International Journal of Scientific Research in Engineering and Management (IJSREM)
Volume: 07 Issue: 04 | April - 2023 Impact Factor: 8.176 ISSN: 2582-3930

Waste Management in India: Challenges and Opportunities for Entrepreneurs

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Keywords:-

Swm, Segregation, Domestic waste, contaminated waste

Abstract

In developing countries like India, the collection, segregation, transportation and disposal of MSW is unscientific. Unregulated dumping of all manner of wastes on the edges or outskirts of towns and cities has created overflowing landfills, which are difficult to reclaim because of the haphazard manner of dumping and have serious environmental consequences.

Recycling has remained an informal industry using outmoded technology in the lack of effective trash classification, collection, and disposal processes. Despite this, it is growing because of the amount of waste material and market demand for less expensive recycled goods. Due to the commodities' rising levels of use, paper and plastic recycling have seen particularly rapid growth. A significant knowledge gap exists in comprehending the potential available for entrepreneurs and the problems they must confront to build up a waste management firm, despite the fact that Indian experts have extensively researched technology-related topics in academic articles.

This review article focuses on the quantity of the garbage that is now produced, collected, and recycled. Specifically, this review paper analyses statistics and information about Indian Waste management and highlights several heralds that a entrepreneur may have to face while setting up a business.

1. Introduction

Solid waste management (SWM) is one of the major problems for many urban local bodies (ULBs) in India, where urbanization, industrialization, and tremendous economic growth have resulted in increased municipal solid waste(MSW) generation per capita, a good example for the above statement is the increase in per capita waste generated in Bengaluru which has increased for 0.25 kg to 0.5 kg per capita within the span of 4 to 5 years. Efficient SWM in metropolitan cities is a challenge due to high population densities. Making a country like India more sustainable is difficult as it is experiencing rapid population growth and improvements in living standards and it is a diverse country with many different religious groups, cultures, and traditions. Despite India showing significant development in social, economic, and environmental areas, the solid waste management systems in India have remained relatively unchanged. The unorganized sector has a key role in

extracting value from waste, with approximately 90% of residual waste currently being dumped rather than properly landfilled. There is an urgent need to move to a more sustainable SWM, and this requires new management systems and waste management facilities. Current SWM systems are inefficient and lack the capacity to handle the humungous amount of waste that is being produced, with waste having a negative impact on public health, the environment, and the economy. The new waste Management Rules in India were introduced by the Ministry of Environment and Forests (MoEF) , although compliance is limited. This paper reviews the challenges, barriers, and opportunities associated with improving waste management in India.

India generates approximately 62 million tonnes of mixed waste each year, consisting of both recyclable and non-recyclable materials, according to data from the Press Information Bureau. Unfortunately, only 60% of this waste is collected, and a mere 15% of the collected waste is properly processed or managed. This lack of proper waste management is due in part to our tendency to view objects as "waste" as soon as they are no longer useful to us, rather than considering ways in which they could be reused or repurposed.

As a society, we have not prioritized the development of new and innovative waste management techniques, focusing instead on disposal and removal. However, given the magnitude of the waste management challenge, it is imperative that we begin to shift our mindset and embrace more sustainable approaches to managing our waste. By investing in research and development of new waste management technologies, promoting public awareness and education, and implementing policies that incentivize sustainable waste practices, we can work towards a cleaner, healthier, and more sustainable future for all.

2. CLASSIFICATION OF WASTE

Domestic waste is any non-recyclable material that is produced during regular household operations. Typical wastes include fruit peels and vegetables, polythene, wood goods, paper, glass, textiles and clothes, tiny products made of metal and steel, etc. These wastes typically emerge as a result of home items being thrown away. As a result, the trash from their home leaks into the streets and drains, where it eventually reaches environmental entities and disrupts the functioning of those entities.

One type of trash produced as the final output of any industrial process of productivity is often one that is produced by industrial processes. These wastes are considered as hazardous waste, i.e., those waste categories that can seriously harm humanity. Wastes that are produced commercially are often those that come from manufacturing, processing businesses that operate mostly between the hours of 9AM and 5PM, or during office hours. Papers, cardboard, plastics, special garbage, potentially hazardous waste in some form, food waste, electronic waste, etc. are all included.

