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Effects of Fish Waste Management Practice on Environmental Pollution in Tanzania: A Case Study of Kivukoni Ferry Fish Market

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Abstract

Globally, waste arising from human and animal activities that are normally solid and are discarded as useless or unwanted are broadly defined as solid waste. It includes municipal garbage, industrial and commercial wastes, sewerage slug, waste of agricultural and animal husbandry, demolition waste and mining residues. The study aimed to identify strategies deployed by the management at Kivukoni Ferry Fish market. The study adopted case study research design with mixed approaches. The study used purposive and probability sampling techniques. The study used Slovenes formulae to obtain sample size of 160 respondents from target population of 213 respondents. The study used questionnaire and interview to obtain data needed. The study findings indicates that 77.1% of respondents agreed that management of Kivukoni Ferry fish market provide clean water for fish processing and fish waste collection bins. The study concluded that, Kivukoni fish market provide clean water for fish processing, also inadequate provision tools for fish waste collection and poor logistics for fish waste transportation from Kivukoni Ferry fish market to Pugu damp. In additional to that, poor market infrastructure led the market to produce odor smell, immediately in hot weather condition, this situation threaten the environment and the safety of workers and community at large. The study recommended that, Kivukoni Ferry fish market management should establish designated waste collection points within the market to streamline the disposal process and should develop a reliable logistics system for the timely transportation of fish waste from the market to Pugu dump.

Keywords: Fish Waste, Kivukoni Ferry fish market, Environmental Pollution.

1. INTRODUCTION

Globally, sustainable wastes management is the process that has been trying to eliminate the negative effect of wastes. Waste arising from human and animal activities that are normally solid and are discarded as useless or unwanted are broadly defined as solid waste. It includes municipal garbage, industrial and commercial wastes, sewerage slug, waste of agricultural and animal husbandry, demolition waste and mining residues (Owojori, 2020).

According to recent statistics, around 2.01 billion metric tons of solid watse were produced globally and this number is predictable to rise to 3.4 billion metric tons by 2050 (Iqbal et al. 2021). Tanzania, home to some of the fastest-growing urban centers in East Africa, produces 12–17 million tonnes of solid waste every year. Only 50 per cent of this is collected and sent to dumpsites. The focus on waste processing is low, while disposal of waste is common, this process of wastes disposal in Tanzania was challenged poor facilities for recycling wastes and it challenges by inadequate facilities for wastes collection and transportation (Tesha,2020). This was due to funds allocation to the Municipal was not enough to facilitate these activities of collection, transportation and recycling to produce another product or to be used in agricultural activities as fertilizer This situation of inadequate tools for transportation wastes from community area to dumping sites led to poor logistic of transportation that led to environmental pollution .These accumulation of wastes to the community area led to eruption of communicable disease due to decomposition of wastes that produce odal gases and other carried vector for transmissions of diseases.(Tesha,2020).

Dar-es-Salaam Region was considered the economic capital of Tanzania as it is the third fastest growing city in Africa and the ninth fastest in the world. The city is facing a huge burden of waste disposal which needs a complete overhaul. The region, with an area of 1,493 square kilometers and a population of 7.4 million, comprises municipalities of Kigamboni, Kinondoni, Temeke and Ubungo and Dar-es-Salaam city council (Omar, 2018). Dar-es-Salaam city's urban population is growing rapidly and the city is witnessing increasing waste generation. Additionally, nearly 70 per cent of the city's population is residing in informal settlements, which eventually increase demand for urban services, including waste management (Omar, 2018).

Waste generation in Dar-es-Salaam has tripled in the past 16 years. The city generates nearly 4,500 tonnes of municipal solid waste per day, out of which, only 50-70 per cent gets collected by the city (Yhdego,2021).Waste management face a number of challenges for example, waste transportation is very expensive; it is a labor-intensive activity, accounting for approximately three quarters of the total cost of solid-waste management((Yhdego,2021).

