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BRIDGING THE GAP: TECHNIQUES FOR EFFICIENT WASTE HANDLING AND THE SHIFT TO A CIRCULAR ECONOMY

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Abstract

The world today is facing a number of serious environmental, financial, and societal issues due to inappropriate techniques of waste management. Conventional waste management techniques emphasise treatment and disposal, however these approaches are frequently expensive, ineffective, and detrimental to the environment. A circular economy strategy, on the other hand, aims to decrease waste, increase resource efficiency, and encourage sustainable patterns of production and consumption. In order to identify important tactics and best practices for efficient waste reduction, recycling, and reuse, this study examines the body of research on waste management and the circular economy. It examines the case studies from different industries and geographical areas, emphasising effective programs and laws that advance the ideas of the circular economy.

Keywords: *Waste management, circular economy, sustainability, resource efficiency, waste reduction, recycling, reuse.*

Introduction

The world is currently dealing with a serious waste management challenge. Global trash production is growing at an accelerated rate, which has created serious problems for the environment, the economy, and society. The World Bank estimates that 2 billion tonnes of municipal solid waste (MSW) were produced worldwide in 2016, and that amount is projected to rise to 3.4 billion tonnes by 2050 (World Bank, 2018). Conventional waste management techniques emphasise treatment and disposal, however these approaches are frequently expensive, ineffective, and detrimental to the environment.

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Literature Review

The concept of a circular economy has gained significant attention in recent years as a potential solution to the waste management crisis. A circular economy is an economic system that is restorative and regenerative by design, aiming to keep resources in use for as long as possible, extract the maximum value from them, and recover and regenerate materials at the end of their service life (Geiss Doerfer et al., 2017). The circular economy approach seeks to reduce waste, promote resource efficiency, and foster sustainable consumption and production patterns.

Traditional waste management practices focus on disposal and treatment, but these methods are often inefficient, costly, and environmentally harmful. Landfills, for example, are a major source of greenhouse gas emissions and can contaminate soil and groundwater (Kumar et al., 2017). Incineration, on the other hand, can release toxic pollutants into the air and produce hazardous ash (Liu et al., 2018).

The circular economy strategy aims to reduce waste, improve resource efficiency, and promote sustainable patterns of consumption and production. The circular economy concept is based on three fundamental principles: planning for circularity, sharing and collaboration, and closing resource loops (Geiss Doerfer et al., 2017). Creating products and services that are restorative and regenerative by design is known as “design for circularity.” Collaboration and sharing entail encouraging the reuse and sharing of goods and services. Designing closed-loop systems, in which materials are continuously recycled back into production, is necessary to close resource loops (McDonough & Braungart, 2002).

Recycling and waste reduction are essential elements of a circular economy. Recycling is the process of turning garbage into new products, whereas waste reduction is the process of lowering the quantity of waste produced. Research has demonstrated that recycling and waste reduction can save natural resources and drastically cut greenhouse gas emissions (EPA, 2020). Reusing aluminium cans, for instance, consumes 95% less energy than making new aluminium from scratch (Aluminium Association, 2020).

Circular business models involve designing business models that are restorative and regenerative by design. Examples of circular business models include product-as-a-service, sharing and leasing, and closed-loop production (Tukker, 2004). Product-as-a-service involves providing customers with access to products rather than ownership. Sharing and leasing involve providing customers with access to products for a limited period of time.

Objectives of the study:

In order to identify important tactics and best practices for efficient waste reduction, recycling, and reuse, this study examines the body of research on waste management and the circular economy

1. To find out the best practices for efficient waste reduction.
2. To highlight the waste management initiatives in India.
3. To identify the challenges in the implementation of initiatives.
4. To give recommendations for the successful implementation of initiatives.

Research Methodology: The study uses a number of case studies by looking through journals, publications, and other pertinent literature.

Case Studies

Several case studies have demonstrated the effectiveness of circular economy strategies in reducing waste and promoting resource efficiency. For example, the city of Stockholm has implemented a waste-to-energy program that converts waste into heat and electricity (City of Stockholm, 2020). The program has reduced the city's greenhouse gas emissions by 70% and has provided heat and electricity to over 800,000 residents.

Sweden's Waste-to-Energy Program

- Sweden's waste-to-energy program is a successful example of a circular economy approach to waste management. The program involves the incineration of waste to produce heat and electricity, reducing the country's reliance on fossil fuels and decreasing greenhouse gas emissions (Swedish Environmental Protection Agency, 2020).

Japan's Recycling Program

- Japan's recycling program is another successful example of a circular economy approach to waste management. The program involves the recycling of a wide range of materials, including paper, plastic, glass, and metal, reducing the country's waste disposal costs and promoting resource efficiency (Japanese Ministry of the Environment, 2020).