According to the source of generation, impacts, and properties waste canbe classified as the mentioned below: -

Residential waste	• Food scrap , paper, cardboard, plastics, textiles, leather, yard wastes, wood, glass, metals, ashes, e-wastes
Industrial waste	• Housekeeping wastes, packaging, food wastes, construction and demolition materials, hazardous wastes, special wastes
Commercial waste	Paper, cardboard, plastics, wood, food wastes, glass, metals, special wastes, hazardous wastes, e-wastes
Municipal Services waste	Street sweepings, landscape and tree trimmings • General Wastes from Parks, beaches 7 other recreational areas, sludge.
Construction & Demolition waste	Wood, steel, concrete, dirt, bricks, tiles
Medical Wastes	Infectious wastes, hazardous wastes, radioactive wastes from cancer therapies, pharmaceutical waste
Agricultural waste	Spoiled food wastes, agricultural wastes like rice husks, cotton stalks, coconut shells, coffee waste, hazardous wastes like pesticides,

Municipally generated wastes are those types of waste that are produced by municipal organizations in any location. This occurs as a result of lax management practices employed by the authorities. Street sweepings, general garbage from parks, beaches, and sludge are examples of such wastes in this field.

Wastes produced by the building and demolition industries are those materials that will eventually end up being left behind. These items are regarded as construction and demolition-related wastes. Ex: wood, steel, soil, concrete, bricks, tiles, etc.

Medical waste is that broad category of produced waste up to the point where it produces very dangerous waste that can result in a number of deaths because the chemicals these wastes contain as property are very active in polluting all the environmental elements that support human existence on this planet. for example, radioactive waste, hazardous waste, and infectious waste. A particular locality's agricultural activities produces agricultural wastes. The wastes in this category are those that typically result from food spoilage in one form or another. Wastes like rice, husks, cotton stalks, coconut shells, and coffee wastes typically fall within the category of particular types of agricultural waste.

3. **Entrepreneur opportunities**

Entrepreneurs can not only spend money in the solid waste management sector, but they can also introduce new ideas, technologies, and skills that can turn refuse from a liability to an advantage. The participation of young businesses ready to take a chance and develop a better solid waste management system improves the effectiveness of solid waste management. Indeed, it has been discovered that involving businesses in solid refuse management planning can cut service costs in half.

Entrepreneurial endeavors in the solid refuse management sector can vary from one-man projects to multi-million dollar projects involving hundreds of trained and unskilled employees. For many years, it has been noted that solid waste management is a labour-intensive process with enormous potential to create new jobs, based on the type of undertaking and degree of creativity. Waste gathering, transportation, reuse and recycling, upcycling, and electricity production are the main fields of entrepreneurial participation.

1) Opportunities in solid waste

Solid waste is a general word for materials that have been dumped or abandoned. The 2016 Solid Waste Management Regulations govern how solid waste is managed. The goal of these new regulations is to encourage "waste to energy" facilities and the usage of compost in place of artificial fertilizers. Municipal solid waste (MSW) can be turned into a fossil fuel substitute by being dried, then crushed, and finally packed into bricks. Moreover, MSW can be turned into compost. In actuality, over 55% of the garbage in India is organic. Sadly, not much of it is converted into compost; instead, it is disposed of in landfills.

A 2012 study by the Clean India Journal found that India has the capacity to produce 4.3 million tonnes of compost annually from only municipal solid waste. India also has over 650,000 organic farmers, whose produce is sold to the country's expanding middle class of health-conscious consumers. Compost demand will increase as a result of new federal incentives to use compost instead of artificial fertilizers.

2) Opportunities in E-waste recycling

Electronic waste (or "e-waste") is the term for outdated electronics or home appliances that are destined for recycling, recovery, or disposal. India serves as a center for the production and consumption of electronics. India generates 18.5 million metric tonnes (MT) of electronic waste annually, according to joint research from ASSOCHAM and Frost & Sullivan from 2016. Around 70% of this comes from public, commercial, and government sources, with families contributing 15%.

The E-waste (Management and Handling) Rules, 2016, which govern how e-waste is to be imported, imported, and recycled, govern how e-waste is to be handled. E-waste collection and recycling facilities, as well as makers, users, and bulk purchasers of electronics, are subject to the E-waste Rules.

Just 2.5% of e-waste gets recycled, and it is disproportionately collected and handled by the unorganized sector. E-waste, such as old computers or smartphones, is disassembled in the unorganized sector and scrapped for precious and other metals.