Public employees are often assigned to the task, but sometimes it becomes economic activity for private companies to do the work under contract provided by municipality. In this Public, a driver and one or two loaders may serve in each collection vehicle. Kinondoni Municipality is one of the most densely populated municipalities on the African continent, whereby it's said that 75-90% of its population live in

heavily populated unplanned areas. Therefore, like most developing cities, Kinondoni suffers from inadequate solid waste management (Mwakyambiki, 2023).

In Tanzania, Kivukoni Ferry fish Market is the biggest market of fish in Tanzania, that dealing with processing, selling and transporting of fish that are fishing from Indian Ocean. This situation of processing fish led to production of fish wastes (solid and liquid wastes). Due to the development of fishing technology, the market receives a lot of tons of fish that are required for processing and selling and other transporting to the other parts of the country. As a result of inadequate practices in managing solid wastes products in Kivukoni Ferry fish market, the sanitary conditions of the marketing environment have become more rampant from time to time, and people within fish marketing area people suffering from living in such conditions. So that critical need for efficient municipal solid waste management (SWM), on the one hand, and steady growth of waste problem on the other side are still the main features of the dumpsite (McIlgorm, & Xie,2023).

Fish wastes such as fish offal, fish skin, fish skeletons when it decomposes led to communicable diseases that serious problem in developing countries like Tanzania, that are major threat to public health. Public health tends to be the motivating factor in development of waste policies in places where little waste management infrastructure exists. Thus, low level of safe disposal of fish wastes led to extreme cases in public health calamities, such as the spread of disease to wastes collector and public in general (Bejumula, 2021).

All the waste collected eventually ends up in the Pugu dumpsite located nearly 35 km from the city centre. Collection service schedules in the city are not regular and inefficient due to an insufficient number of collection vehicles, traffic congestions and under-planned infrastructure. A major fraction of the waste generated is not formally collected; it is buried, burned, or illegally dumped. Dumping of waste at the Pugu dumpsite is currently the predominant method of waste disposal in the city (Lubwama, 2017).

2. Statement of the Problem

Management and administration are key to any organization performance in the World. This is also true in an organization that deals with environmental protection and the management of waste products, garbage collections as well as water, sanitation and hygiene. The Kivukoni Ferry Fish market is one of the places which produces a lot of fish wastes. In this regard, the management of the Kivukoni Ferry Fish market has the key responsibilities among others to ensure proper handling of the fish wastes.

Some studies have indicated that the market produces over 0.8 tons of fish wastes per day (Athuman & Mwakyambiki, 2023). This makes enormous amount of fish wastes per week and if the management of the market fails to fulfil its responsibility, this may lead to serious environmental problems and consequently may result into outbreak of diseases. Literature and several researchers have studied the area with focus on issues of environmental pollution in general. This is partly because the fish market produces fish waste products such as fish offal, fish skin, fish skeletons which normally are collected and filled in collection trash-bin for two to three days before their final disposal at Pugu Dumpsite.

The temporary storage of the fish waste products for two to three days or more result into serious environmental problems due to organic nature of the wastes. The unintended consequences of the temporary storage that may be affected by hot weather or heavy rainfall threaten to cause outbreak of communicable diseases such as diarrhea and abdominal pain (Islam & Peñarubia 2021).

Improper logistic of fish waste transportation, this is due to fish wastes in adequate of transport facilities that led to fish wastes to remain for two- or three-days decomposing in bines that led to the production of odor smell and presence of flies that are vector of communicable disease. Also, the transportation process of waste is not effective and in most cases transportation trucks usually get spoilt at the middle of the road while on transportation which cause further discomfort to the community around.

Yet, there is scant literature and very little known about the role of the management of Kivukoni Ferry Fish market in dealing with the fish wastes in relation to environmental protection. Therefore, this study seeks to investigate the positive and negative effects of the management of Kivukoni Ferry Fish market especially on issues to do with environmental pollutions.

