer Hero Honda worked consistently to reduce and eliminate eco-harmful materials of asbestos and hexavalent chromium from its products. JK Tyres designed, developed and unveiled ecofriendly tyres on world environment day, June 5, 2002.<sup>24</sup>

Consumer Awareness and Adoption of Biobased Products A Comparitive Study of India, China, USA and Canada



**Figure 3.** Consumer Awareness and Confidence in Green Products (Source: Green Living Survey, DuPont, India, 2014)<sup>25</sup>.

The recent Green Living Survey (conducted by TNS Global September for DuPont in 2014, India) found that a majority of Indian consumers are familiar with green products, have confidence that green products are better for the environment, and feel that bio-based ingredients enhance the desirability of a product.<sup>25,26</sup> Highest familiarities of green products in India were found in the following order: South (83%), East (68%), West (42%) and North (53%). The young demography (below 25 years) of India, indicates strong possibilities for adoption of green products. Popular purchase categories were clothing, personal care and household products made with eco-friendly ingredients. Figure 3 shows 63% of Indian consumers' awareness of green product as better for the environment.

In contrast to this awareness about green products, another extensive research on influencing factors of consumer behavior summarizes that while consumers' attitudes may be inclining towards green purchase decisions, they do not actually result in green buying actions, leaving a net result of very few green purchases in comparison to regular products.<sup>27</sup> Even though green products are marked eco-friendly, consumers have little knowledge of how the product can reduce the impact on the environment. A good example is plastic shopping bags marked as eco-friendly, but a common consumer perception exists that all waste is treated equally. Even in developed economies, consumers find green purchase decisions are often difficult.28 To decide upon the right thing to do, information was often too confusing, and thus right knowledge and skills become a pre-requisite.

widespread green approach by business А organizations are yet to happen and current approaches are slow in transforming towards greener operations and product designs. There is a strong need to 'develop green thinking' that is more than just advertising green products, but a multi-layered approach to green consumerism, organizational ethics, and educating consumers. All three approaches explored in this section are inadequate for India's path towards sustainable development. From this discussion on active participation of citizens, urban local bodies and regulation changes, we infer that a comprehensive change in perspective of industrygovernment-citizen's participation is crucial. This is elaborated in the below section on circular economy.

### 5. Circular Economy (CE)

The Circular Economy represents the most recent attempt to conceptualize the integration of economic activity and environmental wellbeing in a sustainable way. CE places emphasis on the redesign of processes and recycling of materials, which contribute to more sustainable business models.<sup>29</sup> The much-criticized linear economy approach manufactures products from finite reserves and disposes waste into landfills. An early approach to practical sustainability was envisioned and demonstrated as an 'economy in loops' of resource savings, waste prevention and product-life extension.<sup>30</sup> The modern approach to CE proposed a stronger recycle agenda, based on analysis of many years of data.<sup>31</sup> Figure 4, compares CE vs linear economy. Table 3 summarizes examples cases demonstrating successful CE implementations from other industry and economies.



**Figure 4.** Comparison of Linear and Circular Economy (Source: Ellen McArthur Foundation)<sup>32</sup>.

## 6. Discussion on Sustainable Development in India by CE

Given the rise in consumerism, the best opportunity for developing economies is to redefine sustainable development in a manner appropriate to their context and culture. While developing policies to maximize social welfare and simultaneously reducing environmental impacts, the threat could be a fixation on 'industrialization – pollution – remediation' cycle.<sup>44</sup> Together with unawareness about the inadequate impacts of green consumerism, a lack of vision to transition towards sustainable policy development and enforcement may settle in.<sup>45</sup> As seen in the current research, a lack of awareness exists among local urban bodies to completely implement recycling programs.

The Green living survey mentioned earlier projected the high awareness levels of Indian citizen towards adopting green products. Even though green consumerism is a costly affair for the consumer, organizations make many trade-offs to ensure eco-friendliness of such products. The debate continues on consumers' attachment to price tags: high price green products affordable for higher income group, with a majority of the Indian population in middle-class consumers' 'value for money' mentality and the poor who struggle to satisfy daily needs. Even though the green products awareness levels are high, the confidence level of people in purchasing the green products is very low because they are unsure about the nature of eco-friendliness of the product. The overall growth of consumerism leading to increased waste generation especially in Indian cities and the related but limited potential of green consumerism to curb urgent eco-issues argues in favor of CE. Thus, green consumerism is summarized as inadequate and not a comprehensively feasible solution for sustainable development of India.