3) Plastic or polymer recycling

About the volume of plastic garbage produced in India, there is no official data. According to a 2015 survey by the Central Pollution Control Board (CPCB) of the Indian government, the top 60 cities in India produce 15,000 tonnes of plastic waste everyday, of which 6,000 tonnes are not recycled. The Plastic Waste (Management and Handling) Rules from 2016 govern the handling of plastic garbage. The Plastic Waste Regulations primarily address plastic bags and require that plastic recycling adheres to Indian Standards. Municipal authorities are authorized and required by the Plastic Waste Regulations, 2016, to create plastics waste management systems.

Although there are more plastic recycling facilities in India, this area of the trash industry is still completely untouched. For instance, polyester yarn made from plastic bottles can be sold as packaging in the industrial and consumer markets

4) Opportunities Bio-Medical and hazardous waste

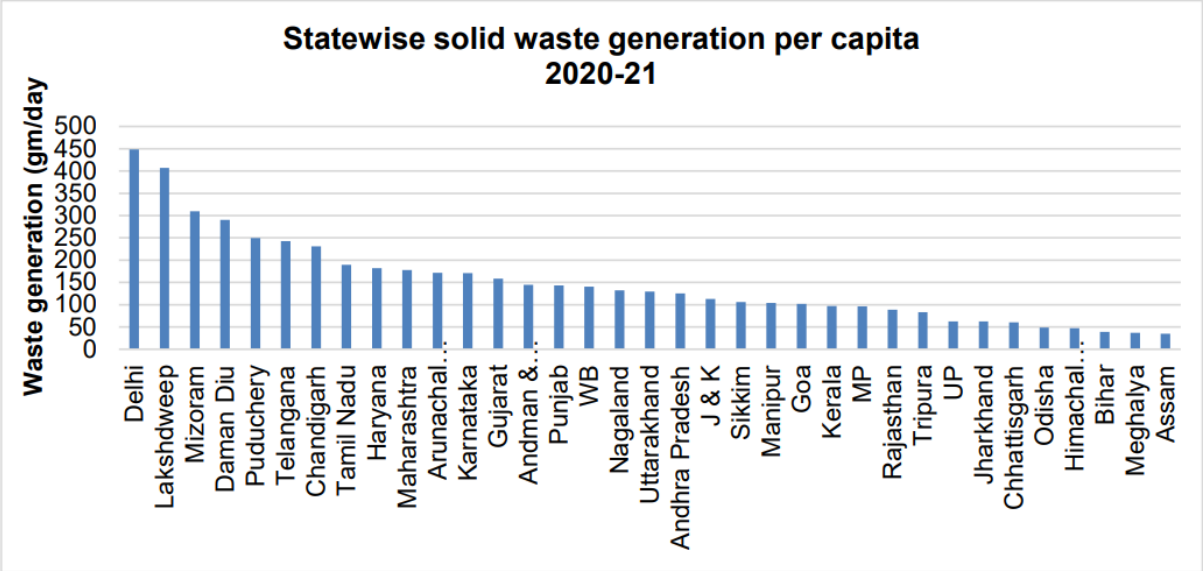
Syringes and other medical trash, including biological materials, are all considered bio-medical waste (BM). A total of 484 tonnes per day (TPD) of bio-medical waste are produced in India by more than 160,000 healthcare establishments (HCF). This biological waste is reportedly processed in India daily at a rate of 447 tonnes.

The Bio-medical Waste (Management and Handling) Rules, 2016, which control BM waste, make sure that it is either adequately treated by the healthcare provider themselves or processed at a shared treatment facility. By January 31st, producers of BM trash must submit annual returns to the State Pollution Control Board outlining the types and amounts of BM waste handled.

India's healthcare industry is expanding, and by 2025, there will be 2.9 million hospital beds there. According to a recent waste management report by the market research firm Novonous, India's bio-medical waste management market will expand at a compound annual growth rate of 8.41 percent, which is faster than the predicted growth rate for trash in general.

