

See discussions, stats, and author profiles for this publication at: <https://www.researchgate.net/publication/312125734>

# Circular Economy for Sustainable Development in India

Conference Paper in Indian Journal of Science and Technology · December 2016

DOI: 10.17485/ijst/2016/v9i46/107325

CITATIONS

21

READS

11,413

3 authors:



**Nisha Yaduvanshi**

Symbiosis International University

1 PUBLICATION 21 CITATIONS

[SEE PROFILE](#)



**Rupesh Myana**

Symbiosis Centre for Information Technology

1 PUBLICATION 21 CITATIONS

[SEE PROFILE](#)



**Saravan Krishnamurthy**

Symbiosis International University

19 PUBLICATIONS 66 CITATIONS

[SEE PROFILE](#)

# 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.

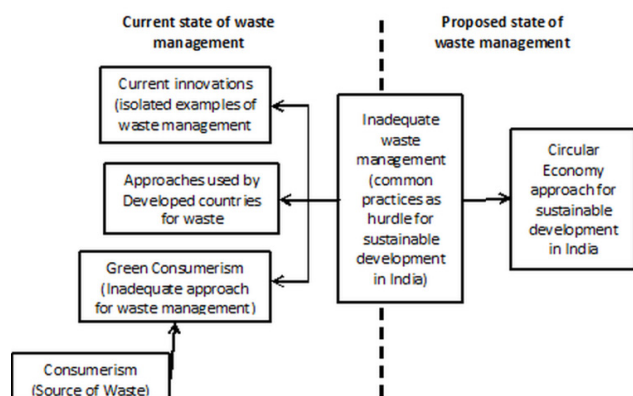
**Keywords:** Circular Economy, Consumer Behavior, Green Consumerism, Recycle, Sustainable Development, Waste Management, Zero Waste

## 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 sub-topics and this proposed transition from current to future CE approach of WM practices.

\* 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>

Country	Per Capita Urban MSW Generation (kg/day)	
	1999	2025
Low income countries	0.45-0.9	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 1951<sup>7</sup> and due to rapid urbanization, it has become important to develop and propagate effective WM system by the government.<sup>8</sup> 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)<sup>12</sup>

Sr. No	Name of City	Municipal Solid Waste (MSW, (Tonnes 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

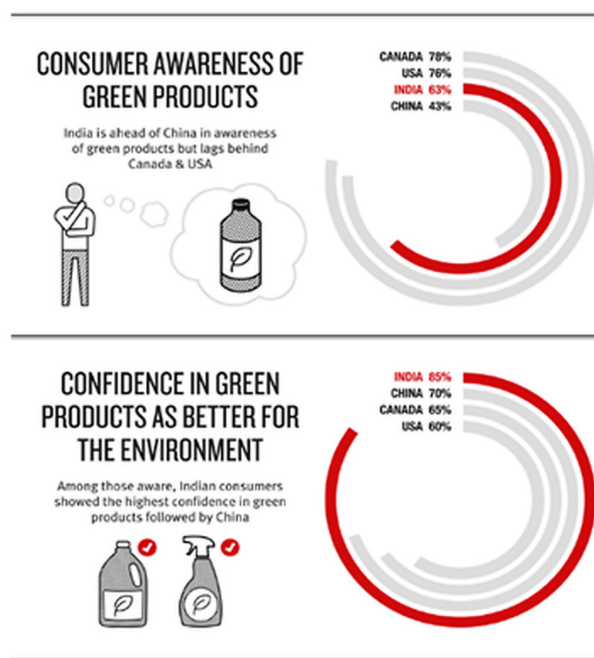
Every product that we purchase has an environmental impact, irrespective of its size and price. As consumers, we become tacitly involved in everything, starting from inputs of production, consumption, and final waste disposal. When the consumer bases of large countries like India with current population of more than 1.2 billion, expected to rise to 1.6 billion by 2020 one can imagine the exponential impact caused on environment.<sup>7</sup> 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 eco-consciousness 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 environment-friendly 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 eco-friendly tyres on world environment day, June 5, 2002.<sup>24</sup>

#### Consumer Awareness and Adoption of Biobased Products A Comparative 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 products and 85% of Indians confidence in green product as better for the environment.

