



Impact of Waste Management Strategies on Sustainable Development: An Applied Study of Waste Treatment Practices in Basra Municipal Institutions

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Abstract | The importance of waste management strategies has grown considerably in recent years due to increasing environmental challenges and the need to achieve sustainable development. This research aimed to provide a comprehensive framework for diagnosing and analyzing the causal relationships between waste management strategies and sustainability. The research problem was based on the observation that many sanitary landfill sites lack proper environmental approval and fail to comply with established environmental regulations and technical specifications. To address this issue, the researchers developed a conceptual framework to represent the study problem and designed a measurement instrument for collecting data related to testing the proposed study model. The questionnaire was distributed to a sample of 150 employees working at different administrative levels within the institutions under study, including the Environmental Protection and Improvement Department in the Southern Region, the Zubair Municipality Directorate, and the Basra Municipality Directorate. The validity and reliability of the instrument were statistically verified before data analysis. The most significant findings of the study indicated the existence of a statistically significant relationship and impact between waste management strategies and sustainability. The study concluded that effective waste management practices contribute positively to environmental sustainability and institutional performance. The major recommendations emphasized the importance of increasing public awareness and encouraging community participation in supporting waste management practices at the source in order to promote environmental sustainability and reduce the negative effects of waste accumulation.

Key Words: Waste Management Strategies, Sustainability

INTRODUCTION

Rapid urbanization has made waste management a serious issue in modern societies. It has long been believed that local authorities are responsible for maintaining the cleanliness of their regions. In recent years, many cities and industries have experimented with innovative approaches to reduce, reuse, recycle, recover, and dispose of waste effectively. Changing the traditional perception of waste is essential for the transition toward a resource-efficient society.

Traditionally, waste has been viewed as something without value, and it has often been assumed that waste

generation is inevitable. Such perceptions have contributed to increased levels of consumption and inefficient management practices that frequently encourage further waste generation. In contrast, within a resource-conserving economy and society, the term "waste" refers only to residual materials that no longer possess economic value. Waste streams that were traditionally regarded as valueless can instead be considered economic resources within a modern circular economy. These materials can be recovered or prevented from being lost through improved efficiency and management during the various stages of production and

consumption. Materials involved in production processes and the resulting waste often follow a one-way path from extraction to landfill, with only a small portion retained within products before eventually completing this journey.

The present study was conducted through structured interviews with employees from several governmental institutions, including the Environmental Protection and Improvement Department in the Southern Region, the Zubair Municipality Directorate, and the Basra Municipality Directorate. In addition, questionnaires were distributed to identify and examine the study problem, with the questionnaire serving as the principal research instrument.

The study aimed to achieve optimal outcomes through the implementation and application of waste management strategies, as well as to measure the extent of the relationship and influence between waste management strategies and sustainability within the selected governmental institutions. The significance of the study lies in addressing an important contemporary issue within the local environment and evaluating the correlation and impact between waste management strategies and sustainability in governmental organizations.

To comprehensively cover the theoretical foundations and practical applications of the study, the research was divided into four sections. The first section included previous research contributions and the study methodology. The second section addressed the intellectual and conceptual framework of waste management strategies and sustainability. The third section presented the statistical analysis and interpretation of the study data, while the fourth section focused on the conclusions and recommendations derived from the research findings.

MATERIALS AND METHODS

Previous Studies

The following presentation provides a summary of several previous research contributions that benefited the researchers in preparing the current study, as follows:

Study by A.K.M. Mahmudul Haque and S.M. Razy (2020)

Practices of 3Rs (Reduce, Reuse and Recycle) Strategy in Urban Solid Waste Management in Rajshahi City Corporation of Bangladesh

This study aimed to investigate the 3Rs pattern of solid waste management in the Rajshahi City Corporation (RCC) in Bangladesh. Data were collected using the snowball sampling technique. The study reached several findings, the most important of which was that there was no clear policy within RCC for handling collected waste, including recycling, composting, landfilling, incineration, or sanitary disposal. Among the most important recommendations proposed by the study were the need to take effective steps to increase public awareness

regarding the separation of solid waste at the source and to encourage people to reduce the amount of unrecovered waste generated in order to minimize greenhouse gas emissions. The study also emphasized the necessity of establishing composting plants Study by Ann T. W. Yu *et al.*

