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Environmental Sustainability and Solid Waste Management Procedures in Bukavu City, Democratic Republic of Congo

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ABSTRACT

Environmental sustainability approaches such as effective solid waste management processes are indispensable for promoting sustainable urban development. Therefore, sustainable approaches to urban solid waste management are essential for every growing city. Bukavu City in Democratic Republic of Congo is a continuously growing city with a correspondingly increasing generation of solid waste which needs effective and sustainable management. This study engaged a mixed method model of both qualitative and quantitative approaches in assessing the perception of respondents on the sustainable aspect of the solid waste management procedures in the city of Bukavu. It administered 400 household questionnaires to residents, but also complemented the retrieved by interviewing key informants about the solid waste management approaches in the city. Results indicate inadequacy in the solid waste management processes in Bukavu City. Therefore, an inclusive and all-encompassing sustainable urban governance is proposed to encourage effective community participation in the management of the city environmental parameters alongside the enshrinement of a sustainable waste and environmental policy.

Keywords: Environmental sustainability, Solid waste management, City, Growing urban and Sustainable urban.

INTRODUCTION

Sustainable environmental approaches are indispensable in maintaining urban sustainability and preserving its security. Thus, it is an essential environmental procedure and a veritable key to sustainable development[1]. Therefore, every city will need to effectively manage its environment to achieve its sustainability in the growing urban age when one in every three human beings is projected to reside in urban communities by 2030 [2]. There has been upward increase in the volume of solid waste generated in growing urban centers as the human population densities continues to swell in most cities around the globe. The world cities generate about 1.3 billion tonnes of solid waste per year and it is expected to increase to 2.2 billion in 2025 [3, 4]. This increase is mostly associated with the growing economies of different cities [5]. To stem this volume down, effective management must be priority for the growing cities around the world. However, the urban solid waste generation challenges and control are becoming a global environmental threat that may be associated with public health implications in mostly developing economy countries [6–8]. These challenges and impacts of urban solid waste inadequate management are becoming complicated in most of the developing economy country cities because of their lack of adequate preparation for the increasing population growth, inadequate urban planning, increasing industrialization and growth of slums and unregulated communities within their urban spaces [8–10]. However, the paradox is that richer countries (developing economy) urban centers and cities that produces larger volume of garbage and waste have developed a better management capacity to garner resources and cope with their waste management technology with minima negative implications than most of their developing economy country cities counterparts that are not prioritizing the process [11, 12]. This has been encouraged by their technological advancement, improved infrastructure, robust administrative capacity, financial input in the waste management technology systems, sustainable environmental education and provision of essential services to their residents [13]. Presently, the concern for urban public and environmental health sustainability has necessitated the increasing scholarly outputs on solid waste management issues, concerns and technologies all over the world. This study intends to examine through perceptions of residents the environmental

sustainability and solid waste management procedures in Bukavu City in the Eastern Democratic Republic of Congo. Bukavu City is situated in the southern part of Lake Kivu in the Eastern Democratic Republic of Congo, with a latitude and longitude corresponding to 2^0 33'S and 28^0 48' with an altitude that ranges between about 1400 meters and 2200 meters above sea level [14]. It has a mean annual temperature of 19^0C, while the mean rainfall is 1414 millimeters [12]. The city possesses a humid climate with about 9 months rainy season and 3 months dry season[14]. It is dominated by mountainous relief alongside steep slopes [14, 15]. The initial population of the city based on estimation was 686,854 people for 2016 and expected by 2030 to double and by 2050 to triple [15]. The demographic growth of the city has been accompanied by encroachment on most of the vacant and green city spaces. As in some developing economy cities, uncontrolled urban growth in Bukavu city is a key land planning constraints when rural migration alongside ineffective land policy is yielding negative consequences on the environment [16]. Land has been an indispensable resource in the city because of economic, political and power dynamics in Congo as a whole which sometimes instigates conflicts [17]. This has impacted adversely on the waste and environmental management programmes with an untold implication encouraged by the continuous infrastructural decay being witnessed in the city[14].

METHODOLOGY

This study engaged a mixed method which included both qualitative and quantitative approaches. Four districts in Bukavu town, including Bariga, Ibanda, Kadutu and Panzi, were designated for the survey. Four hundred household questionnaires were administered to respondents in a face-to-face interaction. Key stakeholders' interviews were also conducted on government officials and leaders of the communities to complement information retrieved from the administered household questionnaires. Also, physical observations of the waste management systems in the city were recorded. The quantitative data from the questionnaires were subjected to statistical analysis while the contents of the interview's scripts were analyzed.