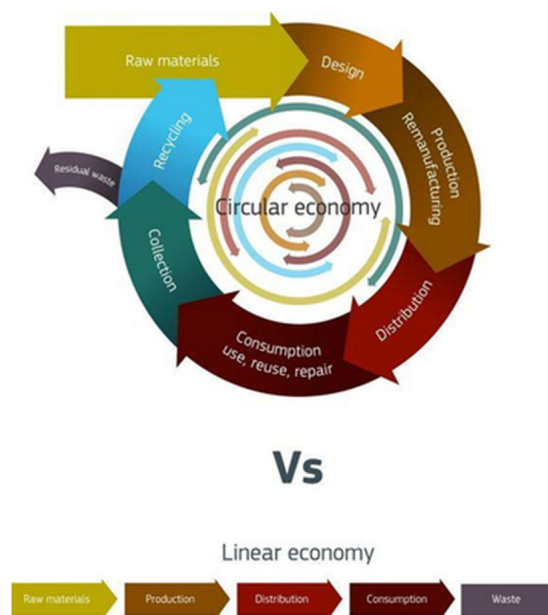
In contrast to this awareness about green products, another extensive research on influencing factors of consumer behavior summarizes that while consumers' attitudes may be inclining towards green purchase decisions, they do not actually result in green buying actions, leaving a net result of very few 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.<sup>28</sup> To decide upon the right thing to do, information was often too confusing, and thus right knowledge and skills become a pre-requisite.

A widespread green approach by business 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 industry-government-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

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

Case No	Industry / economy Example	CE Methodology Adopted	Inference / Learning for India
4	Industry Example - Hewlett Packard demonstration of CE	HP implemented closed material loops in technical grade polypropylene resulting in 90% of HP's inkjet cartridges containing recycled plastic from closed loops in 2014 and 5 million kilos of recycled polypropylene in 2015. <sup>33</sup>	Specific Industry can participate in product redesign by extending manufacturer's responsibility towards CE
5	Industry and Government example - Low carbon industrial manufacturing parks (LOCI-MAP) projects in the UK	Demonstrates industrial symbiosis, co-location of activities to enable integration of savings from commission of manufacturing estates. <sup>34</sup>	Replicable planning for urban local bodies and WM entrepreneurship can be developed in urban India.
6	CE implementations in China	CE implemented in stages. In earlier stage, focused on reducing resource consumption. In middle stage, obstacles in CE evaluations are analyzed and difference in environmental, social and economic condition is accounted. In later stages, custom made CE indicator suitable for city's unique feature was recommended to include economic development, social stability, resource consumption and environmental protection. <sup>35,36,37,38,39,40,41,42</sup>	Economic development, reduction of resource usage and social development have the most influence on CE. CE leads to sustainable development.
7	Sampurna Earth, example of Current Circular economy practice by NGO in India	Segregated waste is managed differently, with wet waste recycled in shorter cycles to ensure its re-absorption within its nearby ecosystem and enriching to convert it into utilities like biogas, electricity, and fertilizer. Dry waste is further segregated into e-waste, paper, clothes etc. at appropriate collection center via the channel of waste collection agents who further reuse and recycle. <sup>43</sup>	It is feasible to implement CE in India. Replicating zero waste approach, enhanced collection chains, increased awareness among citizens and government support are essential.

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.



