

Cost Estimation of Waste Disposal and Risk Sensitivity in Port-Harcourt Township, Rivers State

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Abstract : Waste disposal is an action deliberately aim at enhancing clean and green environment, in an attempt to improve the general wellbeing and healthy condition of the ever-increasing populace. This consistent appreciation in population in Rivers State also create a corresponding increase in waste generated, and so the approach of disposal and control become complex and uneasy in the present dispensation. Hence, this study focusses on control of waste disposal and risk sensitivity in Port-Harcourt Township, Rivers state. Data was acquired through structured questionnaires and direct interviewed. Both statistical and qualitative techniques was employed for data analysis. Investigation shows that amongst five identified risks associated with waste disposal action, biological risks was more predominant in rainy season with accrued cost of 2.8×10^6 naira per year and ergonomics risk was the least in same season with accrued cost of 1.2×10^6 naira per year. Besides, in dry season, physical risk was the most predominant which consumed 1.4×10^6 naira annually, while chemical risk was the least significant in dry season and consumed accrued cost of 1.0×10^6 naira per year. Adequate training and sensitization of staff and stakeholders should be embarked on as a primary mitigation major for waste disposal and control in Port-Harcourt Township, Rivers State.

Keywords: Waste disposal, Waste control, Waste stimulants, Industrial products, Solid waste

1.0 INTRODUCTION

Manufacturing, agriculture, telecommunication, and domestics or households are some known waste stimulants, in Port-Harcourt township, Rivers State. Waste disposal is the removal of undesired materials from agriculture, domestic usage or industrial products. Solid waste is typically disposed of by incineration and compaction. Waste disposal is always associated with some level of risks, either on the environment or the citizenry. According to Davoli *et al.* (2010), risk associated with waste disposal is potential losses and rewards from exposure to hazards, which is anything that can lead to a negative outcome in the process of trying to meet a target. The control of waste disposal is very essential for the benefit of the public. Lima & Paulo (2006) asserted that waste control is identification, monitoring and controlling potential risks in order to minimize the adverse effects on a system. Stanley & Owzor (2018) assessed solid waste control practice in Port Harcourt Metropolis using descriptive statistical for data analysis. Result showed that 76% of respondents dumped their refuse indiscriminately. Environmental awareness and waste management policies were proposed. Raphela *et al.* (2024) investigated the impacts of improper waste disposal on human health and the environment in the KwaZulu Natal Province of South Africa. Chi-Squared tests of independence, regression, and descriptive statistics were used for analysis. Disparity in awareness of risks associated with improper waste disposal was discovered.

Fakorede *et al.* (2021) studied waste disposal practices amongst residents of Oluyole local government area of Ibadan, Oyo State. Descriptive statistics was used for variables check. It was showed that for proper disposal, 44.4% of the residents dumped their refuse with government, 32.4% with private waste collectors. For improper waste disposal 10.3% in rivers, 14.8% on road sides, 20.4% open dumpsites, 9.3%, gutter, and 33.3% open air burning. 97.5% strongly agreed that indiscriminate waste dumping has inimical environmental implications. Czekala *et al.* (2023) reported a reviewed on selected modern solutions for waste management. The challenges and remedies were investigated in the context of the circular economy. Result showed that used of modern solutions in waste management enhance sustainable development. Kalonde *et al.* (2023) examined a dataset of the waste disposal patterns in Malawi. A regression model utilized for analysis showed that the choice of private garbage collection sites increased when a lady in charge of the household. We presented these findings to the neighborhood community development committee. A potential approach for developing waste management policies using a bottom-up approach was provided. Nsirim *et al.* (2018) carried out study of waste management in Port Harcourt metropolis. Questionnaires and interviewed were employed for data acquisition. It was showed that RIWAMA used various communication modes to reached the public about waste management. 62% of respondents were fully aware of RIWAMA activities through television, 12%, 21%, and 5% though traditional means, social media and mobile phones, respectively.

Elenwo (2020) investigated the attitudes of residents to solid waste management in Obio/Akpor Local Government Area, Rivers State. The methods used for the study were cross-sectional survey and questionnaires. Result revealed that the level of compliance was very low (16.4%). Furthermore, level of compliance was affected by attitude to waste management (73.2%). From the study, it

was also discovered that there was no significant difference in the management of solid waste in the affected area. Ayoola *et al.* (2021) reviewed the effect of dumpsite leachate to the environmental and public health. From the study, it was discovered that leachate is generated due to the moisture state of dumpsites. This leachate contains microbial pathogens and hazardous substance. These substances were cyanides, heavy metals and their chemicals acquired from dumpsites. Furthermore, when leachate migrates into the environment, contaminated the soil, food products, animals, ground water, surface water and the air environment. These in return affect the health of those who Consumes the contaminated products and those who live close to the dumpsites.