Strategies for Effective Waste Reduction and Management of Building Construction Projects in Highly Urbanized Cities — A Case Study of Hong Kong

This study aimed to explore and formulate effective strategies and measures for reducing and managing construction waste in highly urbanized cities such as Hong Kong, as well as to identify the major contributions of potential waste management strategies. Structured interviews and organized focus group meetings were adopted as the scientific research tools. The study reached several conclusions, the most important being that recycling is not yet considered a fully sustainable approach to waste management within the construction sector, although it may become so in the future. Among the most significant recommendations proposed by the study was that, although construction waste management practices have been implemented in Hong Kong for years, performance remains unsatisfactory. The study further indicated that government authorities and construction sector stakeholders are willing to adopt effective strategies for reducing and managing construction waste, and that economic considerations remain the dominant factor for successful implementation Study by Kenneth E. Okedu *et al.*

Utilization in Oman: A Review Sustainable Waste Management Strategies for Effective Energy

The study aimed to review sustainable waste management strategies in Oman in alignment with the United Nations goals for environmental waste management and to propose several waste-to-energy conversion technologies. Data for this study were collected through investigation and analysis. The study reached several important findings, the most significant being the review of plans for converting organic and solid waste into energy in the Sultanate of Oman as an alternative approach for effective waste management. However, these plans have not yet been fully implemented. Among the most important recommendations proposed by the study was that integrated waste management facility technologies could significantly reduce the large volume of mixed municipal solid waste while simultaneously recovering valuable resources. Therefore, the Government of Oman plays a key role in implementing this technology to achieve more effective and sustainable waste management practices.

Research Methodology

Study Problem

The implementation of waste management strategies is still in its early stages within Iraqi business organizations.

Furthermore, selecting and appointing highly qualified employees with extensive experience alone is not sufficient to ensure organizational excellence. Rather, it is necessary to pay attention to these employees and provide them with opportunities to acquire knowledge in waste management strategies in order to utilize such strategies for waste reduction and sustainability achievement.

Through field visits conducted at the Environmental Protection and Improvement Department in the Southern Region, the Zubair Municipality Directorate, and the Basra Municipality Directorate, it was found that these institutions suffer from several problems. Structured interviews with heads and managers of relevant departments revealed numerous issues, which can be summarized as follows:

- Sanitary landfill sites contribute to water source pollution, disease spread, and air pollution caused by the illegal burning of waste by garbage scavengers
- Most sanitary landfill sites lack environmental approval, and many do not comply with the stipulated environmental regulations and standards
- The distance of landfill sites from municipal boundaries negatively affects the implementation of waste management strategies due to the long distance (approximately 2 km from municipal boundaries) and inadequate transportation systems resulting from a lack of vehicles and equipment necessary for waste collection and transport
- Urban expansion has made it increasingly difficult to allocate suitable sanitary landfill sites
- Most landfill sites do not meet environmental requirements and fail to comply with Law No. 27 of 2009 concerning the protection of water and air quality from pollution

Study Objectives

The current study seeks to achieve the following objectives:

- To provide a theoretical framework explaining the concepts of waste management strategies and sustainability
- To identify the level of awareness among leaders in service organizations, including the Environmental Protection and Improvement Department in the Southern Region, the Zubair Municipality Directorate, and the Basra Municipality Directorate, regarding waste management strategies
- To determine the level of implementation of waste management strategies in the service organizations selected as the study sample in Basra
- To identify the extent of commitment by leadership in the selected service organizations to environmental protection and improvement laws and environmental regulations

- To propose recommendations concerning the adoption of waste management strategies to achieve sustainability through waste reduction
- To provide recommendations for decision-makers in the selected service organizations that support the concept of waste management strategies and encourage their implementation

Importance of the Study

The continuous changes occurring in business environments have rendered traditional environmental management methods insufficient for achieving organizational excellence and progress. Consequently, organizations have become increasingly in need of modern environmental management approaches such as waste management strategies to improve performance and enhance organizational effectiveness.