## 8. References

- World Bank Group, editor. World Development Indicators 2012. World Bank Publications; 2012 Apr 18.
- Rajput R, Prasad G, AK C. Scenario of solid waste management in present Indian context. *Caspian Journal of Environmental Sciences*. 2009 Jan 1; 7(1):45–53.
- Indian Consumer Market, Report on India's FMCG industry growth [Internet]. IBEF- India Brand Equity Foundation (IBEF). 2016 [cited 17 September 2016]. Available from: <http://www.ibef.org/industry/indian-consumer-market>.
- Dey S. Middle Class Consumerism in India: An Introspective Study. *Indian Journal of Applied Research*. 2016 Jun 22;5(8).
- Patil Y, Rao P. Industrial waste management in the era of climate change: a smart sustainable model based on utilization of passive biomass. *Handbook of Climate Change Adaptation*. 2015:2079–92.
- Goal 12: Responsible consumption, production [Internet]. UNDP (2012). 2012 [cited 25 September 2016]. Available from: <http://www.undp.org/content/undp/en/home/md-goverview/post-2015-development-agenda/goal-12.html>
- Census of India 2011, Rural and Urban Distribution of population. New Delhi: Government of India, 2011.
- Gupta S, Mohan K, Prasad R, Gupta S, Kansal A. Solid waste management in India: options and opportunities. *Resources, conservation and recycling*. 1998 Nov 30; 24(2):137–54.
- Indhira K, Senthil J, Vadivel S, Anand PH. Geo Spatial Analysis of Solid Waste Management in Kumbakonam Town, *International Journal of development and research*.
- Gidde MR, Todkar VV, Kokate KK. Municipal solid waste management in emerging mega cities: a case study of Pune city. *In Indo Italian Conference on Green and Clean Environment*. 2008. p. 441–450.
- Yedla S. Modified landfill design for sustainable waste management. *International journal of global energy issues*. 2005 Jan 1;23(1):93–105.
- Status report on Municipal Solid waste management. Central Pollution Control Board, India; 2011.
- Smart cities 2016 [Internet] 2016 [cited 19 October 2016]. Available from: Ministry of Urban development, Govt. of India, <http://smartcities.gov.in/>
- Smart waste management system at GIFT city - Times of India [Internet]. The Times of India. 2016 [cited 5 August 2016]. Available from: <http://timesofindia.indiatimes.com/city/ahmedabad/Smart-waste-management-system-at-GIFT-city/articleshow/46060472.cms>
- Solid Waste Collection and Handling (SWaCH) newsletter, February 2014 [Internet]. Pune; 2014. Available from: <http://www.swachcoop.com/newsletter/englishnewsletter/swachnewsletter-vol3-issue2.pdf>.
- SWaCH (Solid Waste Collection and Handling or, officially, SWaCH Seva Sahakari Sanstha Maryadit, Pune) is India's first wholly-owned cooperative of self-employed waste pickers or waste collectors and other urban poor. [Internet]. Swachcoop.com. 2016 [cited 10 September 2016]. Available from: <http://www.swachcoop.com>.
- Pune Municipal Corporation [Internet]. Solid Waste Management, Pune Corporation, India. 2016 [cited 6 September 2016]. Available from: <http://swm-unecorporation.org>.
- DOE/EIA [Internet]. Department of Energy (DOE), Administration (EIA). 1999 [cited 8 October 2016]. Available from: <http://www.energy.gov> and [www.eia.gov](http://www.eia.gov)
- Chapple W, and Harris R. (2003). Accounting for solid waste generation in measures of regional productivity growth.
- Environmental Protection Agency [Internet]. 2006 PAYT Program. 2012 [cited 2 August 2016]. Available from: <http://www.epa.gov/epawaste/conservation/tools/payt/states/06comm.htm>
- Shin D. Generation and Disposition of Municipal Solid Waste (MSW) in the United States—A National Survey. Master of Science thesis submitted to the Department of Earth and Environmental Engineering Fu Foundation School of Engineering and Applied Science, Columbia University. 2014 Jan 3.
- Singh G. Green Consumerism in India: The Challenges Ahead.
- Ecomark, Ministry of Environment and Forests, Govt. of India, Gazette Notification No. 71, 21st February 1991 [Internet]. Mppcb.nic.in. 2016 [cited 27 September 2016]. Available from: <http://www.mppcb.nic.in/ecomark.htm>
- Borah S. The rise of green consumerism. The Shillong Times article [Internet]. 2012 [cited 29 August 2016];. Available from: <http://www.theshillongtimes.com/2012/03/15/the-rise-of-green-consumerism>.
- India Green Living Study | DuPont | DuPont USA [Internet]. Dupont.com. 2016 [cited 7 July 2016]. Available from: <http://www.dupont.com/products-and-services/industrial-biotechnology/articles/india-green-living-study.html>
- Muralidharan S, Rejón-Guardia F, Xue F. Understanding the green buying behavior of younger Millennials from India and the United States: A structural equation modeling approach. *Journal of International Consumer Marketing*. 2016 Jan 1; 28(1):54–72.
- Joshi Y, Rahman Z. Factors affecting green purchase behaviour and future research directions. *International Strategic Management Review*. 2015 Dec 31; 3(1):128–43.
- Moisander J. Motivational complexity of green consumerism. *International journal of consumer studies*. 2007 Jul 1; 31(4):404–9.
- Murray A, Skene K, Haynes K. The circular economy: An interdisciplinary exploration of the concept and application in a global context. *Journal of Business Ethics*. 2015:1–2.
- Stahel WR, Reday-Mulvey G. Jobs for tomorrow: the potential for substituting manpower for energy. Vantage Press; 1981.
- Pearce DW, Turner RK. Economics of natural resources and the environment. JHU Press; 1990.

