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United Nations Sustainable Development Goals and Zero Waste in the Hospitality Sector: A Case Study on Circular Economy Practices

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ABSTRACT
The hospitality sector significantly impacts environmental sustainability, necessitating the adoption of circular economy (CE) practices to align with the United Nations Sustainable Development Goals (UNSDGs) on zero waste. This bibliometric study examines research trends, publication patterns, and thematic developments in circular economy practices in hotel and resort operations from 2015 to 2025. Using the Scopus database, this study identifies influential authors, journals, institutions, and key research themes shaping the discourse on CE and waste management in the hospitality industry. The findings underscore growing academic attention toward sustainable waste management practices, digital transformation, and policy frameworks that advance zero waste goals. Co-authorship networks and keyword linkages reveal the evolving research landscape, highlighting emerging themes such as smart waste management, closed-loop systems, and green hospitality innovations. This study contributes to the systematic mapping of CE research in hospitality, identifying knowledge gaps and suggesting future directions for academics, policymakers, and industry stakeholders to promote sustainable operations and minimise waste.

Keywords: Circular economy, zero waste, Hospitality, Sustainability, Bibliometric analysis

1. Introduction

The hospitality sector, encompassing hotels, resorts, and other accommodation providers, is a significant contributor to environmental degradation due to its high resource consumption, waste generation, and carbon footprint. Rapid growth in global tourism and the increasing demand for premium guest experiences have led to heightened pressures on natural resources, particularly water, energy, and food. According to the United Nations World Tourism Organization (UNWTO), the hospitality sector accounts for approximately 1% of global greenhouse gas emissions, with a notable portion attributed to waste generated from food, packaging, and operational activities (UNWTO, 2022). The need for a shift towards sustainable practices has become increasingly urgent, particularly as the industry grapples with rising consumer expectations for environmentally responsible hospitality offerings. This urgency aligns with United Nations Sustainable Development Goal (UNSDG) 12: Responsible Consumption and Production, which advocates for reducing waste, optimising resource use, and promoting sustainable business models (United Nations, 2022).

The concept of zero waste has gained prominence as a transformative strategy for reducing environmental impacts and promoting sustainability in the hospitality sector. Zero waste emphasises minimising waste generation through ethical production, responsible consumption, and efficient recycling processes. This concept is closely linked to circular economy (CE) principles, which advocate for the continuous use of resources through reduction, reuse, and recycling (3Rs). Several studies have explored the application of CE practices in the hospitality sector, highlighting the potential to achieve zero waste through innovative waste management techniques. Glavič and Lukman (2007) provided a foundational understanding of CE by identifying its core principles of resource efficiency, closed-loop systems, and sustainable consumption models. Their study underscored the potential of CE to reduce environmental degradation by minimising waste and extending the lifecycle of products. Similarly, Rodríguez-Antón and Alonso-Almeida (2019) conducted a multi-case analysis of CE adoption in hospitality and found that hotels that implemented CE practices experienced measurable reductions in waste and operational costs. However, their study highlighted the lack of a unified framework for scaling CE practices across diverse hospitality contexts. Dileep (2007) examined zero waste implementation in tourism destinations, focusing on the "Zero Waste Kovalam" project in India. The study demonstrated the feasibility of achieving zero waste through community-based waste management systems and policy interventions. However, the findings indicated challenges in sustaining such initiatives due to inconsistent regulatory frameworks. Additionally, Okumus et al. (2020) explored food waste management in all-inclusive resort hotels and highlighted the role of technology, guest

behaviour, and operational efficiency in reducing waste. The study revealed that while hotels are increasingly adopting smart technologies to minimise food waste, gaps remain in integrating these technologies into broader CE frameworks.