India's Waste Management Initiatives

India's waste management initiatives are a successful example of a circular economy approach to waste management. The initiatives involve the segregation of waste at source, the composting of organic waste, and the recycling of inorganic waste, reducing the country's waste disposal costs and promoting resource efficiency (Indian Ministry of Environment, Forest

and Climate Change, 2020). Some of the major initiatives taken in India for Waste Management include :

- **Mumbai's Waste-to-Energy Plant:** The trash-to-energy facility established by the Mumbai Municipal Corporation produces 12 MW of electricity daily from 600 tonnes of rubbish. The city's greenhouse gas emissions and garbage disposal expenses have decreased as a result of this project.
- **Delhi's Composting Initiative:** The Delhi government has launched a composting initiative that aims to convert 50% of the city's organic waste into compost. This initiative has helped reduce the city's waste disposal costs and promote sustainable agriculture practices.
- **Bangalore's Recycling Program:** The Bangalore Municipal Corporation has launched a recycling program that aims to recycle 100% of the city's dry waste. This initiative has helped reduce the city's waste disposal costs and promote sustainable consumption practices.
- **Chennai's Waste Management Initiative:** The Chennai Municipal Corporation has started a waste management program with the goals of recycling dry garbage, composting organic waste, and separating waste at the source. This program has promoted sustainable waste management techniques and assisted in lowering the city's garbage disposal expenses.
- **Kerala's Zero-Waste Initiative:** The Kerala government has launched a zero-waste initiative that aims to eliminate waste disposal in landfills. This initiative has helped promote sustainable waste management practices and reduce the state's waste disposal costs.
- **Tamil Nadu's Plastic-Free Initiative:** The Tamil Nadu government has launched a plastic-free initiative that aims to eliminate single-use plastics in the state. This initiative has helped promote sustainable consumption practices and reduce plastic waste.
- **Pune's Waste-to-Compost Initiative:** In an effort to turn all of the city's organic waste into compost, the Pune Municipal Corporation has started a waste-to-compost program. This program has promoted sustainable farming methods and assisted in lowering the city's trash disposal expenses.
- **Ahmedabad's Recycling Program:** The Ahmedabad Municipal Corporation has launched a recycling program that aims to recycle 100% of the city's dry waste. This initiative has helped reduce the city's waste disposal costs and promote sustainable consumption practices.

- **Hyderabad's Waste Management Initiative:** The Hyderabad Municipal Corporation has launched a waste management initiative that aims to segregate waste at source, compost organic waste, and recycle dry waste. This initiative has helped reduce the city's waste disposal costs and promote sustainable waste management practices.
- **Gujarat's Zero-Waste Initiative:** The Gujarat government has launched a zero-waste initiative that aims to eliminate waste disposal in landfills. This initiative has helped promote sustainable waste management practices and reduce the state's waste disposal costs.

Results

The various case studies point out that successful waste management initiatives in India are those that adopt a circular economy approach, promoting waste reduction, reuse, and recycling. The initiatives also highlight the importance of community engagement, education, and awareness in promoting sustainable waste management practices.

- **Increasing garbage Generation:** As a result of population increase and urbanisation, garbage generation has surpassed municipalities' ability to efficiently manage it.
- **Lack of Segregation at the Source:** Recycling efforts are made more difficult by the fact that many homes and institutions do not separate biodegradable and non-biodegradable waste.
- **Hazardous and Biomedical Waste:** Poor enforcement of guidelines for hazardous and biomedical waste disposal poses risks to human health and the environment.
- **Inadequate Infrastructure:** Urban municipal governments frequently lack the facilities required for the collection, processing, and disposal of waste. The issue is made worse by inadequate waste treatment facilities and outdated technologies.
- **Landfill Overload:** Methane emissions and groundwater contamination are among the environmental problems caused by the majority of landfills in India being overloaded.
- **Budgetary Restrictions:** The adoption of sustainable methods is hampered by a lack of funds for waste management initiatives.
- **Public understanding and Participation:** Inadequate disposal methods are frequently the result of a lack of community involvement and understanding of waste management programs.
- **Hazardous and Biomedical Waste:** Poor enforcement of guidelines

for hazardous and biomedical waste disposal poses risks to human health and the environment.

Discussion

The findings of this research paper suggest that adopting a circular economy approach to waste management is critical for promoting sustainable waste management practices in India. The circular economy approach promotes waste reduction, reuse, and recycling, and has been shown to have numerous environmental, economic, and social benefits. However, the adoption of a circular economy approach to waste management in India is faced with several challenges, including lack of infrastructure, lack of awareness, and lack of policy support.

Conclusion

In conclusion, this research paper highlights the importance of adopting a circular economy approach to waste management in India. The circular economy approach promotes waste reduction, reuse, and recycling, and has been shown to have numerous environmental, economic, and social benefits. The case studies presented in this research paper demonstrate that successful waste management initiatives in India are those that adopt a circular economy approach, promoting waste reduction, reuse, and recycling.

Recommendations

Based on the findings of this research paper, the following recommendations are made:

- There is a need to adopt a circular economy approach towards waste management.
- Efforts should be made to promote community engagement, education as well as awareness.
- Infrastructure should be developed for waste reduction, reuse as well as recycling.
- Provision of policy support for circular economy initiatives.
- More and more public private partnerships should be encouraged for waste management initiatives.

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