32. Circular Economy - UK, Europe, Asia, South America and USA | Ellen MacArthur Foundation [Internet]. Ellen-macarthurfoundation.org. 2016 [cited 17 November 2016]. Available from: <http://www.ellenmacarthurfoundation.org/circular-economy>
33. McIntyre K, Ortiz JA. Multinational Corporations and the Circular Economy: How Hewlett Packard Scales Innovation and Technology in Its Global Supply Chain. In *Taking Stock of Industrial Ecology 2016* (p. 317–330). Springer International Publishing.
34. Bailey M, Gadd A. Quantifying the Potential of Industrial Symbiosis: The LOCIMAP Project, with Applications in the Humber Region. In *Taking Stock of Industrial Ecology 2016* (p. 343–357). Springer International Publishing.
35. WANG S, HUANG XJ, CHEN Y. On Evaluating Regional Cycling Economy—A Case Study of Jiangsu Province [J]. *Journal of Jiangxi Agricultural University (Social Sciences Edition)*. 2006; 1:031.
36. Meng LS, Shen ZH. Research on the circular economy evaluation of central pain cities. *Technology Economics*. 2006; 25(11):12–7.
37. Xian-jin ZB. Research on circular economy development indicator system and demonstrable assessment. *China Population, Resources and Environment*. 2005; 3:006.
38. Qin Z, Wang J, Zhang JE, Luo S, Ye Y. Integrative evaluation and case study on the development level of circular economy in Guangdong. *Ecological Economy*. 2009; 8:43–8.
39. LI W, ZHANG T. Research on the Circular Economy Evaluation Index System in Resource Based City [J]. *Science of Science and Management of S. and T.* 2005; 8:18.
40. Lihua H, Heming X, Min H, Mingxiang L, Shibin Y. On the Index System of Cities' Sustainable Development Based on the Circular Economy [J]. *Reformation and Strategy*. 2009; 9:029.
41. Li F, Liu X, Hu D, Wang R, Yang W, Li D, Zhao D. Measurement indicators and an evaluation approach for assessing urban sustainable development: A case study for China's Jining City. *Landscape and Urban Planning*. 2009 Apr 30; 90(3):134–42.
42. Du Chunli CJ. Evaluation on Circular Economy Efficiency about Iron and Steel Industry in China: 2003—2006 [J]. *Industrial Economics Research*. 2009;5:001.
43. Sampurnearth Environment Solutions Pvt. Ltd. [Internet]. Sampurnearth.com. 2016 [cited 29 September 2016]. Available from: <http://www.sampurnearth.com>
44. Bain A, Shenoy M, Ashton W, Chertow M. Industrial symbiosis and waste recovery in an Indian industrial area. *Resources, Conservation and Recycling*. 2010 Oct 31; 54(12):1278–87.
45. Singh DP, Kothari R, Tyagi VV. Emerging Energy Alternatives for Sustainable Environment. *The Energy and Resources Institute (TERI)*; 2016 Jun 28.
46. Rao P, Patil Y. Evolution of the environment sustainability paradigm and processes—trends and perspectives in Indian business and industry. In Rao Prakash and Patil Yogesh (2011) *Evolution of the environment sustainability paradigm and processes—trends and perspectives in Indian business and industry*. International Journal of Academic Conference Proceedings 2014 Nov 6 (Vol. 1, No. 1).
47. Krishnamurthy S, Joseph S, Bharathi V. Creating Environment Friendly Projects in Rural India—A Synergy Framework for Sustainable Renewable Energy. *International Journal of Applied Engineering Research*, ISSN. 2014 Dec 31:0973–4562.