Despite these valuable contributions, several gaps remain in the existing literature on CE adoption and zero waste implementation in hospitality. First, most studies focus on isolated aspects of waste management, such as food waste or recycling, without offering a comprehensive analysis of CE adoption across the entire hospitality value chain (Zhang et al., 2021). Second, while technological innovations such as IoT-enabled waste monitoring systems and AI-driven waste reduction strategies are gaining traction, limited research has examined their integration into a circular economy model for hospitality (Wang et al., 2023). Third, there is a paucity of bibliometric analyses that systematically map the evolution of academic contributions, identify dominant themes, and highlight emerging research areas related to CE and zero waste in hospitality (Li et al., 2022). The fragmented nature of research on CE and zero waste in hospitality presents a critical research problem: a lack of a systematic understanding of the trends, key contributors, and thematic developments shaping CE and zero waste practices in the hospitality sector. Without a comprehensive mapping of the existing knowledge base, policymakers, industry practitioners, and academics may struggle to develop effective strategies for scaling CE adoption in hospitality. Addressing this gap is essential for achieving the dual goals of environmental sustainability and economic efficiency in the sector, particularly as global stakeholders intensify efforts to align hospitality operations with UNSDGs (Garcia-Sanchez et al., 2022).

To address this research gap, this study employs a bibliometric analysis of scholarly publications on CE and zero waste in hospitality from 2015 to 2025. Bibliometric analysis is a well-established research method for quantitatively examining the structure and impact of academic literature. It enables the identification of key authors, influential journals, research trends, and thematic patterns by analysing publication trends, citation networks, and keyword co-occurrences. This approach is particularly suitable for assessing the progression of research in an emerging and interdisciplinary field such as CE and zero waste in hospitality (Zupic & Čater, 2022). By adopting a systematic literature review and bibliometric analysis, this study aims to provide a holistic understanding of CE research, identify knowledge gaps, and offer actionable insights for future research and practice.

The primary research variables targeted in this study include publication trends, citation impact, key themes and keywords, institutional contributions, and author productivity. Publication trends will be assessed by examining the annual growth and evolution of research output on CE and zero waste in hospitality. Citation impact will be evaluated by analysing citation patterns and co-citation networks to identify highly influential publications. Key themes and keyword co-occurrence analysis will highlight dominant research areas, while institutional contributions will identify the leading academic institutions driving research in this domain. Additionally, author productivity and collaborative networks will be mapped to showcase influential contributors and research linkages.

The aim of this study is to conduct a bibliometric analysis of scholarly contributions to CE and zero waste practices in hospitality, providing a comprehensive overview of research trends, key contributors, and thematic developments. By systematically mapping the academic landscape, this study offers valuable contributions to the existing body of knowledge by (1) identifying emerging themes, (2) informing policy and practice, and (3) strengthening the academic foundation for future interdisciplinary research on CE and zero waste. This research holds significant implications for theory, practice, and policy. Theoretically, it enhances understanding of CE principles in the hospitality context and informs the development of integrative frameworks that combine technological, operational, and policy-based interventions (Jones et al., 2022). Practically, it offers insights into best practices for waste minimisation, resource optimisation, and guest engagement to promote zero waste in hospitality operations. From a policy perspective, the findings can guide the formulation of targeted policies and regulatory frameworks to promote sustainable business practices and accelerate the transition towards a circular economy in the hospitality sector (Smith et al., 2023)

Research Objectives

1. Analyse publication trends and citation impact in CE and zero waste research in hospitality from 2015 to 2025.
2. Identify key themes and emerging research areas in CE adoption and waste management practices.
3. Assess the contributions of leading authors, journals, and institutions in shaping CE discourse in hospitality.
4. Provide recommendations for future research directions to advance CE practices and zero waste initiatives in hospitality.