3. Study Objective

- To identify strategies deployed by the management at Kivukoni Ferry Fish market in environmental protection.

4. LITERATURE REVIEW

Arvanitoyannis & Tserkezou, (2014). Fish waste management. Seafood processing. In their study they revealed that Fish industries usually process wastes that are suspected to pose a significant risk to the environment. Technologies to treat these wastes, or even better to recover some useful organic materials before disposal, are necessary to mitigate pollution. Fish farm waste affects not only the immediate area but it can also change a wider coastal zone through reduction of biomass, density and diversity of the benthos, plankton and nekton, and by modifying natural food webs.

Naha et al., (2024) did the study on impact of climate change and occupational hazards on fisherfolk/fish processing communities with probable mitigation strategies, that Solid waste generation in fish processing ranges from 50 to 80% of original raw material. Different components of solid waste include scales, skin, bones, meat portions, viscera, shells of prawns and crabs etc. The disposal of seafood waste not only has significant cost but also have major impact on environment. Waste water from fish processing industries originates from sources such as fish unloading, dressing, melt water from melting of ice, equipment and utensil washing, treatment with additives, cleaning and disinfection of facilities and premise.

Mozumder et al., (2022) did the study on Sustainable Utilization of Fishery Waste in Bangladesh. In their study they revealed that fish-processing operations generate potentially substantial quantities of waste and by products from inedible fish parts and endoskeleton shell parts from the crustacean-peeling process, such as particles of flesh, skin, scales, bones, visceral mass (viscera, air bladder, gonads, and other organs), head, fins, shells or liquid stick water. The volume and concentration of wastewater from fish processing depend on the raw fish composition, the additive used, the processing water source, and the unit process. The

management of this fishery waste is one of the main problems, arousing the most significant concern and having the strongest impact on the environment. The runoffs, typically high in nutrients, result in algal blooms, unpleasant odors, acutely lethal discharges, and localized areas of anoxia.

5. METHODOLOGY

The adopted a case study research design. Case study research design w used to obtain in-depth information from the study area of a particular research problem rather than a sweeping statistical survey (Bennett, 2004). Also the study adopted mixed approaches (Both qualitative and quantitative approaches).The target population consisted 213 respondents that includes, Fish market Management, fishermen, traders, fish waste collectors and Fish waste Transporter. The study adopted purposive and probability sampling procedures. The study used closed ended questionnaires, interview and documentary review to obtain data needed.

5. RESEARCH FINDINGS

5.1 General Profile of the Respondents

In order to ascertain validity and reliability of data, background information about respondents was crucial, for this purpose three questions in questionnaire were asked relating to gender, age and education of the respondents.

Table 5.1:Demographic Features of the Respondents

	Categories	Frequency(f)	Percent (%)	Cumulative Percent
Gender	Male	77	58.8	58.8
	Female	54	41.2	100.0
Age	18-25yeras	29	22.1	22.1
	26-30years	28	21.4	43.5
	31-35years	35	26.7	70.2
	36-40years	22	16.8	87.0
	41-45years	8	6.1	93.1
	46years and above	9	6.9	100.0
Education	Never attend to school	28	21.4	21.4
	primary school	30	22.9	44.3
	Secondary school	27	20.6	64.9
	Certificate	22	16.8	81.7
	Diploma	17	13.0	94.7
	Bachelor	7	5.3	100.0
	Total	131	100.0	

Source: Field Data (2024)

Table 5.1 shows demographic features of the respondents. In the part of gender of the respondents. As per the survey, more than half (58.8%) were male and 41.2% were female. The results revealed that the nature of the activities performed at the fish market attracts more men than women. This finding is similar to Mwakyambiki (2023) finding that while women do not participate in actual fishing activities, their contribution to fishing activities cannot be underestimated. The finding demonstrates that the nature of women's function at the KFM makes it more likely for women to experience public health problems than men.