The importance of this study lies in the following aspects:

- Attempting to identify different types of waste management strategies and link these strategies with sustainability dimensions
- The concept of waste management strategies is relatively new within Iraqi and Arab administrative systems; therefore, subjecting this concept to applied research provides significant value in the field of environmental management studies and may support management efforts to achieve organizational objectives
- The current study directs the attention of researchers and practitioners toward the necessity of focusing on modern environmental management approaches for organizational development and strengthening market position
- The researchers expect that the current study will enrich the environmental management literature in Iraq by addressing a topic that may attract the attention of researchers and scholars
- The study may contribute to obtaining results and recommendations that help answer questions related to the research problem
- The study may benefit service organizations included in the research sample by enhancing the impact of waste management strategies on achieving sustainability through waste reduction

Study Approach

The researchers adopted the descriptive-analytical approach in conducting this study. The descriptive approach was used in the theoretical aspect of the research, whereas the analytical approach was employed in the practical aspect through the use of questionnaires to identify the study problem, in addition to a final checklist form used to collect information related to the applied aspect of the study. These tools were developed in accordance with previous literature and earlier scientific contributions in the field.

RESULT AND DISCUSSION

The researchers devoted the third section of the study to presenting and discussing the results of the statistical analysis of the research model and testing the research hypotheses according to the following subsections:

Coding of the Waste Management Strategies and Sustainability Scale Items

The accuracy of research results depends on the mechanisms used for data collection, analysis, and interpretation. Therefore, the variables, dimensions, and

Table 1: Coding of Waste Management Strategies and Sustainability Items

Variable	Dimensions	Items	Code
Waste Management Strategies (WMS)	Recycling Strategy (RECY)	There is a complete level of awareness regarding the recycling strategy.	RECY1
		There is considerable attention paid by management to the issue of recycling strategy.	RECY2
		There is a model recycling plant at the governorate level.	RECY3
		An effective waste separation system is available for recyclable waste in order to benefit from it in the future and over the long term.	RECY4
		The current waste recycling process is conducted in a timely manner without causing negative impacts on the environment and society.	RECY5
		The policies and solutions adopted by the department contribute to proper waste recycling.	RECY6
	Reuse Strategy (REUS)	There is a complete level of awareness regarding the reuse strategy.	REUS1
		Reuse contributes effectively to reducing waste levels in the governorate environment.	REUS2
		A waste collection and classification system is available, which is important for determining the possibility of implementing the reuse strategy in the future.	REUS3
		There is the possibility of reusing products to which the reuse strategy can be applied.	REUS4
		Your expectation regarding the impact of this strategy on the governorate at the present time.	REUS5
		I am satisfied with the waste treatment mechanism for proper reuse without causing harmful effects on health or the environment.	REUS6
	Reduction Strategy (REDU)	There is a complete level of awareness regarding the waste reduction strategy.	REDU1
		Do you support the currently adopted waste reduction approach?	REDU2
		Reducing individual consumption practices and limiting daily use to essential needs currently practiced by individuals.	REDU3
		Factories and plants should be obligated to produce products that are easy to recycle or reuse.	REDU4
		There are directives promoting the concept of product reuse before disposal.	REDU5
		Governmental and private institutions contribute to reducing paper and plastic transactions through the use of electronic technologies.	REDU6
	Disposal Strategy (RESS)	Do you support the idea of removing waste through traditional methods that may cause environmental damage and are currently adopted?	RES1
		Are the rules and regulations adopted for waste disposal consistent with international standards?	RES2
		Legislation and awareness campaigns organized by the government for waste removal play an important long-term role.	RES3
		The government relies on successful waste collection as an important activity, and therefore involves investment participation from the private sector.	RES4
		There is a tendency to reduce the distance between municipal boundaries and landfill sites to facilitate waste transportation and disposal.	RES5
		There is reliance on effective maintenance and continuous development of landfill sites.	RES6
Sustainability (SUST)	Environmental Sustainability (ENSS)	There is clear encouragement by the department to select the best strategy that preserves natural resources, biodiversity, and improves environmental conditions at landfill sites.	ENS1
		There is assurance of compliance with environmental protection and improvement laws at landfill sites.	ENS2
		Continued emphasis is placed on using the best waste management strategies to achieve environmental sustainability and reduce pollutant emissions into land, water, and air.	ENS3
		Thermal emissions resulting from waste disposal (incineration) are utilized as an energy source.	ENS4
		There is commitment to constructing fences around landfill sites and planting vegetation around them as much as possible.	ENS5
		Commitment to the proposed measures for preventing and treating pollution causes in compliance with environmental regulations and instructions.	ENS6
	Social Sustainability (SOSS)	Commitment to establishing landfill sites at least three kilometers away from residential areas and in suitable locations.	SOS1
		The department continuously motivates citizens to preserve the environment and understand the importance of waste management at the source to reduce operational problems in waste treatment.	SOS2
		Safe and proper treatment is implemented to reduce the spread of odors, insects, and resulting diseases.	SOS3
		Provision of occupational health and safety requirements and preservation of workplace safety for workers.	SOS4
		Provision of suitable employment opportunities at landfill sites for citizens, helping to reduce unemployment.	SOS5