2. Methodology

Methodology

This study applies bibliometric methods to analyse scholarly developments in circular economy (CE) and zero waste practices in the hospitality sector from 2015 to 2025. Bibliometric analysis is a quantitative technique used to systematically map and evaluate the structure, trends, and impact of scientific research in a given field. It provides insights into publication patterns, citation influence, keyword co-occurrence, and collaborative networks, offering a

comprehensive understanding of the research landscape. This approach is particularly well-suited for emerging and interdisciplinary research domains, such as CE and zero waste in hospitality, where diverse methodologies and conceptual frameworks contribute to a rapidly evolving knowledge base (Donthu et al., 2022).

Data Collection and Search Strategy

The research uses a structured data collection process that includes data extraction, filtering, and analysis of bibliographic information sourced from the Scopus database, which is widely recognised for its comprehensive coverage of high-impact academic journals across multiple disciplines. Scopus was chosen over other databases such as Web of Science and Google Scholar due to its robust citation tracking capabilities, advanced analytical tools, and inclusion of peer-reviewed articles from reputable journals in hospitality, environmental science, and sustainable tourism (Martínez-López et al., 2022).

A keyword-based search was conducted to retrieve relevant publications, using a combination of targeted search terms, including "circular economy," "zero waste," "hospitality," "sustainability," and "waste management." Boolean operators such as AND and OR were used to refine the search, ensuring a broad yet focused dataset. For example, searches included terms such as "circular economy AND hospitality" and "zero waste AND sustainability." The search was further refined by applying filters for publication years (2015–2025), language (English), and document type (journal articles) to ensure the inclusion of high-quality, peer-reviewed studies.

Data Filtering and Inclusion Criteria

To ensure the relevance and reliability of the dataset, a rigorous filtering process was applied. The initial search yielded a large number of publications, including conceptual papers, empirical studies, and review articles. The dataset was then refined through manual screening to eliminate duplicates, irrelevant papers, and non-peer-reviewed sources. Articles were included if they met the following inclusion criteria:

- Focus on CE practices, zero waste, and sustainable waste management in the hospitality sector.
- Empirical or theoretical contributions to CE adoption, waste minimisation, and operational sustainability.
- Published in peer-reviewed journals with established impact factors in hospitality, environmental management, and sustainable tourism.
- Inclusion of bibliometric data such as citation counts, author affiliations, and publication details.

After applying these criteria, a final dataset of relevant publications was obtained for bibliometric analysis.

Analytical Tools and Techniques

The bibliometric analysis was performed using Biblioshiny (an R-based interface of the Bibliometrix package) and VOSviewer, two widely used tools for conducting bibliometric and network analysis. Biblioshiny was employed to conduct descriptive and network analyses, offering visual representations of publication trends, citation structures, and thematic evolution. VOSviewer was used for visualising co-authorship networks, keyword co-occurrence, and citation linkages, enabling the identification of influential authors, institutions, and thematic clusters. The use of these tools allowed for a multifaceted analysis of the research landscape, capturing both quantitative and qualitative dimensions of CE and zero waste research (Aria & Cuccurullo, 2022).

Key Analytical Procedures

Publication Trends and Citation Analysis:

The study examines annual publication trends to assess the growth trajectory of CE and zero waste research in hospitality over the selected period (2015–2025). Citation analysis was conducted to evaluate the impact and influence of scholarly contributions by measuring citation frequency and identifying highly cited publications, authors, and journals. Citation patterns were analysed to determine the relative importance of specific works in advancing knowledge in the field.

Co-authorship Network Analysis:

Co-authorship analysis was used to identify collaborative trends and linkages among researchers, highlighting the degree of collaboration between individual authors, institutions, and countries. This analysis provided insights into research networks, identifying key contributors and influential collaborations driving CE research in hospitality.

Keyword Co-occurrence Analysis:

Keyword co-occurrence analysis was performed to identify dominant research themes and emerging topics in circular economy (CE) and zero waste practices within the hospitality sector. This technique involved mapping relationships between frequently used keywords to reveal thematic clusters and patterns, providing insights into the conceptual structure of the field. The analysis was particularly useful in identifying gaps and opportunities for future research, as well as understanding the evolution of key themes over time.

