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Sustainable Waste Management Practices in the Hotel Industry: Strategies, Challenges, and Environmental Implications

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Abstract

The hospitality industry, particularly hotels, significantly contributes to global waste generation due to high consumption patterns and operational intensity. This study explores sustainable waste management practices in hotel management, focusing on waste generation sources, mitigation strategies, and environmental implications. Using a descriptive and exploratory research approach based on secondary data, the study identifies key waste streams such as food waste, plastic waste, hazardous waste, and wastewater. Findings reveal that food waste constitutes the largest proportion of hotel waste, accounting for over 50% in many establishments. The paper further highlights strategies such as the 5R approach (Refuse, Reduce, Reuse, Recycle, Restore), waste audits, composting, and technological innovations. Despite growing awareness, challenges such as lack of infrastructure, cost constraints, and limited regulatory enforcement persist. The study concludes that sustainable waste management not only reduces environmental impact but also enhances operational efficiency and brand image in the hospitality sector.

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1. Introduction

The global hotel industry has experienced rapid expansion over the past few decades, driven by increased international travel, globalization, and rising consumer demand for leisure and business tourism. As a core component of the hospitality sector, hotels play a significant role in economic development through employment generation, foreign exchange earnings, and infrastructure development (Makoondlall-Chadee, 2024). However, this growth has also resulted in substantial environmental challenges, among which waste generation has emerged as one of the most critical concerns.

Hotels are inherently resource-intensive operations, characterized by high consumption of food, water, energy, and disposable products. These consumption patterns result in the generation of large volumes of waste, including food waste, solid waste, hazardous waste, and wastewater (Pirani & Arafat, 2014). Unlike other industries, the hospitality sector operates in a service-oriented environment where customer satisfaction is paramount, often leading to overproduction, excessive packaging, and inefficient resource utilization. Consequently, waste generation is not only inevitable but also deeply embedded in operational processes.

Waste generation is widely recognized as one of the most visible environmental impacts of the hotel industry. This visibility stems from the direct interaction between guests and hotel services, including dining, housekeeping, and amenities. For instance, buffet-style dining often leads to significant food waste due to over-preparation and consumer behavior (Lee, 2023). Similarly, the use of single-use plastics, toiletries, and packaging materials contributes to the accumulation of solid waste. These practices not only increase environmental degradation but also pose reputational risks for hotels in an era where sustainability is a key determinant of consumer choice.

The environmental implications of improper waste management are far-reaching. Landfills, which are the primary disposal method in many regions, contribute to greenhouse gas emissions, particularly methane, which is significantly more potent than carbon dioxide (Diaz-Farina et al., 2023). Additionally, improper disposal of hazardous waste, such as cleaning chemicals and electronic waste, can lead to soil and water contamination, posing risks to both ecosystems and human health. In developing countries like India, where waste management infrastructure is often inadequate, these challenges are further exacerbated.

In response to these concerns, sustainable waste management has become an integral aspect of hotel management. The concept of sustainability in hospitality extends beyond environmental protection to include economic efficiency and social responsibility. Waste management practices such as reduction, recycling, composting, and reuse are increasingly being adopted by hotels to minimize environmental impact and improve operational efficiency (Kasavan et al., 2017). These practices align with global sustainability frameworks, including the United Nations Sustainable Development Goals (SDGs), particularly SDG 12, which focuses on responsible consumption and production.

Furthermore, the growing awareness among consumers regarding environmental issues has led to a shift in preferences toward eco-friendly accommodations. Hotels that implement sustainable waste management practices not only reduce their environmental footprint but also enhance their brand image and competitiveness in the market (Makoondlall-Chadee, 2024). This dual benefit underscores the importance of integrating sustainability into core business strategies.

Despite the increasing emphasis on sustainability, the adoption of effective waste management practices in the hotel industry remains uneven. Factors such as lack of awareness, high implementation costs, and limited regulatory enforcement hinder progress, particularly in small and medium-sized enterprises (SMEs). Therefore, there is a need for comprehensive research to understand the current state of waste management in hotels and to identify strategies for improvement.

This study aims to address this gap by exploring the types of waste generated in hotels, analyzing existing waste management practices, and evaluating the challenges associated with their implementation. By doing so, it contributes to the growing body of literature on sustainable hospitality management and provides practical insights for industry stakeholders.

2. Literature Review

The issue of waste management in the hospitality industry has gained increasing attention in recent years, although it remains relatively underexplored compared to other environmental concerns such as energy and water conservation (Pirani & Arafat, 2014). Existing literature highlights the complexity of waste generation in hotels and underscores the need for systematic and integrated waste management approaches.