Considering future policy initiatives for sustainability, strategic attempts by Indian companies to translate global sustainability challenges into opportunities for businesses were suggested.<sup>46</sup> Frameworks to develop synergized efforts for sustainability need to be developed.<sup>47</sup> Considering the emerging economy of India with increased consumerism and the related challenges due to rapid increases of urban waste aptly translates into opportunities for development of sunrise industry sectors in WM. Although composite environmental, social and economic practices may be in place to comply with corporate social responsibility requirements, further sustainability policy enhancements are required from GOI. A better strategy to curb eco-damages is observed in the CE approach.

The CE approach encompasses green consumerism within its principles and places a higher emphasis on zero waste principle. Circular economy includes 3R philosophy and demands industry to redesign its processes towards sustainability. It ensures biological nutrients entry into the biosphere safely and technological nutrients are designed to be re-circulated in the production system without entering the biosphere. Thus, to enable

| Case | Industry / economy Example  | CE Methodology Adopted  | Inference / Learning for India   |
|------|---|---|--|
| 4    | Industry Example - Hewlett<br>Packard demonstration of CE   | HP implemented closed material loops in tech-<br>nical grade polypropylene resulting in 90% of<br>HP's inkjet cartridges containing recycled plastic<br>from closed loops in 2014 and 5 million kilos of<br>recycled polypropylene in 2015. <sup>33</sup>   | Specific Industry can participate in<br>product redesign by extending manu-<br>facturer's responsibility towards CE  |
| 5    | Industry and Government ex-<br>ample - Low carbon industrial<br>manufacturing parks (LOCI-<br>MAP) projects in the UK | Demonstrates industrial symbiosis, co-location<br>of activities to enable integration of savings from<br>commission of manufacturing estates. <sup>34</sup>   | Replicable planning for urban local<br>bodies and WM entrepreneurship can<br>be developed in urban India.  |
| 6    | CE implementations in China   | CE implemented in stages. In earlier stage,<br>focused on reducing resource consumption.<br>In middle stage, obstacles in CE evaluations<br>are analyzed and difference in environmental,<br>social and economic condition is accounted. In<br>later stages, custom made CE indicator suitable<br>for city's unique feature was recommended to<br>include economic development, social stability,<br>resource consumption and environmental pro-<br>tection. <sup>35,36,37,38,39,40,41,42</sup> | Economic development, reduction of<br>resource usage and social development<br>have the most influence on CE. CE<br>leads to sustainable development.  |
| 7    | Sampurna Earth, example of<br>Current Circular economy<br>practice by NGO in India                                    | Segregated waste is managed differently, with<br>wet waste recycled in shorter cycles to ensure its<br>re-absorption within its nearby ecosystem and<br>enriching to convert it into utilities like biogas,<br>electricity, and fertilizer. Dry waste is further<br>segregated into e-waste, paper, clothes etc. at<br>appropriate collection center via the channel of<br>waste collection agents who further reuse and<br>recycle. <sup>43</sup>  | It is feasible to implement CE in India.<br>Replicating zero waste approach,<br>enhanced collection chains, increased<br>awareness among citizens and govern-<br>ment support are essential. |

Table 3. Example Cases demonstrating successful CE implementation (self-compiled)

an effective 'industry-government-citizens' triad for sustainable development, the contention 'the poor cannot afford eco-friendly products' needs to be replaced with 'the poor can be enabled with circular economy policies and sustainability practices'. The transition from linear to circular economy in developing countries like India may prove to be challenging in the beginning, but is a necessary challenge to overcome.

## 7. Conclusion

Urgent WM issues of India and corrective perception of green consumerism were discussed. The proposed transition to CE was discussed in seven success case examples of civil society, government, industry and regional groups to infer adaptations and possibilities for India to adopt CE. The sustainable development pathway for India is a complex charting process, and therefore it needs to gain clarity on current practices. The difference in felt vs. assessed impacts of green consumerism, relevant social welfare and WM would be useful results for future CE policy development to influence India's sustainable development in a planned manner. While such assessment instruments may be learned from developed economies, they cannot be accomplished without implanting seeds of CE education and training to enhance skills at multiple levels in WM. Overall industry shift towards CE practices may be slow, but need to be initiated today. Educating and increasing awareness levels of people of India for effective methods of WM goes a long way towards accepting new sustainability policies and practices.

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