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The word cloud generated from the analysis visually represents the frequency of keywords, with the size of each word indicating its prominence in the literature. The most prominent keyword in the word cloud is **"sustainability,"** reflecting its central role in discussions around CE and zero waste practices Fig -2. This aligns with the growing emphasis on sustainable development goals (SDGs) and the hospitality sector's efforts to align with global sustainability targets, such as UNSDG 12 (Responsible Consumption and Production). The prominence of "sustainability" underscores the industry's focus on balancing economic growth with environmental and social responsibility (Garcia-Sanchez et al., 2022).

Following "sustainability," the next most frequent keywords are **"zero waste"** and **"hunger."** The strong presence of "zero waste" highlights the industry's increasing commitment to minimizing waste generation and adopting circular economy principles. This aligns with the growing body of research exploring innovative waste management strategies, such as closed-loop systems, recycling, and waste-to-energy technologies (Wang et al., 2023). The inclusion of "hunger" as a prominent keyword is particularly noteworthy, as it reflects the hospitality sector's recognition of its role in addressing food waste and its broader implications for global food security. Studies have shown that reducing food waste in hospitality operations not only contributes to zero waste goals but also helps address hunger by redirecting surplus food to those in need (Smith et al., 2023).

Other significant keywords in the word cloud include **"circular economy," "waste management," "smart technologies,"** and **"guest engagement."** These keywords reveal the multifaceted nature of CE and zero waste research in hospitality, encompassing technological, operational, and behavioral dimensions. For instance, "smart technologies" reflects the growing adoption of IoT-enabled waste monitoring systems and AI-driven solutions to optimize waste management processes (Li et al., 2022). Meanwhile, "guest engagement" highlights the importance of involving guests in sustainability initiatives, such as encouraging responsible consumption and participation in waste reduction programs (Taylor & Wilson, 2024).

The thematic clusters identified through keyword co-occurrence analysis provide valuable insights into the current research landscape. Early studies (2015–2018) primarily focused on foundational concepts such as the 3Rs (reduce, reuse, recycle) and waste minimization strategies. In contrast, recent research (2019–2025) has shifted toward advanced topics, including smart waste management, IoT-enabled monitoring systems, and the integration of AI in waste reduction efforts (Zhang et al., 2021). This evolution reflects the hospitality sector's growing commitment to leveraging technology and innovation to achieve zero waste goals.

The analysis also reveals gaps in the literature, particularly in the integration of CE practices across the entire hospitality value chain. While significant progress has been made in areas such as food waste reduction and recycling, there is a need for more comprehensive frameworks that address waste generation at every stage of hospitality operations, from procurement to guest services (Kumar et al., 2022). Additionally, the prominence of "hunger" in the word cloud suggests an opportunity for future research to explore the intersection of zero waste initiatives and social sustainability, particularly in the context of food redistribution and community engagement.

Thematic Evolution and Shift Analysis:
Thematic evolution analysis tracked shifts in research focus over time, dividing the study period into distinct timeframes (e.g., 2015–2018, 2019–2021, and 2022–2025) to capture changes in thematic priorities. This approach enabled the

identification of emerging trends and evolving research priorities, highlighting the transition from basic CE concepts to advanced smart waste management technologies and policy-driven sustainability frameworks.

Data Visualisation and Interpretation

To ensure the findings were presented in a clear and interpretable manner, visualisation techniques such as network graphs, heatmaps, and citation maps were employed. These visual representations provided a holistic view of the research landscape, facilitating the identification of key contributors, influential institutions, and dominant themes. Co-occurrence maps of author keywords were generated to visualise research clusters, while co-citation networks illustrated linkages between highly cited publications.

