

Circular Economy in Thailand Waste Management: Strategies for Reducing Plastic Pollution

N. Vattanapratchep^{1,*}, P. Wongthong¹, P. Hathaipichitchai¹, P. Thunyamaneelertsakul²,
S. Asawarujanon³ and W. Ponloa¹

¹Department of Civil Engineering, ²Department of Mechanical Engineering,

³Department of Aerospace Engineering, Faculty Engineering, Bangkokthonburi University, Bangkok, Thailand

(Received 27 March, 2025; Accepted 14 May, 2025)

ABSTRACT

This study explores the implementation of circular economy strategies in Thailand waste management sector, with a focus on reducing plastic pollution. Through an analysis of current practices, key challenges, and potential strategies, the research identifies critical areas for improvement in the country's approach to plastic waste. Data from surveys reveal that while traditional methods like landfilling remain prevalent, there is a growing interest in sustainable practices such as recycling. However, barriers like inadequate infrastructure and high costs pose significant challenges. The study suggests strategies including enhanced recycling infrastructure, extended producer responsibility, and public-private partnerships as effective ways to advance circular economy practices in Thailand. These strategies show high feasibility and potential impact, offering a pathway to reducing plastic pollution and promoting sustainable development. The findings underscore the need for coordinated efforts to transition towards a circular economy, positioning Thailand as a leader in the region

Key words: Plastic Pollution, Circular Economy, Waste Management, Sustainable development

Introduction

Plastic pollution has emerged as one of the most pressing environmental challenges of the 21st century, particularly in rapidly developing nations like Thailand. With its extensive coastlines, vibrant tourism industry, and substantial reliance on plastic products, Thailand has become a significant contributor to global marine plastic pollution. Despite various efforts to address this issue, including public awareness campaigns and government regulations, the scale and complexity of plastic waste management remain daunting (Kwon *et al.*, 2023; Babaremu *et al.*, 2022).

In response to this growing crisis, the concept of

a circular economy has gained traction as a sustainable solution to reduce plastic waste. Unlike the traditional linear economy, which follows a 'take-make-dispose' model, the circular economy emphasizes resource efficiency by keeping materials in use for as long as possible through practices such as recycling, reuse, and redesign. For Thailand, adopting a circular economy approach in waste management not only presents an opportunity to mitigate plastic pollution but also offers economic and environmental benefits, such as reducing the reliance on virgin materials, minimizing waste generation, and creating new business opportunities (Tulashie *et al.*, 2022; Rossi and Bianchini, 2022).

This article explores the strategies for implement-

ing circular economy principles in Thailand's waste management system, with a particular focus on reducing plastic pollution. By examining current practices, identifying key challenges, and proposing actionable solutions, this study aims to contribute to the ongoing efforts to transition towards a more sustainable waste management framework in Thailand. The findings of this research are intended to inform policymakers, industry stakeholders, and environmental advocates, offering insights into how circular economy practices can be effectively integrated into the country's waste management strategies to address the pervasive issue of plastic pollution.

Methodology

This study employs a mixed-methods approach, combining quantitative and qualitative research techniques to comprehensively analyze the implementation of circular economy strategies in Thailand's waste management sector, particularly focusing on reducing plastic pollution.

Data Collection

The primary data was collected through a structured survey distributed to a sample of 400 participants, including representatives from government agencies, waste management companies, NGOs, and the general public across Thailand. The sample size was determined using Yamane's formula to ensure a representative sample with a 95% confidence level and a 5% margin of error. The survey included questions on current waste management practices, perceived challenges, and potential strategies for implementing circular economy principles.

Survey Design

The survey was designed to gather data on three main areas:

Current Adoption of Circular Economy Practices: Questions focused on identifying the prevalence of various waste management practices, such as recycling, land filling, and incineration.

Barriers to Circular Economy Implementation: Respondents were asked to rank the most significant barriers to adopting circular economy practices, such as infrastructure limitations, cost concerns, and regulatory challenges.

Potential Strategies for Improvement: Participants provided insights on the feasibility and poten-

tial impact of various strategies, including extended producer responsibility, public-private partnerships, and improvements in recycling infrastructure.

Data Analysis

The quantitative data was analyzed using statistical software to calculate frequencies, percentages, and correlations between different variables. The results were then presented in three tables:

Table 1: Perception of current circular economy practices.

Table 2: Identification of key barriers to circular economy adoption.

Table 3: Evaluation of potential strategies, including their feasibility and expected outcomes.

Qualitative data from open-ended survey questions was analyzed using thematic analysis to identify common themes and insights that complement the quantitative findings.

Results and Discussion

Current Plastic Waste Management Practices

The data in Table 1 illustrates the distribution of plastic waste management practices in Thailand. The majority of plastic waste is collected and sorted, accounting for 42% of the total waste management activities. Mechanical recycling constitutes 14%, while chemical recycling remains minimal at 7%. Land filling and incineration contribute to 21% and 16% of waste management, respectively.

The results presented in Table 1 highlight the significant reliance on traditional waste management practices in Thailand, such as land filling and incineration, which together account for 37% of the total waste management activities. While collection and sorting processes are the most prevalent, representing 42% of the activities, the low percentage of recycling-especially chemical recycling at only 7%-indicates the need for improvements in this area to align

Table 1. Current Plastic Waste Management Practices in Thailand

Practice	Percentage of Total Plastic Waste Managed (%)
Collection and Sorting	42
Mechanical Recycling	14
Chemical Recycling	7
Landfilling	21
Incineration	16

with circular economy principles.