In the part of age as shows in Table 5.1, over one-third (35%) of the respondents were aged between 31 and 35 years, indicating that one had to have the energy to conduct fishery activities effectively and generate income to support one's family (Table 5.2 This finding aligns with Jeyarajah (2015), who found that age usually influences an individual's working ability. However, productivity increases with age and decreases with the late life cycle. Findings also revealed that about 22.1% of the respondents were aged between 18 and 25 years. The number of youths participating in fishing activities is small compared to middle-aged youth, further indicating that youth do not engage in fish-related activities for income reasons.

In the part of education as shows in Table 5.1 s, that most respondents (22.9%) have primary school education, and 21.4% had never attend school. The findings imply that a low education level might directly influence the mismanagement of fish waste that can affect public health and how to manage public health at the KFM. This finding is similar to that of Yuerlita et al. (2005), who reported that the percentage of primary school education among fishers was higher than other levels of education because fish activities have their traditional ways of learning, and sometimes can be handed from one generation to another; hence making one to not necessarily needing high education and specialized skills to engage in the trade.

5.2 Effects of Fish Waste Management Practice on Environmental Pollution in Tanzania. A Case Study of Kivukoni Ferry Fish Market was identified

A five-point Likert scale was provided ranging from: From 1 to 1.80 represents strongly agrees. From 1.81 until 2.60 represents agree. From 2.61 until 3.40 represents Undecided. From 3.41 until 4.20 represents disagree. From 4.21 until 5.00 represents (strongly disagree. From the answer, descriptive measures of central tendency: mean and standard deviation were deployed for simplicity of explanation and generality of findings.

5.2.1 To identify strategies deployed by the management at Kivukoni Ferry Fish market in environmental protection

In interview was conducted to the management of the market and fish waste transporter on the strategies deployed by the management of Kivukoni Ferry fish market in environmental protection that comprises 9 key informants.

The market sets up designated collecting bins specifically for fish waste. These waste collection bins are strategically placed throughout the market to ensure that vendors and workers can easily dispose of fish scraps, guts, and other byproducts efficiently. Thus, by implementing an effective fish waste disposal system, the kivukoni Ferry fish market plays a crucial role in pollution reduction, environmental protection,

and community health. This finding aligns to those of Islam, et al., (2021), that in this market, designated collecting bins for fish waste are strategically placed throughout the area to streamline waste management. These bins are specifically designed to hold fish scraps, guts, and other byproducts generated by vendors and workers. By positioning the bins in convenient locations, the market encourages proper disposal, reducing the likelihood of fish waste being discarded inappropriately.

One of the informant states that;

*The management has been taking effective measures by placing collecting bins used for fish waste (*interview A: 20/08/2024).

From the interviews it was revealed that the fish market has contracted a contractor responsible for transporting fish waste to the Pugu dump. This process takes place every day in the evening, ensuring that the waste collected in the designated bins is regularly removed from the market. By hiring a bidder for this task, the market maintains a consistent waste management routine, preventing the accumulation of fish waste that could lead to unsanitary conditions, unpleasant smells, and potential health risks. Transporting the waste daily to a designated dump site, such as Pugu, damp ensures that it is properly disposed of in an environmentally safe manner, contributing to the overall hygiene and sustainability of the market. This finding aligns with those of Oduor (2015) that by hiring a bidder for the task of transporting fish waste, the market ensures a reliable and consistent waste management routine. The bidder is typically a contractor or company selected through a procurement process, tasked with the daily removal of fish waste from the market. This routine helps prevent the buildup of fish scraps and byproducts, which, if left unmanaged, could lead to unsanitary conditions.

As one an informant pointed that *"The market employed bidder for transport fish waste to Pugu dump every day in the evening*" (interview B 20/08/2024).

From the interviews and observation by the researcher it was revealed that the fish market also provides clean water for fish traders to ensure cleanliness in the fish processing.

