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Effects of Construction Waste Management on Economy

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KEYWORDS

Economic impact Construction waste
Waste management strategies
Cost-benefit analysis
Sustainability
Circular economy

ABSTRACT

The construction industry generates substantial waste, posing both economic and environmental challenges. This study explores the economic implications of implementing construction waste management (CWM) strategies, emphasizing cost efficiency, resource optimization, and sustainability. A detailed review of current practices highlights significant cost reductions through waste minimization, enhanced material recovery, and recycling initiatives. Moreover, the integration of advanced technologies, such as blockchain, and the adoption of circular economy principles, are shown to drive financial benefits while overcoming market and policy barriers. Findings reveal that CWM not only reduces landfill dependency and raw material expenses but also generates revenue streams, making it a pivotal aspect of sustainable construction. This paper underscores the need for tailored regulatory frameworks and industry-wide collaboration to fully leverage the economic potential of CWM.

1. INTRODUCTION

Proper waste management can lower disposal costs, with significant price variations across regions in Spain, where disposal costs can exceed EUR 30 per ton in some areas (Colmenero Fonseca et al., 2023).

Implementing effective document management systems can reduce waste by up to two-thirds, thereby minimizing project costs and enhancing competitiveness (Arsenos & Giannadakis, 2023).

This paper explores the economic effects of construction waste management, emphasizing cost savings, resource recovery, and the financial feasibility of different waste management approaches. It aims to answer how effective strategies can mitigate waste generation while ensuring economic benefits.

2. LITERATURE REVIEW

Literature reviews play a key role in research, as they help to deeply explore and structure a particular field of research. In this literature review, the investigation and review of different papers and researches were made to investigate the effect of construction waste management on economy and based on the different experiences and views of other researchers.

2.1 Economic Implications of Construction Waste Management

Research indicates a lack of focus on the economic impacts of construction and demolition (C&D) waste management, with most studies emphasizing recycling without adequately addressing life-cycle costing. This gap highlights the need for economic evaluations that consider the long-term financial implications of waste management strategies (Illankoon & Tam, 2021).

The economic benefits of construction waste recycling enterprises can be significantly enhanced through tax incentives. For instance, simulations show that a 70% tax incentive can lead to substantial increases in revenue and return on investment (ROI) for recycling enterprises (Liu et al., 2021).

2.2 Integration of Innovative Technologies

The synergy between blockchain technology and the circular economy presents opportunities for improving CWM efficiency. Supportive legislation and technological adaptation are identified as key enablers for integrating these concepts, which can optimize resource use and reduce waste (H.S.N.M., Jayarathna et al, 2023).

Studies reveal a disparity in CWM practices between developed and emerging economies, with developed countries focusing on economic viability and recycling, while emerging nations prioritize management proposals (Soto-Paz et al., 2023).

2.3 Circular Economy and Financial Benefits

Recent studies highlight the potential of circular economy principles to transform the economic landscape of construction waste management. By integrating reuse and recycling, construction industries can minimize costs related to landfill disposal and raw material procurement. For instance, circular strategies have been shown to offset operational costs, especially in regions adopting advanced recycling technologies and policy incentives (Ferriz-Papi et al., 2024).

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While the economic benefits are evident, challenges persist, including the high cost of implementing waste management infrastructure and limited market demand for recycled materials. Overcoming these barriers requires innovative approaches, such as collaborative public-private partnerships and financial incentives for adopting sustainable practices (Elshaboury et al., 2022), (Ferriz-Papi et al., 2024).

3. METHODOLOGY

3.1 Systematic Literature Review

This study employs a systematic literature review (SLR) approach to assess the economic effects of construction waste management (CWM). The SLR was conducted in accordance with established guidelines to ensure a comprehensive and unbiased exploration of existing literature.

By using the following keywords: Economic impact, construction waste, waste management strategies, cost-benefit analysis, circular economy and sustainability. The Science Direct, Springer Link, Elsevier, MDPI and Google Scholar databases were searched in order to shape the literature.

The following criteria were established to choose the set of applicable research from the identified literature:

1. Including all published studies, regardless of whether they went through peer review.
2. Studies addressing the economic aspects of CWM.
3. Studies with quantitative findings.
4. Cost-benefit analyses.
5. Excluding studies focusing solely on technical aspects without economic evaluation.