One of the most prominent findings in the literature is the dominance of food waste in hotel operations. Studies indicate that food waste accounts for a significant proportion of total waste generated in hotels, often exceeding 50% (Lee, 2023). This is largely attributed to buffet-style dining, overproduction, and consumer behavior, including plate waste and preference for variety. Food waste not only represents a loss of resources but also contributes to environmental degradation through methane emissions when disposed of in landfills (Diaz-Farina et al., 2023).

In addition to food waste, hotels generate substantial amounts of solid waste, including plastics, paper, glass, and metals. The widespread use of single-use plastics, such as water bottles, straws, and packaging materials, has been identified as a major contributor to environmental pollution (Kasavan et al., 2017). The literature emphasizes the need for reducing reliance on such materials and promoting sustainable alternatives.

Effective waste management practices have been shown to significantly improve environmental performance and operational efficiency in hotels. For instance, waste audits, which involve the systematic analysis of waste generation patterns, enable hotels to identify areas for improvement and implement targeted interventions (Sobti, 2024). Similarly, the adoption of the 5R principles—Refuse, Reduce, Reuse, Recycle, and Restore—has been widely recommended as a comprehensive approach to waste management (Kasavan et al., 2017).

Another important aspect highlighted in the literature is the role of sustainable sourcing in reducing waste. By procuring locally sourced and minimally packaged products, hotels can significantly reduce waste generation while supporting local economies (Makoondlall-Chadee, 2024). This approach aligns with the concept of circular economy, which emphasizes resource efficiency and waste minimization.

Technological innovations are also playing a crucial role in enhancing waste management practices in the hospitality industry. Smart waste bins equipped with sensors can monitor waste levels and optimize collection schedules, thereby improving efficiency (Mbokazi, 2025). Waste-to-energy technologies, which convert waste into usable energy, offer a sustainable solution for waste disposal, particularly in large hotels with high waste generation (Diaz-Farina et al., 2023).

Employee training and awareness are identified as critical factors in the successful implementation of waste management practices. Staff members play a key role in waste segregation, recycling, and reduction efforts, and their participation is essential for achieving sustainability goals (Sobti, 2024). Similarly, guest behavior has a significant impact on waste generation, and initiatives such as awareness campaigns and incentives can encourage responsible consumption.

Despite these advancements, several challenges continue to hinder the effective implementation of waste management practices in hotels. These include high initial investment costs, lack of infrastructure for recycling and composting, and limited regulatory enforcement (Mbokazi, 2025). In developing countries, these challenges are compounded by inadequate waste management systems and lack of technical expertise.

Overall, the literature underscores the importance of adopting a holistic approach to waste management in the hospitality industry. While significant progress has been made, there is a need for further research to explore innovative solutions and address existing challenges.

3. Objectives of the Study

The primary objective of this study is to examine sustainable waste management practices in the hotel industry and to identify strategies for improving environmental performance. The specific objectives are as follows:

1. To identify the major types of waste generated in hotels
2. To analyze existing waste management practices in the hospitality sector
3. To evaluate the challenges associated with implementing sustainable waste management
4. To suggest effective strategies for improving waste management in hotels

These objectives are designed to provide a comprehensive understanding of waste management in the hotel industry and to contribute to the development of sustainable practices.

4. Research Methodology

This study adopts a descriptive and exploratory research design to examine waste management practices in the hotel industry. The choice of this methodology is based on the need to gain a comprehensive understanding of the subject, given the limited availability of empirical studies in this area.

4.1 Research Design

The descriptive approach is used to provide a detailed analysis of waste generation and management practices in hotels, while the exploratory approach allows for the identification of emerging trends and challenges. This combination is particularly suitable for studies that aim to generate insights and propose solutions in relatively underexplored areas (Makoondlall-Chadee, 2024).

4.2 Data Sources

The study relies on secondary data collected from a variety of sources, including:

- Scopus-indexed journals
- ResearchGate publications
- ScienceDirect articles
- Industry reports and sustainability guidelines

These sources provide a comprehensive and reliable foundation for the analysis, ensuring the validity and credibility of the findings.

4.3 Data Collection Method

Data was collected through a systematic review of literature related to waste management in the hospitality industry. Relevant articles were selected based on their relevance, quality, and contribution to the field. Keywords such as “hotel waste management,” “hospitality sustainability,” and “food waste in hotels” were used to identify relevant studies.

4.4 Data Analysis Technique

The study employs qualitative content analysis to interpret the data. This involves the identification of key themes, patterns, and relationships in the literature. The analysis focuses on:

- Types of waste generated in hotels
- Existing waste management practices
- Challenges and barriers
- Innovative solutions and best practices

This approach allows for a comprehensive understanding of the subject and facilitates the development of practical recommendations.

4.5 Scope of the Study

The study focuses on the global hotel industry, with particular emphasis on developing countries such as India. This focus is justified by the unique challenges faced by these countries, including inadequate infrastructure and regulatory constraints. By examining both global and regional perspectives, the study provides a balanced and comprehensive analysis.