4. Waste management market analysis

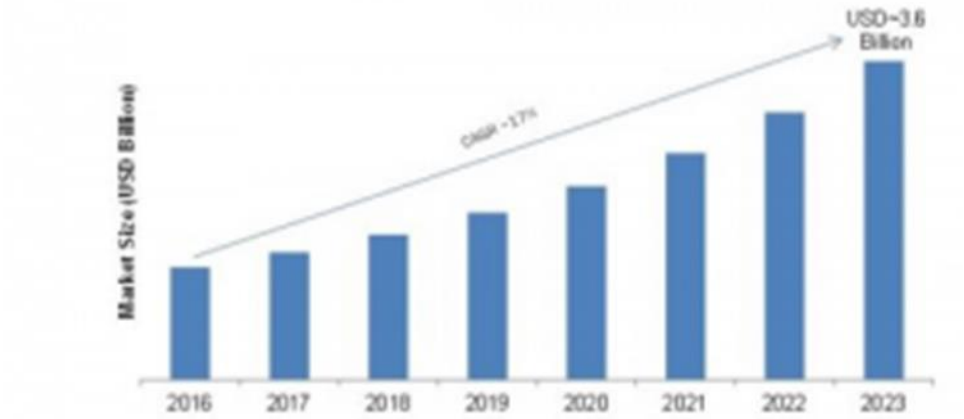
By 2050, it is anticipated that there will be over 27 billion tonnes of trash produced year, with Asia accounting for almost a third of that total and China and India making up the majority. In 2025, India's metropolitan areas would produce 0.7 kilograms of waste per person each day,



which is four to six times more waste than they did in 1999. When communities grow in size, garbage-related issues become more serious, and this presents chances for decentralized waste management by NGOs and self-help groups.

Due to population growth and changing lifestyles, India's urban areas currently produce about 170 000 tonnes of waste per day, or 62 million tonnes annually. This amount is expected to rise by 5% annually. According to Table 5, India's metropolitan areas produced 31.6 million tonnes of trash in 2001 and today produce 47.3

million tonnes. Waste production is expected to increase by a factor of five over the course of four decades, to 161 million tonnes by 2041.



5. Challenges faced by Entrepreneurs

1. Poorly trained/managed employees

Poorly trained and under-motivated staff is a common issue that can affect the success of recycling operations. Often, these employees have not received adequate management or training and may lack a clear understanding of their job requirements and expectations. To address this challenge, it is important for reputable labor team suppliers to provide comprehensive training and management for their workers.

Clear communication of job expectations, coupled with effective management practices, can help to motivate employees and improve job satisfaction. By empowering employees to succeed in their roles and providing them with the tools and resources needed to perform their jobs effectively, organizations can cultivate a more engaged and productive workforce. In turn, this can help to boost operational efficiency, improve customer satisfaction, and enhance overall business performance. Ultimately, investing in employee training and management is an investment in the long-term success and sustainability of the recycling operation.

2. Employee retention

Employee retention is a critical issue that can impact an organization's productivity and efficiency. High employee turnover rates can lead to a sense of uncertainty and instability among remaining employees, resulting in a need to constantly play catch-up and fill the gaps left by departing staff. To address this challenge, organizations should focus on providing effective training and management from day one, laying a solid foundation for employee growth and development.

Additionally, promoting from within can provide employees with a sense of hope and a clear career path, incentivizing them to remain with the organization over the long term. By cultivating a culture of internal mobility and offering opportunities for advancement, organizations can not only retain top talent but also create a more engaged and motivated workforce. This, in turn, can help to boost productivity, improve employee satisfaction, and ultimately drive business success..

3. Excessive downtime

Excessive downtime can have a detrimental effect on both productivity and employee morale. To mitigate this issue, it is important for employees to be accountable for their time and to be prepared to work from the moment they arrive, rather than simply clocking in and waiting for the machinery to start. Implementing simple procedural changes, such as reducing the length of phone calls, limiting the duration of lunch breaks, and

minimizing unexplained absences, can help to reclaim valuable hours of productive time that might otherwise be lost.

By fostering a culture of accountability and responsibility for time management, organizations can not only boost productivity but also improve employee engagement and job satisfaction. By empowering employees to take ownership of their schedules and encouraging them to be mindful of their time usage, organizations can create a more efficient and effective workplace where everyone is working together towards shared goals..

4. Overcoming language/cultural issues

In today's increasingly globalized world, language and cultural barriers can present significant challenges for organizations operating in diverse regions. For instance, in major metropolitan cities such as Bengaluru, a significant proportion of workers in certain sectors are immigrants from different parts of India, which can lead to communication gaps and cultural misunderstandings. To address these challenges, smart workforce suppliers actively seek out individuals from a wide range of linguistic and cultural backgrounds. This may require the recruitment of operations managers who can speak the languages of these workers.