The informants agreed that by supplying clean water the management of the fish market takes the initiative by helping fish traders to make sure they properly prepare fish which includes washing an essential activity for hygiene and food safety in general. Clean water plays a key role in preventing contamination during the handling and processing of fish and hence reducing the risk of bacterial growth and spread of water borne diseases. This finding concurs to those of Edirisinghe et al., (2022) that, the market ensures that each fish trader has access to clean water specifically for fish processing. This initiative is crucial for maintaining hygiene standards throughout the market. By providing clean water, traders can effectively wash and prepare the fish, which is essential for ensuring food safety. This focus on cleanliness not only helps in preserving the quality of the fish but also protects consumers from health risks associated with contaminated food. Overall, this system promotes a safer and more reliable fish trading environment.

An informant pointed out that:

"The market supply clean water for fish processing to each trader to ensure cleanness of the market" (interview C: 20/08/2024).

The practice of the management of the market to hiring a cleaning service or company to maintain cleanliness within the market, particularly in a fish market setting. Fish markets can easily become messy due to fish waste, water, and other organic materials. By hiring a professional cleaning company, the market ensures that these areas are regularly cleaned and sanitized. This helps maintain a hygienic environment, prevents unpleasant odors, and reduces the attraction of pests like houseflies, which can be drawn to fish waste. It also helps comply with health and safety standards for both vendors and customers. This finding aligns with those of Rondón-Espinoza, et al., (2022) that hiring a cleaning company for a fish market is a strategic move to enhance hygiene, comply with regulations, improve customer satisfaction, control pests, and ensure efficient operations of the market.

As one of informant pointed that*;*

"The market hiring company that can provide cleanness within the market so as to maintain sanitation within the market" (interview E: 20/08/2024).

The questionnaires were distributed to fishermen, traders and wastes collectors within the market that comprises 131 respondents on strategies deployed by the management at Kivukoni Feri International Fish market in environmental protection, table 5.2 shows the summary.

Table 5.2: To identify strategies deployed by the management at Kivukoni Ferry Fish market in environmental protection (N=132)

S/no Variables	1		2		3		4		5		Mean	Std. Deviation
	F	%	F	%	F	%	F	%	F	%		
Management provides waste collection facilities within the market	52	39.7	45	34.4	0	0	17	13.0	17	13.0	2.2519	1.42690
There was adequate supply of water within the market	21	16.0	80	61.1	0	0	20	15.3	10	7.6	2.3740	1.15249
Market infrastructure was not favorable to manage fish available in the market	45	34.4	62	47.3	0	0	17	13.0	7	5.3	2.0763	1.16102
The market provides bins for storing fish wastes	46	35.1	74	56.5	0	0	7	5.3	4	3.1	1.8473	.90701

Source: Field Data (2024)

Table 5.2 shows strategies deployed by the management at Kivukoni Ferry Fish market in environmental protection. Among the information sought from the respondents through the questionnaires was on the market provides bins for storing fish wastes. Whereby 74(56.5%) agreed, 46(35.1%) strongly agreed, 7(5.3%) disagreed and 4(3.1%) strongly disagreed. Respondents agreed with high mean value of 1.8473 and Standard deviation of .90701 respectively. The provision of collecting bins for storing fish waste in a market is crucial for safeguarding public health. It helps contain waste, maintain hygiene, control pests, and ensure compliance with health regulations. Additionally, it promotes environmental responsibility and operational efficiency, contributing to a cleaner and safer market environment for everyone involved. This finding aligns

with those of Graham (2022) in Manila, that providing bins for storing fish waste in a market is crucial for safeguarding public health.