3.2 Data Extraction and Content Allocation

Data were extracted based on the following questions:

1. What are the predefined economic goals of CWM?
2. What specific economic impacts of CWM have been reported?
3. What regulatory and policy frameworks were mentioned?
4. What barriers and challenges were highlighted?
5. How does CWM influence project budgets through material recycling and reuse?

3.3 Analytical Framework

To interpret the findings, the study employed the following approaches:

Cost-Benefit Analysis (CBA): Assessing the financial viability of CWM strategies.

Comparative Analysis: Comparing the economic impacts of traditional waste disposal versus sustainable CWM.

Trend Analysis: Identifying patterns in economic outcomes across different geographic and regulatory contexts.

4. RESULTS AND DISCUSSION

The review of the previous researches in literature review have emerged to results that can help giving a judgement on the positive effect of the construction waste management on economy and the arguments founded are discussed in this section.

The direct economic benefits of waste reduction strategies are clear, as they reduce landfill dependency and operational inefficiencies. These savings are especially pertinent in regions with high disposal costs. However, implementation is contingent on the availability of infrastructure and regulatory support, particularly in emerging markets.

Recycling revenue is a powerful driver for economic viability in CWM, but its success is tied to regulatory frameworks like tax incentives. While developed economies leverage these strategies effectively, developing countries struggle due to market limitations and policy gaps.

The circular economy offers a compelling vision for sustainable waste management. However, its widespread adoption is hindered by systemic challenges like uneven technological adoption and inadequate policy frameworks in developing regions.

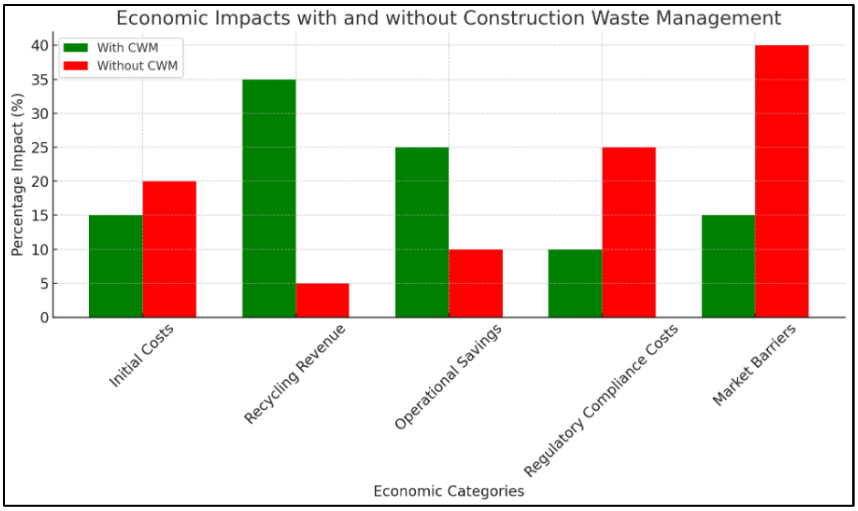

Figure 1. Economic distribution across various categories with and without implementing CWM (Ferriz-Papi et al., 2024).

The observation for the bar chart above in Figure 1 shows that initial costs are higher by 20% without CWM due to inefficient waste disposal methods and higher raw material usage and reduced by 15% with CWM due to savings from efficient procurement and reuse strategies. It also could be noticed that market barriers are significantly more pronounced without CWM by 40%, highlighting difficulties in adopting sustainable practices and reduced by 15% with CWM, attributed to improved infrastructure and market readiness. The recycling revenue generation is as low as 5% without CWM and significantly higher with CWM to around 35%, showcasing the economic potential of recycling materials.

Advanced technologies such as blockchain enhance traceability and operational efficiency, reducing economic losses associated with poor waste management. Nonetheless, their adoption is slow in regions with limited access to digital infrastructure.

Barriers such as high implementation costs, limited market demand for recycled materials, and infrastructure deficits are critical. Addressing these challenges requires coordinated efforts across stakeholders, including governments and private enterprises.

5. CONCLUSION

The economic benefits of construction waste management extend beyond cost reduction to include resource efficiency and sustainability. The references in the paper present a balanced view of the economic effects of CWM, highlighting significant opportunities alongside persistent challenges.

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