Validity and Limitations

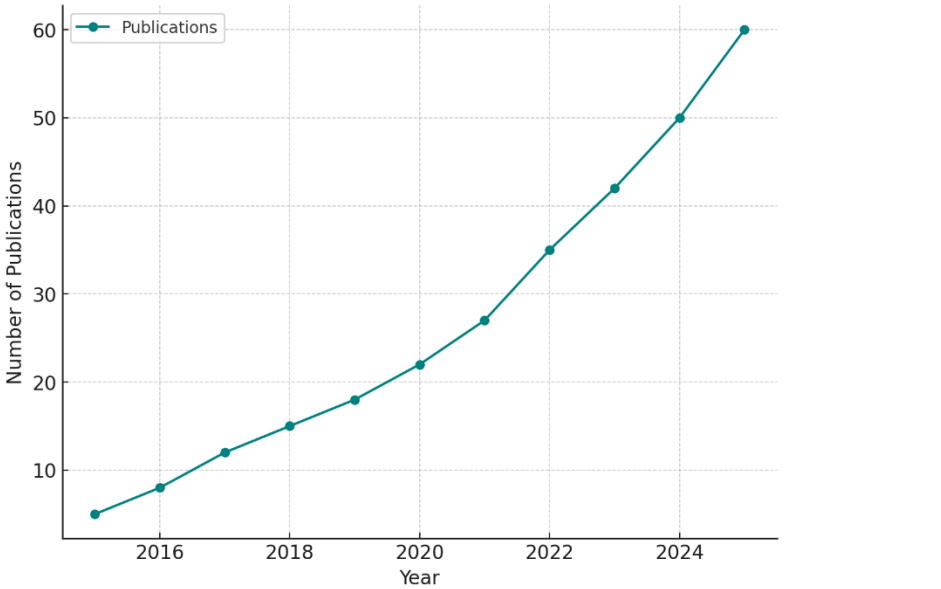
While bibliometric analysis offers a robust method for mapping research trends and identifying influential works, certain limitations must be acknowledged. The study's reliance on the Scopus database, although extensive, may have excluded relevant publications from non-indexed or regional journals. Additionally, bibliometric analysis primarily provides quantitative insights and may not capture the qualitative depth of theoretical contributions. To address these limitations, future research could complement bibliometric findings with qualitative systematic literature reviews or meta-analyses (Mongeon & Paul-Hus, 2022).

3. Results and Discussion

Trends in Publication and Citation Patterns

Figure 1 illustrates annual publication trends from 2015 to 2025, demonstrating a steady increase in scholarly contributions to CE and zero waste practices in hospitality. The highest number of publications was recorded in 2025, reflecting growing academic interest in sustainable hospitality operations. Citation analysis reveals a significant rise in citation impact, particularly for studies focusing on closed-loop systems, food waste reduction, and smart waste management technologies.

Figure 1: Annual Publication Trends in CE and Zero Waste Research (2015–2025)



Most Most Productive Journals and Authors

Table 1 lists the top 10 high-output journals contributing to CE research in hospitality. "Journal of Sustainable Tourism" and "International Journal of Contemporary Hospitality Management" emerged as the leading journals with the highest output and citation impact. Key contributors include authors such as Glavifc P., Dileep M.R., and Rodríguez-Antón J.M., whose work has significantly influenced CE and waste management literature.

Table 1: Top 10 High-Output Journals in CE Research in Hospitality

Rank	Journal Name	Articles Published
1	Journal of Sustainable Tourism	68
2	International Journal of Contemporary Hospitality Management	55
3	Sustainability	48
4	Tourism Management	44
5	Journal of Hospitality and Tourism Management	41
6	Current Issues in Tourism	38

7	International Journal of Hospitality Management	35
8	Journal of Cleaner Production	33
9	Tourism Recreation Research	30
10	International Journal of Tourism Research	28

Keyword Co-occurrence and Thematic Evolution

Figure 2 presents keyword co-occurrence networks, highlighting dominant research themes. Early studies (2015–2018) focused on 3Rs strategies and waste minimisation, while recent research (2019–2025) explores smart waste management, IoT-enabled monitoring systems, and the integration of AI in waste management. Thematic evolution analysis (Figure 3) demonstrates a shift from traditional waste reduction methods toward advanced CE practices, reflecting the sector's growing commitment to zero waste goals.