RESULTS AND DISCUSSION

Demographic analysis of the respondents

The respondents composed of males (52%) and females (48%), with the majority falling between 15 to 29 years of age. Other age groups included: 13 to 14 years (3%), 30 to 45 years (27%), 46 to 64 years (7%), and 65 years and above (16.2%). This section relays the information about waste management practices identified through the survey in Bukavu City. This includes the characteristics, sources and types of waste generated, estimated quantity of waste produced in households per week in terms of sacks, frequency of waste disposal or waste collection (emptying sacks). Hence, it establishes through perceptions of the respondents the levels of awareness and the knowledge of respondents of the existence of solid waste management in the town.

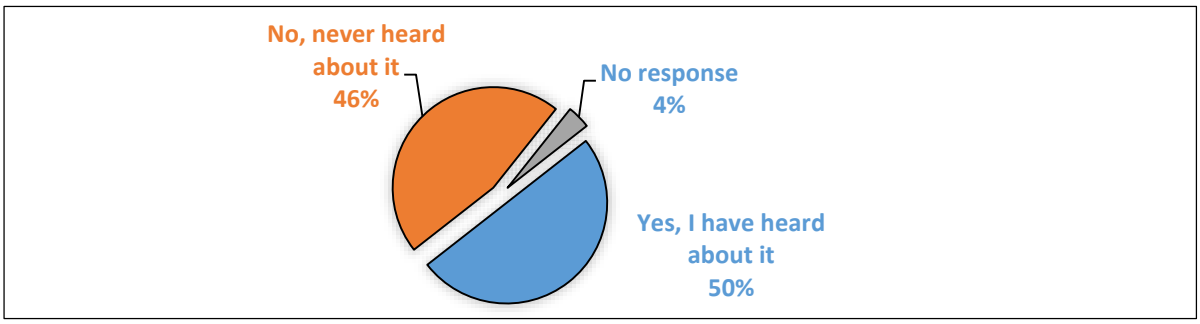

Figure 1: Awareness of the existence of solid waste management practices (field data 2023).

Figure 1 illustrate the level of awareness concerning waste management among the residents within the study area. Half of the respondents (50%) knew about the existence of solid waste management practices and the approach of the city. However, 46% of the respondents didn't know about it, and were completely new to the concept of waste management programmes. A leader in the community said concerning the waste management approach of his community. The study examined through 'perceptions of the respondents' the categories of waste generated in their households. This was based on different categories of solid waste specifically characterized for the study. The characterization included food waste, plastic waste, paper waste, metallic waste and mixed or inseparable waste (this include materials whose waste are co-joined together such include some household equipment such as electronics. Hence, plastic waste was found to be 49% while food waste accounted for 32%, paper waste was 7% and metallic material waste 4.5%. Inseparable or mixed waste was 7.5% and 1% of the respondents decline

to respond to the question. These are represented in a column below.