4.6 Limitations of the Study

While the study provides valuable insights, it is subject to certain limitations. The reliance on secondary data may limit the ability to capture real-time trends and variations. Additionally, the findings may not be generalizable to all types of hotels, particularly small and independent establishments.

5. Types of Waste Generated in Hotels

The hotel industry generates a diverse range of waste streams due to its multifaceted operations, including accommodation services, food and beverage production, housekeeping, maintenance, and guest activities. These waste streams can be broadly categorized into food waste, solid waste, hazardous waste, and wastewater. Understanding the composition and characteristics of these waste types is essential for designing effective waste management strategies.

5.1 Food Waste

Food waste represents the most significant proportion of waste generated in hotels, often accounting for more than 50% of total waste output (Pirani & Arafat, 2014; Lee, 2023). This category includes both pre-consumer waste (generated during food preparation) and post-consumer waste (leftovers from guests' plates).

One of the primary drivers of food waste in hotels is the buffet-style dining system, which encourages overproduction to ensure variety and availability. While this approach enhances customer satisfaction, it also leads to substantial wastage of edible food (Filimonau & De Coteau, 2019). Additionally, poor inventory management, improper storage, and lack of demand forecasting contribute to food spoilage.

Food waste has significant environmental implications. When disposed of in landfills, it decomposes anaerobically, producing methane—a greenhouse gas that is approximately 25 times more potent than carbon dioxide (Diaz-Farina et al., 2023). Moreover, food waste represents a loss of resources, including water, energy, and labor used in food production and preparation.

To address this issue, hotels are increasingly adopting practices such as portion control, menu optimization, food donation programs, and composting. Technologies such as food waste tracking systems and AI-based demand forecasting are also being utilized to minimize waste generation (Papargyropoulou et al., 2019).

5.2 Solid Waste

Solid waste in hotels comprises a wide range of materials, including paper, plastics, glass, metals, textiles, and packaging materials. This waste is generated from various sources such as guest rooms, restaurants, offices, and maintenance activities (Kasavan et al., 2017).

Plastic waste is a major concern due to its non-biodegradable nature and environmental persistence. Items such as single-use bottles, straws, toiletries, and packaging materials contribute significantly to plastic pollution. Paper waste, including newspapers, brochures, and office materials, also constitutes a substantial portion of hotel waste.

Glass and metal waste, although recyclable, require proper segregation and collection systems to ensure effective recycling. Failure to segregate waste at the source often leads to contamination, reducing the efficiency of recycling processes (Sobti, 2024).

The management of solid waste requires a systematic approach, including waste segregation, recycling, and reduction strategies. Hotels are increasingly adopting eco-friendly alternatives such as biodegradable packaging, refillable dispensers, and digital communication to reduce paper usage.

5.3 Hazardous Waste

Hazardous waste generated in hotels includes cleaning chemicals, pesticides, batteries, fluorescent lamps, and electronic waste (e-waste). These materials contain toxic substances that pose risks to human health and the environment if not handled and disposed of properly (Makoondlall-Chadee, 2024).

For instance, cleaning agents used in housekeeping and maintenance often contain chemicals that can contaminate water sources. Similarly, improper disposal of batteries and electronic devices can lead to the release of heavy metals such as lead and mercury into the environment.

The management of hazardous waste requires specialized handling, storage, and disposal procedures in compliance with regulatory standards. Hotels must ensure proper labeling, training of staff, and collaboration with authorized waste disposal agencies to mitigate risks.

5.4 Wastewater

Wastewater is another significant waste stream in hotels, generated from kitchens, laundry operations, bathrooms, and swimming pools. This wastewater contains organic matter, detergents, oils, and chemicals, which can cause environmental pollution if discharged untreated (Pirani & Arafat, 2014).

In many developing countries, inadequate wastewater treatment infrastructure exacerbates the problem, leading to contamination of water bodies and adverse impacts on aquatic ecosystems. Hotels with large-scale operations, such as resorts, often generate substantial volumes of wastewater, necessitating efficient treatment systems.

To address this issue, hotels are increasingly investing in wastewater treatment plants (WWTPs), greywater recycling systems, and water-saving technologies. These measures not only reduce environmental impact but also contribute to cost savings through water reuse.

6. Waste Management Practices in Hotels

The growing awareness of environmental sustainability has led hotels to adopt structured waste management practices aimed at minimizing waste generation and promoting resource efficiency.

6.1 Waste Audits

Waste audits are a fundamental component of effective waste management. They involve the systematic collection, analysis, and evaluation of waste data to identify sources, composition, and quantities of waste generated (Sobti, 2024).

By conducting waste audits, hotels can gain insights into their waste generation patterns and identify opportunities for reduction and recycling. For example, audits may reveal excessive food waste in buffet operations or high levels of plastic usage in guest amenities.