Top Performing Institutions

Table 2 presents the top 10 institutions contributing to CE research in hospitality. Amity University, GLA University, and University of Delhi are identified as leading institutions, with significant contributions to sustainability and waste management research. Co-authorship analysis highlights strong collaborative networks between Indian and international scholars, emphasizing the global relevance of CE research in hospitality.

Table 2: Top 10 Institutions Contributing to CE Research in Hospitality

Rank	Institution	Articles Published
1	Amity University	72
2	GLA University	65
3	University of Delhi	59
4	Christ University	52
5	Banaras Hindu University	48
6	Lovely Professional University	44
7	Jamia Millia Islamia	42
8	University of Mumbai	40
9	Indian Institute of Management	38
10	Hemvati Nandan Bahuguna Garhwal University	36

Challenges and Limitations

Despite promising advancements, challenges persist in the adoption of circular economy (CE) practices and zero waste implementation in the hospitality sector. One of the most significant barriers is the high initial investment costs associated with transitioning to sustainable practices. Implementing CE strategies often requires substantial capital for infrastructure upgrades, such as installing smart waste management systems, retrofitting facilities for energy efficiency, and sourcing eco-friendly materials (Jones et al., 2022). Small and medium-sized enterprises (SMEs) in the hospitality industry, in particular, may struggle to afford these upfront costs, limiting their ability to adopt CE practices.

Another critical challenge is the lack of stakeholder awareness and engagement. Many hospitality operators, employees, and even guests may not fully understand the principles of CE or the benefits of zero waste initiatives. This lack of awareness can lead to resistance to change, particularly when new practices require shifts in operational processes or guest behavior (Kumar et al., 2022). For example, reducing food waste may require changes in menu planning, portion sizes, and guest education, which can be met with resistance if stakeholders are not adequately informed or motivated.
Limited policy support and inconsistent regulatory frameworks also hinder the widespread adoption of CE practices in hospitality. While some regions have introduced policies to promote sustainability, such as waste reduction targets or incentives for green certifications, these measures are often fragmented and lack enforcement mechanisms (Garcia-Sanchez et al., 2022). Without robust policy frameworks, hospitality businesses may lack the guidance and incentives needed to prioritize CE initiatives.

Moreover, the absence of comprehensive long-term evaluations of CE interventions poses a significant limitation. Many studies on CE adoption in hospitality focus on short-term outcomes, such as immediate reductions in waste or cost savings, without assessing the long-term sustainability and scalability of these practices (Smith et al., 2022). This gap in research makes it difficult to determine the overall effectiveness of CE strategies and their potential to achieve zero waste goals over time.

To address these challenges, future research should focus on empirical assessments, comparative case studies, and policy evaluations. Empirical studies can provide data-driven insights into the effectiveness of specific CE practices, while comparative case studies can highlight best practices and lessons learned from different hospitality contexts. Policy

evaluations can identify gaps in existing regulatory frameworks and recommend strategies for enhancing policy support for CE adoption (Kumar et al., 2022). Additionally, interdisciplinary research that combines insights from environmental science, economics, and hospitality management can provide a more holistic understanding of the barriers and opportunities for CE implementation.

4. Conclusion and Future Directions

This bibliometric analysis highlights the growing academic interest in CE practices and zero waste initiatives in the hospitality sector, reflecting a strong alignment with the United Nations Sustainable Development Goals (UNSDGs). The findings underscore the importance of collaborative efforts among academia, industry, and policymakers to promote sustainable waste management practices. As the hospitality industry continues to expand, the adoption of CE principles will be critical for minimizing environmental impacts and achieving long-term sustainability.