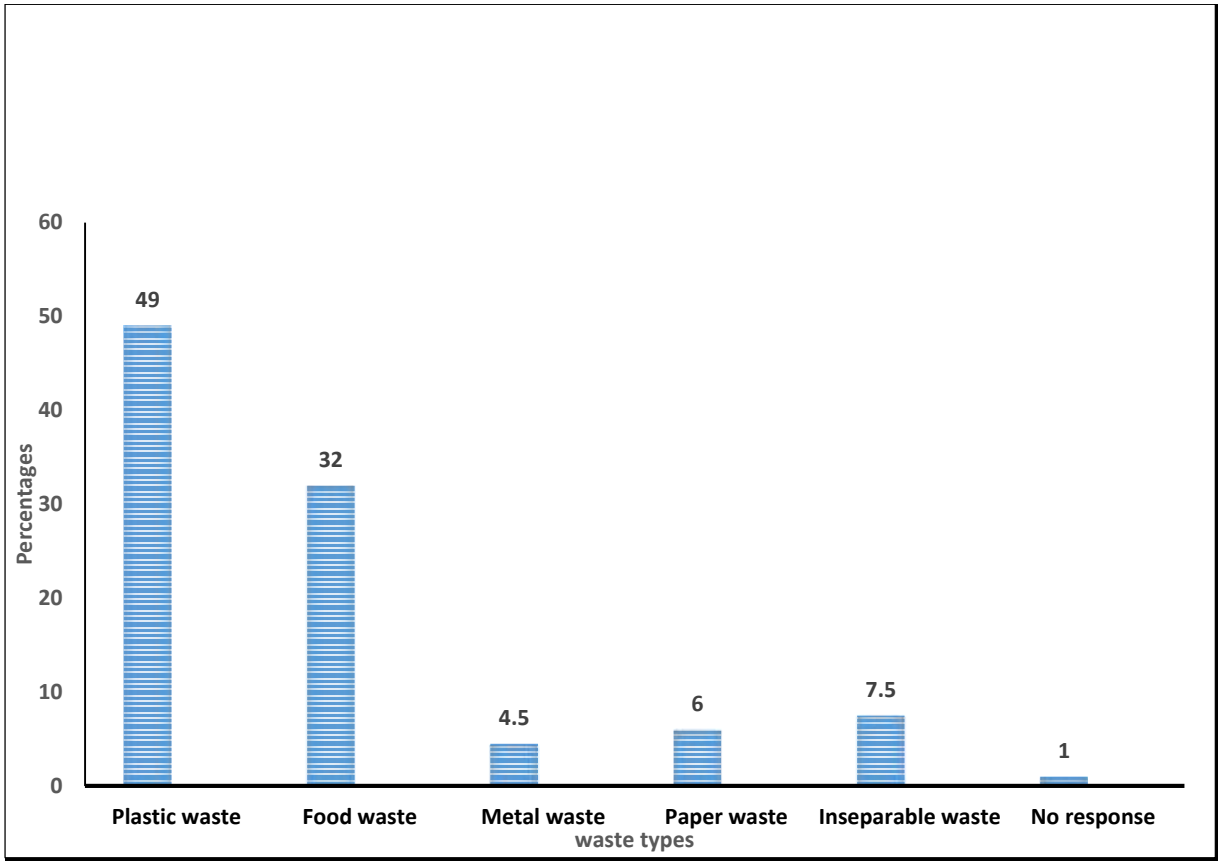

Figure 2: Types of waste generated in Bukavu City households (source: field data)

Plate 1. Solid waste on a road in Bukavu, source: field data, 2023

Frequency of waste disposal per household

For a family home, emptying dustbin might be done once every day or twice due to general bin filling up with household waste.