Table 1: Continued

Variable	Dimensions	Items	Code
	Economic Sustainability (ECSS)	There is serious effort toward changing consumer and company behavior to reduce waste directed to landfill sites.	SOS6
		Waste management processes contribute to reducing buried waste quantities and minimizing landfill areas, thereby allowing land to be used for other beneficial investments.	ECS1
		Adoption of waste management strategies contributes to saving raw materials instead of importing them, thereby preserving foreign currency resources.	ECS2
		Current waste treatment practices are carried out safely and properly, leading to increased production capacity.	ECS3
		Continued implementation of financial penalties to reduce waste generated from shops, factories, and companies.	ECS4
		Does the current landfill location near the city reduce costs and accelerate waste management and treatment processes?	ECS5
		There is interest in considering waste as a tradable commodity capable of generating financial returns.	ECS6

Table 2: Exclusion of Outlier Values Using Mahal. Distance Analysis

Variable	Minimum	Maximum	Mean	Std. Deviation	N
Predicted Value	0.987	4.975	3.791	0.817	150
Std. Predicted Value	-3.161	2.004	0.000	1.000	150
Standard Error of Predicted Value	0.053	0.403	0.207	0.063	150
Adjusted Predicted Value	0.8689	4.284	2.906	0.838	150
Residual	-1.851	1.764	0.000	0.783	150
Std. Residual	-2.377	2.763	0.000	0.615	150
Stud. Residual	-3.048	3.496	0.000	1.033	150
Deleted Residual	-2.170	2.140	0.00073	0.766	150
Mahal. Distance	0.227	19.123	9.913	6.520	150
Cook's Distance	0.000	0.561	0.027	0.071	150
Centered Leverage Value	0.001	0.341	0.072	0.083	150

measurement items were coded in order to simplify the analytical procedures and facilitate data processing while ensuring objectivity and accuracy of the results. A total of seven sub-dimensions and 42 measurement items were coded, as illustrated in Table 1.

Chi-Square Values and Mahal. Distance Test for Outlier Values

The purpose of conducting the Mahal. Distance analysis was to verify the efficiency and consistency of the collected data and to determine whether there were any values inconsistent with the dataset in order to exclude them before performing further statistical tests.

Based on this procedure, and at a significance level of (p -value ≤ 0.01), the Mahal. Distance test was conducted. Nine abnormal and unacceptable cases were identified and excluded, namely cases (17, 30, 37, 44, 45, 49, 81, 96, and 101). After removing these outlier values, the dataset became more consistent.

As illustrated in Table 2, the Mahal. Distance analysis values fell within the acceptable range and were lower than the Chi-Square value at the significance level of (p -value ≤ 0.01), indicating the absence of significant outlier values within the data. The results are presented in Table 2.

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