Nwankwoala *et al.* (2022) studied effects of waste dump on groundwater quality in Rukpokwu, Rivers State. Result revealed the subsurface lithology, thickness of lithology, prolific auriferous zones, curve types and zones of contamination. In terms of resistivity values; high indicates uncontaminated subsurface lithologic zones, while low indicates contaminated subsurface lithologic zones as a result of dissolved ions and metals from waste dumps decomposing through biochemical reactions, hydrolysis, oxidation and reduction processes. It was proposed that before the drilling of any bore holes in the region, geophysical survey needs to be carried out. Eze *et al.* (2023) mapped solid waste disposal sites in Obio/Akpor local government area, Rivers State. Proximity analysis for buffer of 200m, 500m and 1km for suitability of solid waste collection centres and dumpsites was utilized which amounted to a total of 114 disposal sites. It was found that Elenwo community in ward 6 has the highest (12), whereas Egbelu Ozodo community in ward 16 has the lowest (1) number of collection sites within the study area. Prompt review and enforcement of soil waste management laws was proposed to forestall likely environmental hazards.

Emine *et al.* (2022) reported municipal solid waste management using questionnaires. Waste specimens were categorized into 14 portions. Investigation revealed a 56.3% biodegradable solid waste, 40.87% possible recycle parts, and 2.83% portions suitable for energy recovery. The researchers concluded that government enact law to legalize, recycling and composting activities, in a manner that ensures environmental sustainability, economic sustainability, and global acceptability.

2.0 MATERIALS AND METHODS

2.1 Materials

The materials employed were obtained from responses of structured questionnaires targeted at stakeholders in waste disposal. Frequency classes for risk analysis, consequences/severity classes for risk analysis and risk classification matrix were some of the raw data.

2.2 Methods

Both questionnaires and direct interviews were employed for data acquisition. Spearman's rank correlation coefficient was used to analyzed the collected data.

2.2.1 Relative Importance Index

The relative importance index can be obtained according to Equation (1).

$$R^1 = \frac{\sum k_i d_i}{\sum k_i} \quad (1)$$

where R^1 is relative importance index, k is the respondents and d_i is rating ($i = 1$ to 5)

2.2 Evaluating Spearman's Rank Correlation Coefficient

Spearman's rank correlation coefficient (r) can be evaluated as showed in Equation (2).

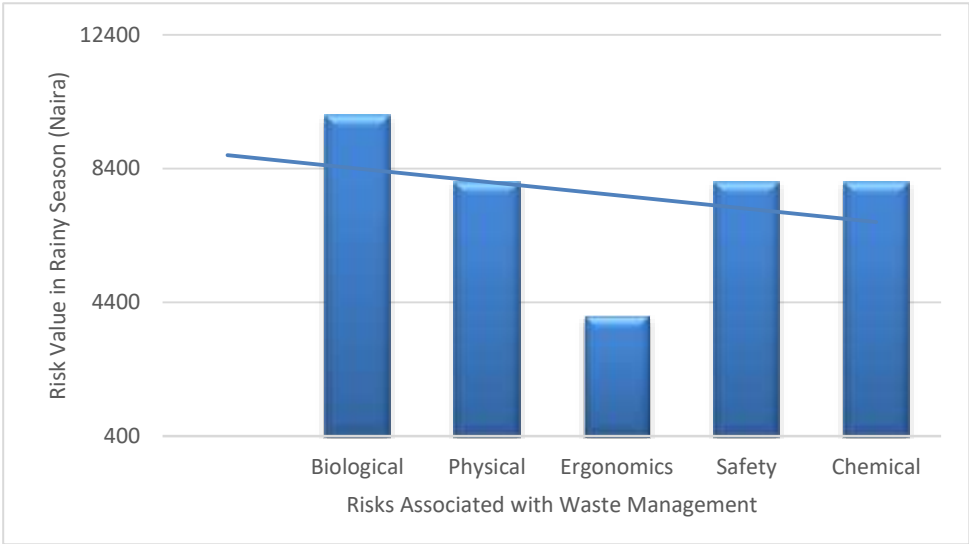
$$r = \frac{N \sum kd - (\sum k)(\sum d)}{[N \sum k^2 - (\sum k)^2][N \sum d^2 - (\sum d)^2]} \quad (2)$$

where r is the spearman's rank correlation coefficient, N is number of pairs of respondents, k is the respondents, and d is stands for rating.