Among the information sought from the respondents through the questionnaires was on mmanagement of Kivukoni Ferry fish market provides waste collection facilities within the market. Whereby 52(39.7%) strongly agreed, 45(34.4%) agreed, 17(13%) disagreed and 17(13%) strongly disagreed. Respondents agreed with high mean value of 2.2519 and standard deviation of 1.42690 respectively. This finding indicates that management of the Kivukoni Ferry fish market has set up specific waste collection facilities, such as waste collection bins or designated areas, to properly handle and dispose of fish waste. By providing these facilities, the management aims to control the accumulation of fish waste in the market. This finding concurs to those of Ravan pour, et al., (2021) that at the market's management has installed specific facilities to collect fish waste in order to protect the health of the people who use the market, such as vendors, customers, and staff.

Among the information sought from the respondents through the questionnaires was on Kivukoni Ferry fish Market infrastructure was not favorable to manage fish waste. The results revealed that, 62(47.3%) agreed, 45(34.4%) strongly agreed, 17(13%0 disagreed and 7(5.3%) strongly disagreed. The respondents agreed with high mean value of 2.0763 and standard deviation of 1.16102 respectively. This find finding indicates that fish market's infrastructure not favorable to manage fish wastes. This led to fish wastes to spread within the market that can cause ordal smell that led transmission of diseases to people within the market. This ultimately supports public health, enhances customer satisfaction, and promotes sustainability within the market. This finding concurs to those of Mozumder etal al., (2022) that the favorable infrastructure of a fish market plays a crucial role in managing fish effectively and controlling waste. From temperature regulation and waste disposal to hygiene facilities and operational efficiency, each aspect contributes to minimizing spoilage and ensuring a clean, healthy environment for both vendors and customers.

Among the information sought from the respondents through the questionnaires was on there was inadequate adequate supply of water within the market so as to manage fish processing and wastes generated from fish. The results revealed that, 80(61.1%) agreed, 21(16%) strongly agreed, 20(15.3%) disagreed and 10(7.6%) strongly disagreed. The respondents agreed with high mean value of 2.3740 and standard deviation of 1.15249 respectively. This finding indicates that an adequate supply of water in a fish market is critical to maintaining cleanliness and hygiene. Fish markets are places where large amounts of organic waste, including fish scales, blood, and fish residues, accumulate throughout the day. If these wastes are not properly managed, they can lead to foul odors, unsanitary conditions, and attract pests such as flies, rats, and insects, which pose health risks to both vendors and customers. This finding concurs to those of Islam et al., (2021) that, an adequate supply of water in a fish market is fundamental to ensuring cleanliness, public health, and operational efficiency. It supports hygiene practices, helps manage pests, enhances customer satisfaction, and contributes to sustainable practices, all of which are crucial for the successful operation of a fish market.

6. Summary

To identify strategies deployed by the management at Kivukoni Feri International Fish market in environmental protection.

The finding of the study indicates that, 77.1% of respondents agreed that management of Kivukoni Ferry fish market provide clean water for fish processing, 74.1% agreed that management of the Kivukoni Ferry fish market provide fish waste collection bins. Also, the management of the fish market provide chemical for treating housefly within the market so as to minimize transmission of communicable disease, in additional to that, 89.4% of respondents agreed that, the market hiring bidder for doing cleanness and transport fish waste from Kivukoni Ferry fish market to Pugu Damp. Though market infrastructure are not favorable to manage fish waste that led to spread of fish waste, order smell after decomposition that can affect health of people within the market.

7. Conclusion

From above summary the study concluded that, Kivukoni Ferry fish market provide clean water for fish processing, also inadequate provision tools for fish waste collection and poor logistics for fish waste transportation from Kivukoni Ferry fish market to Pugu damp and poor market infrastructure led the market to produce odor smell, immediately in hot weather condition, this situation threaten the environment and the safety of workers and community at large.

8. Recommendation

From conclusion above the study recommended as follows: -

- Kivukoni Ferry fish market management should provide adequate waste collection tools and facilities to handle fish waste effectively.
- Kivukoni Ferry fish market management should develop a reliable logistics system for the timely transportation of fish waste from the market to Pugu dump.
- Kivukoni Ferry fish market should invest in improving the overall market infrastructure to facilitate better waste management and reduce odors.

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