Waste audits also facilitate the development of targeted waste management strategies and enable hotels to monitor progress over time. Regular audits are essential for continuous improvement and compliance with environmental standards.

6.2 5R Strategy

The 5R strategy—Refuse, Reduce, Reuse, Recycle, and Restore—provides a comprehensive framework for sustainable waste management (Kasavan et al., 2017).

- **Refuse:** Avoid unnecessary consumption and eliminate waste at the source.
- **Reduce:** Minimize resource usage and waste generation.
- **Reuse:** Extend the lifecycle of products through reuse.
- **Recycle:** Convert waste materials into new products.
- **Restore:** Rehabilitate ecosystems and promote sustainability.

This approach emphasizes the importance of waste prevention and resource efficiency, aligning with the principles of the circular economy.

6.3 Recycling and Composting

Recycling and composting are widely adopted practices in the hotel industry. Recycling involves the collection and processing of materials such as paper, plastic, and glass, while composting converts organic waste into nutrient-rich soil (Papargyropoulou et al., 2019).

Composting is particularly effective for managing food waste, reducing landfill dependency, and producing valuable by-products for landscaping and agriculture. Many hotels have established on-site composting facilities or collaborate with local composting agencies.

6.4 Technological Innovations

Technological advancements are transforming waste management in the hospitality sector. Smart waste bins equipped with sensors can monitor fill levels and optimize collection schedules, reducing operational costs (Mbokazi, 2025).

Waste-to-energy technologies convert waste into electricity or heat, providing a sustainable alternative to landfill disposal. Additionally, digital platforms and data analytics enable hotels to track waste generation and implement data-driven strategies.

6.5 Employee Training

Employee training is a critical factor in the successful implementation of waste management practices. Staff members are responsible for waste segregation, recycling, and adherence to sustainability protocols (Sobti, 2024).

Training programs should focus on raising awareness, developing skills, and fostering a culture of sustainability. Engaging employees in sustainability initiatives not only improves waste management outcomes but also enhances job satisfaction and organizational commitment.

7. Challenges in Waste Management

Despite significant progress, the implementation of effective waste management practices in hotels faces several challenges.

One of the primary challenges is the lack of awareness and training among staff and management. Without proper knowledge and skills, it is difficult to implement and sustain waste management initiatives (Mbokazi, 2025).

High implementation costs also pose a significant barrier, particularly for small and medium-sized hotels. Investments in technologies, infrastructure, and training require substantial financial resources, which may not be readily available.

Limited infrastructure for recycling and composting is another major challenge, especially in developing countries. The absence of reliable waste collection and processing systems hampers the effectiveness of waste management efforts.

Regulatory and compliance issues further complicate the situation. Inconsistent policies, lack of enforcement, and bureaucratic hurdles can discourage hotels from adopting sustainable practices.

Guest behavior and consumption patterns also play a crucial role in waste generation. Excessive consumption, lack of awareness, and resistance to change can undermine waste reduction efforts.

8. Discussion

The findings of this study highlight the critical importance of waste management in achieving sustainability in the hotel industry. Effective waste management practices not only reduce environmental impact but also enhance operational efficiency and competitiveness.

Hotels that adopt sustainable practices benefit from cost savings through reduced resource consumption and waste disposal expenses. Moreover, sustainability initiatives improve brand image and attract environmentally conscious consumers (Makoondlall-Chadee, 2024).

The integration of waste management into hotel operations aligns with global sustainability frameworks, particularly the United Nations Sustainable Development Goals (SDGs). SDG 12 emphasizes responsible consumption and production, which is directly مرتبط with waste reduction and resource efficiency.

Furthermore, the adoption of circular economy principles can transform waste into valuable resources, creating new opportunities for innovation and value creation.

9. Recommendations

Based on the findings, the following recommendations are proposed:

1. **Comprehensive Waste Management Policies:** Hotels should develop and implement structured policies to guide waste management practices.
2. **Adoption of Circular Economy Principles:** Emphasize resource efficiency and waste minimization.
3. **Investment in Technology:** Utilize advanced technologies for waste tracking and management.
4. **Staff Training and Awareness:** Conduct regular training programs to enhance employee participation.
5. **Collaboration with Authorities:** Partner with local governments and waste management agencies to improve infrastructure and compliance.

10. Conclusion

Waste management is a critical aspect of sustainable hotel operations, with significant implications for environmental protection, economic efficiency, and social responsibility. While the hotel industry has made considerable progress in adopting sustainable practices, challenges such as cost constraints, infrastructure limitations, and behavioral factors continue to hinder progress.

The findings of this study underscore the need for a holistic and integrated approach to waste management, incorporating technological innovation, stakeholder engagement, and policy support. By adopting sustainable waste management practices, hotels can not only reduce their environmental footprint but also enhance their competitiveness and long-term profitability.

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