Although this approach may require additional effort and resources, the long-term benefits of having a diverse and inclusive workforce can be significant. By hiring individuals who are comfortable communicating in multiple languages and who possess a deep understanding of different cultural norms and values, organizations can foster more effective collaboration, creativity, and innovation. Moreover, by investing in training and development programs that are sensitive to the unique needs and perspectives of each employee, organizations can cultivate a workplace culture that is both supportive and empowering for all.

5. Recruiting employees in locations with a lower unemployment rate

Attracting and recruiting employees with the requisite skills and qualifications in areas where the unemployment rate is comparatively low can pose a considerable challenge for organizations. In the current economic climate, India's unemployment rate stands at 7.45%, making it increasingly difficult to fill available job openings with top-tier talent. In this context, labor team leaders typically conduct the hiring process at the worksite, rather than in a storefront, as this provides prospects, potential employees, and other stakeholders with the opportunity to experience the work environment firsthand and determine whether it aligns with their professional aspirations and preferences.

Moreover, in the context of waste processing operations, it may be possible to train semi-skilled workers to manage the various tasks involved. This approach could prove especially beneficial in areas where local youth are struggling to find gainful employment. By offering training and employment opportunities in this field, organizations can help build a pipeline of skilled workers while also promoting economic growth and development within the community.

6. Lack of industry expertise

In the waste/recycling industry, specific hands-on industry experience is crucial for effective operations. Equipment knowledge is essential, as operations managers must understand how machinery works and keep it in optimal condition depending on the amount of feedstock it is receiving. Effective people skills are equally important, as a strong operations manager must respect the workforce and deal effectively with personal and work-related challenges and opportunities. The lack of industry expertise in the waste management sector can be attributed to the sector's unorganized nature, resulting in a lack of adoption of large and efficient machinery to process waste.

8. Proper employee placement

Proper employee placement is crucial to optimize productivity in the waste/recycling industry. An experienced manager observes various factors, such as the speed of the conveyor belt, quality of recyclables, and the number of available people, to determine the best placement for each employee. With many variables involved, operations managers with specific industry experience are best suited to maximize employee performance.

9. Reducing poor-quality recyclables

The quality of recyclable materials depends significantly on the geographic location. The Pacific Northwest, including Seattle, has high-quality recyclables due to its ecological consciousness, while other parts of the country may have varying quality levels. Poor-quality recyclables, including items such as garden hoses, can cause equipment damage and reduce productivity. Henceforth, having knowledgeable onsite operation managers who know how to operate the machinery etc and well-trained employees can help maintain productivity even when the quality of recyclables is low.

10. Improving safety

The waste/recycling industry faces various safety challenges, such as chemical exposure, combustible dust explosions, and machine guarding hazards. Industry leaders adopt a proactive safety approach by conducting safety compliance audits at every plant and providing rigorous safety training to all employees.

A proactive safety approach in the waste/recycling industry can lead to improved safety levels, reduced accidents and injuries, increased compliance with safety regulations, and a better safety culture within the industry.

6. **Government action**

Local governments have a responsibility to "accordance with the Solid Waste Management Regulations 2016" "etc up secondary storage or material recovery facilities with enough room for recycling sorting

Provide waste collectors and recyclers with easy access to segregated recyclable waste such as paper, plastic, metal, glass, and textile from the source of generation or from material recovery facilities. Materials to enable informal or authorized waste pickers and waste collectors to separate recyclables from the waste."

Under the Swachh Bharat Mission-Urban, a step-by-step guide titled "An Inclusive Swachh Bharat through the Integration of the Informal Sector: A Step by Step Guide" was also published to assist urban local bodies and states in integrating informal waste pickers to encourage the reuse and recycling of solid wastes. The Bureau of Indian Standards (BIS) has amended/revised the IS 383 - Specification for Coarse and Fine Aggregates to enable for the recycling and repurposing of Construction & Demolition Waste, making it easier to use reclaimed aggregates in construction projects.

The Indian government's Ministry of New and Renewable Energy (MNRE) is giving central financial assistance (CFA) for the creation of large-scale waste-to-energy facilities to produce power from urban solid refuse, industrial waste, and biomass.

7. Conclusion

The waste management business in India has a vast scope due to several factors such as the country's growing population, increasing urbanization, and rapid industrialization. The government's initiatives such as Swachh Bharat Abhiyan and the focus on sustainable development have also opened up opportunities in the waste

management sector. Moreover, the rise of the circular economy concept, coupled with the growing awareness among people about the harmful effects of improper waste disposal, has led to an increased demand for innovative waste management solutions. Therefore, the waste management business in India holds great potential for growth and investment.

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