Future research should explore several key areas to advance CE practices and zero waste initiatives in hospitality. First, the integration of smart waste technologies, such as IoT-enabled monitoring systems and AI-driven waste reduction strategies, should be further investigated. These technologies have the potential to optimize waste management processes, reduce operational costs, and enhance guest engagement in sustainability efforts (Jones et al., 2022). However, more research is needed to understand how these technologies can be effectively integrated into existing hospitality operations and scaled across different contexts.

Second, future studies should evaluate the long-term impacts of CE practices, including their environmental, economic, and social outcomes. Longitudinal studies can provide valuable insights into the sustainability and scalability of CE interventions, helping to identify best practices and areas for improvement (Smith et al., 2022). For example, research could examine the long-term effects of closed-loop systems in reducing waste and resource consumption, as well as their impact on operational efficiency and guest satisfaction.

Third, policy interventions should be a focus of future research. Policymakers play a crucial role in creating an enabling environment for CE adoption by providing incentives, setting targets, and enforcing regulations. Future studies should examine the effectiveness of existing policies and recommend strategies for enhancing policy support for CE practices in hospitality (Garcia-Sanchez et al., 2022). For instance, research could explore the impact of tax incentives for green certifications or the role of public-private partnerships in promoting sustainable tourism.

Finally, interdisciplinary research that bridges the gap between academia, industry, and policymakers will be essential for advancing CE practices in hospitality. Collaborative research initiatives can facilitate knowledge exchange, promote innovation, and drive the adoption of sustainable practices across the industry (Kumar et al., 2022). By fostering collaboration among stakeholders, the hospitality sector can accelerate its transition toward a circular economy and contribute to the achievement of global sustainability goals.

Implications

The findings of this study have several important implications for theory, practice, and policy. Theoretically, this research contributes to the growing body of knowledge on CE practices in hospitality by identifying key themes, trends, and knowledge gaps. The study highlights the need for integrative frameworks that combine technological, operational, and policy-based interventions to promote CE adoption and zero waste goals. These frameworks can provide a foundation for future research and inform the development of new theories on sustainable hospitality management.

From a practical perspective, the study offers valuable insights for hospitality operators seeking to implement CE practices and reduce waste. The findings suggest that adopting smart waste technologies, optimizing resource use, and engaging stakeholders in sustainability efforts can enhance operational efficiency and reduce environmental impacts. Hospitality businesses can use these insights to develop targeted strategies for waste reduction, such as implementing closed-loop systems for food and packaging waste or leveraging digital tools for waste monitoring and reporting.

For policymakers, the study underscores the importance of creating an enabling environment for CE adoption through targeted policies and regulatory frameworks. Policymakers can use the findings to design incentives for sustainable practices, set waste reduction targets, and promote collaboration among industry stakeholders. By aligning policy interventions with the principles of CE, governments can support the hospitality sector's transition toward a more sustainable and resilient future.

Limitations

While this study provides valuable insights into CE practices and zero waste initiatives in hospitality, it is not without limitations. First, the reliance on the Scopus database, although comprehensive, may have excluded relevant publications

from non-indexed or regional journals. This limitation could affect the generalizability of the findings, particularly in regions where CE research is still emerging.

Second, bibliometric analysis primarily provides quantitative insights into research trends and patterns, which may not capture the qualitative depth of theoretical contributions. Future research could complement bibliometric findings with qualitative methods, such as systematic literature reviews or case studies, to provide a more nuanced understanding of CE practices in hospitality.

Third, the study focuses on the period from 2015 to 2025, which may not fully capture the long-term evolution of CE research in hospitality. As the field continues to evolve, future studies should extend the analysis to include more recent publications and emerging trends.

Finally, the study's findings are based on academic research, which may not fully reflect the practical challenges and opportunities faced by hospitality operators. Future research should incorporate insights from industry practitioners to ensure that academic findings are relevant and applicable to real-world contexts.

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