3.0 RESULTS AND DISCUSSION

3.1 Costs Associated with Waste Disposal and Control

The costs of risks associated with waste disposal and control in Port-Harcourt Township was evaluated and reported in Figure 1.



During Rainy Season
Port-Harcourt township studied, biological risks consumed 140,000 naira per year, and

The financial equivalent of risk associated with waste disposal and control was evaluated and depicted in Figure 2.

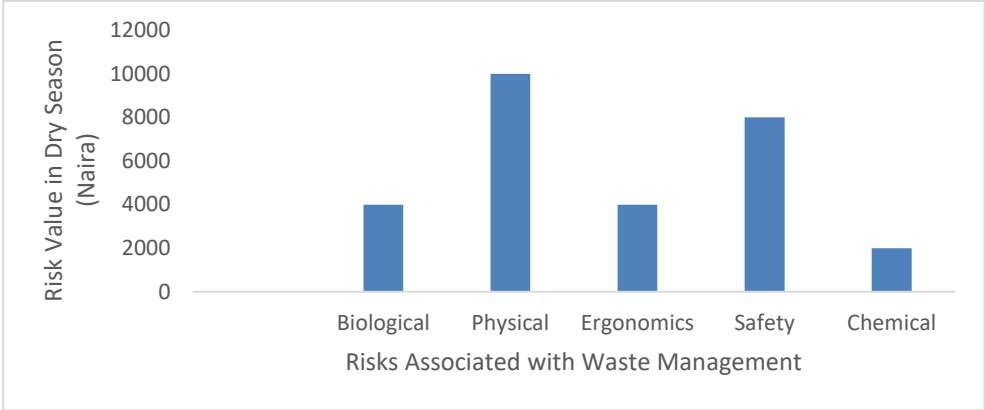


Figure 2: Cost of Risks in Dry Season

Figure 2 shows that physical risks had the greatest cost value in dry season with an accrued cost of 1.4×10^6 naira annually, while chemical risks had the lowest risk value with an accrued cost of 1.0×10^6 naira per year.

3.3 Analysis of Risks Associated with Waste Disposal and Control in Port Harcourt

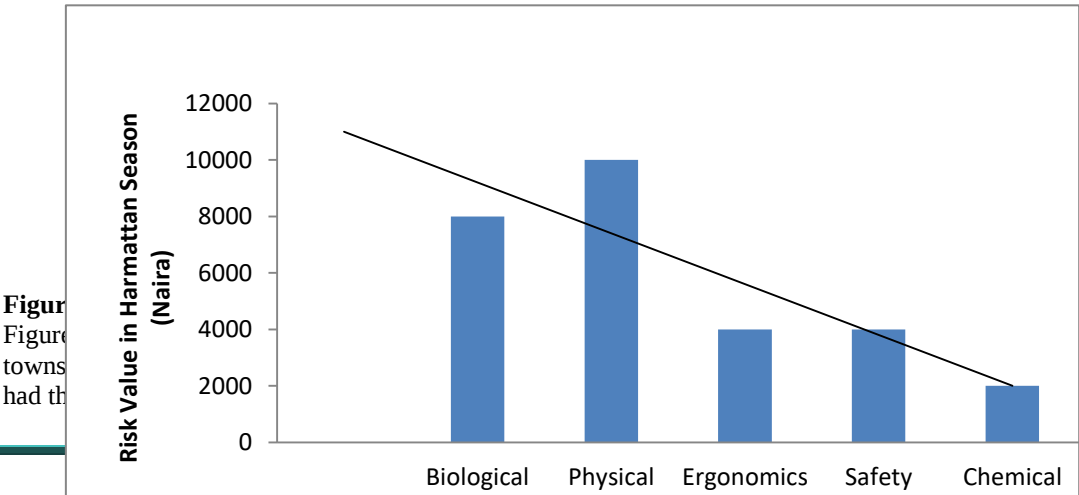


Figure
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per year while chemical risks

4.0 CONCLUSION

Risk analysis and mitigation of waste management and control in Port Harcourt township was carried out and the following were established:

- i. Risk levels for different seasons differs; electricity hazards is the lowest hazards; and chemical risk is the lowest risk encountered by the public in waste management operation in Port-Harcourt Township.
- ii. Risk can be reduced by educating contractors and employees in waste management.
- iii. Hazard analysis and risk assessment must be conducted regularly.
- iv. An effective corporate risk management policy which incorporates the risk mitigation framework should be encourage.

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