Challenges in Implementing Circular Economy in Plastic Waste Management

Table 2 outlines the key challenges that hinder the adoption of circular economy practices in Thailand's plastic waste management. The most frequently reported challenge is the lack of infrastructure, representing 33% of the responses. High costs of recycling technologies follow with 29%, while limited consumer awareness and fragmented waste collection systems account for 19% and 13%, respectively. Ineffective policy and regulatory support are the least reported challenge at 6%.

Table 2 reveals the challenges that must be addressed to enhance the adoption of circular economy practices in Thailand. The lack of infrastructure and high costs associated with recycling technologies are the most critical barriers, reported by 33% and 29% of the respondents, respectively. These barriers suggest that significant investment and policy reform are necessary to improve Thailand's waste management system.

Table 2. Challenges in Implementing Circular Economy in Plastic Waste Management

Challenge	Frequency Reported (%)
Lack of Infrastructure	33
High Cost of Recycling Technologies	29
Limited Consumer Awareness	19
Ineffective Policy and Regulatory Support	6
Fragmented Waste Collection Systems	13

Potential Circular Economy Strategies for Reducing Plastic Pollution in Thailand

Table 3 evaluates the potential strategies for enhancing circular economy practices in plastic waste management. The strategy with the highest expected impact is promoting extended producer responsibility, with 36% expected impact and a feasibility rating of 5.

Table 3. Potential Circular Economy Strategies for Reducing Plastic Pollution in Thailand

Strategy	Expected Impact (%)	Feasibility Rating (1-5)
Enhancing Recycling Infrastructure	11	3
Promoting Extended Producer Responsibility	36	5
Developing Public-Private Partnerships	7	3
Implementing Advanced Sorting Technologies	18	4
Encouraging Consumer Participation Programs	28	5

ing of 5. Enhancing recycling infrastructure and developing public-private partnerships also have significant potential, with expected impacts of 28% and 18%, and feasibility ratings of 5 and 4, respectively. Implementing advanced sorting technologies and encouraging consumer participation programs show lower expected impacts but are still relevant, with 11% and 7% expected impacts and feasibility ratings of 3 each.

The potential strategies outlined in Table 3 provide a roadmap for overcoming these challenges. Promoting extended producer responsibility stands out as the most impactful and feasible strategy, with a 36% expected impact and a feasibility rating of 5. This strategy, along with enhancing recycling infrastructure and developing public-private partnerships, offers the greatest potential for reducing plastic pollution in Thailand. However, the success of these strategies will depend on coordinated efforts between government, industry, and consumers to create a more sustainable and circular waste management system.

Conclusion

This study highlights the critical need for advancing circular economy practices within Thailand's plastic waste management sector. The findings indicate that while traditional waste management methods like land filling and incineration continue to dominate, there is a growing recognition of the importance of recycling and other sustainable practices. However, significant barriers, such as the lack of infrastructure and high costs of recycling technologies, hinder the widespread adoption of circular economy principles.

The analysis identifies key strategies that can drive the transition towards a more sustainable waste management system in Thailand. Promoting extended producer responsibility, enhancing recycling infrastructure, and developing public-private

partnerships emerge as the most effective strategies with the highest potential impact and feasibility. Implementing these strategies requires coordinated efforts between government, industry, and the public to foster a circular economy that reduces plastic pollution and contributes to sustainable development.

In conclusion, addressing the challenges and leveraging the opportunities identified in this study can significantly improve Thailand's approach to plastic waste management, positioning the country as a leader in circular economy practices in South-east Asia.

Acknowledgement

The author would like to extend heartfelt gratitude to the Faculty of Engineering at Bangkok Thonburi University for their invaluable financial support, which was essential to the successful completion of this research.

Conflict of Interest -None

References

Babaremu, K.O., Okoya, S.A., Hughes, E., Tijani, B., Teidi,

- D., Akpan, A., Igwe, J., Karera, S., Oyinlola, M. and Akinlabi, E.T. 2022. Sustainable plastic waste management in a circular economy. *Heliyon*. 8(7): e09984.
- Kwon, G., Cho, D.W., Park, J., Bhatnagar, A. and Song, H. 2023. A review of plastic pollution and their treatment technology: A circular economy platform by thermochemical pathway. *Chemical Engineering Journal*. 464: 142771.
- Liu, H., Pan, H., Chu, P. and Huo, D. 2022. Impact of plastic pollution on outdoor recreation in the existence of bearing capacity and perspective management. *Environmental Research*. 214(2): 113819.
- Maddalene, T., Youngblood, K., Abas, A., Browder, K., Cecchini, E., Finder, S., Gaidhani, S., Handayani, W., Hoang, N.X., Jaiswal, K., Martin, E., Menon, S., Roy, P., Septiarani, B., Trung, N.H., Voltmer, C., Werner, M., Wong, R. and Jambeck, J.R. 2023. Circularity in cities: A comparative tool to inform prevention of plastic pollution. *Resources, Conservation and Recycling*. 198: 107156.
- Rossi, J. and Bianchini, A. 2022. "Plastic waste free" -A new circular model for the management of plastic packaging in food value chain. *Transportation Research Procedia*. 67: 153-162.
- Tulashie, S.K., Dodoo, D., Mensah, S., Atisey, S., Odai, R., Adukpoh, K.E. and Boadu, E.K. 2022. Recycling of plastic wastes into alternative fuels towards a circular economy in Ghana. *Cleaner Chemical Engineering*. 4: 100064.