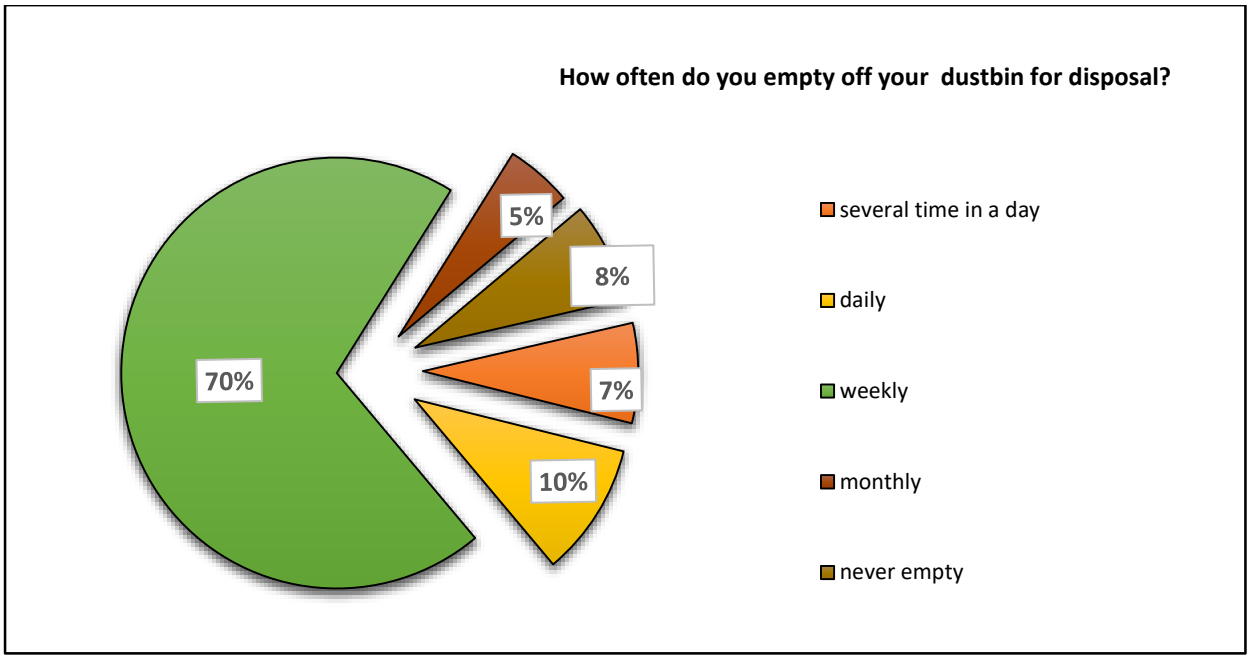

Figure 3: Frequency of waste disposal in Bukavu Town (source: field data 2023)

The study discovered that approximately 57% of household were using refuse sacks for storing their solid waste, while 25% were using polythene bags and 18% were using standardized dustbin. It was also observed that solid waste donned different

streets yielding offensive odours in public space (Plate 1). A community leader concurs saying

> 'Solid waste is not separated, so it is collected together and dumped on the streets and bushes in the city. It has always been difficult to manage waste in this city'

Plate 2: Mixed waste in Bukavu (source: Field data 2023)

Rate of people engaging door to door municipality waste collection service

On the rate of people engaging door to door municipality waste collection service in the city, It was discovered that 55% of the respondents engaged door to door waste collection services from either the private or government agencies while 37% of respondents affirmed not to engage these waste collectors. However, 8% of the respondents said they never knew whether they were engaging solid waste collectors or not. Figure 4 below depicts the percentages of household that engage waste collection services in Bukavu City.

Figure 4: Percentages of household that engaged waste collection services (source: field data 2023)

Furthermore, on the amount of money paid per household for garbage collection service, the study revealed that close to halve of the respondents (47.2%) were paying an equivalent of 7 to 10 dollars to the garbage collectors per month while 32.5% were paying 4 to 6 dollars per month, 14% were paying 11 dollars and more and 6.3% were paying 1 to 3 dollars per month.

DISCUSSION

The study allowed the adolescents to participate with understanding that adulthood transitioning periods is one of the key parameters in determining environmental behavior [18]. However, the demography of Bukavu depicts that about 52% are less than the age of 18 years [14]. This shows the

youthfulness of the population involved in the study. Also, it was revealed that Bukavu City is a multicultural setting with people of diverse nationality. Respondents that were from Democratic Republic of Congo were 80% while non-Congolese were 15% and they were mostly from the immediate neighbouring countries of Rwanda and Burundi. However, 5% of the respondents refused to state their nationalities. In order to ensure the validity of the respondent answers and their familiarity with case environment, the study examined the time the respondents have lived in Bukavu City. Eisenhart et al. [19] emphasizes that the proportion of time spent in a location (that is resident time) have a role to play in determining the sense of place [19]. It discovered that 28% of the respondents have lived in the city for 9 years and more, while 22.2% have live for 3 to 5 years and 15% have lived for 6 to 8 years. However, 28% have only resided in the city below 2 years while 5.8% of the respondents refused to state the time they have spent in the city. The volume of urban household solid waste is dependent on the solid waste generated in each household. One of the factors that influences the characteristics of household waste is the family size [20]. The study analyzed the size of the households of respondents and discovered that 40% of the respondents had 3 to 5 persons in their households while 26% had 6 to 8 persons and 21% had 1 to 2 persons in their households. However, 12% of the respondents had 9 and more in their households and 1% of the respondents refused to say the number of persons in their households. Therefore, the mean household size in the survey was 5 persons. This is in line with the range of the recent survey of Mathobela et al [21] on pig farmers in Bukavu City. Result of figure 2 is consistent with studies carried out in Bukavu by Zagabe et al [12], where it was found that plastic waste was 19% of the solid waste produced; and Forbid et al [22] in Cameroon in the city of Deschang found that plastic (3.97%) was the most non degradable waste produced. It is to be noted that in this study the value of non-biodegradable waste is much higher than that of biodegradables. Plate 1 below shows solid waste on one of the roads in Bukavu City. There were no records of the exact estimated quantity of waste produced in household and the community. However, the study found out that the majority of families in Bukavu City (50%) generated 1 to 2 sacks of waste per week, while 3 to 4 sacks per week of waste were generated by 35% of households and 15% generated 5 sacks and more. A recent study by Zagabe et al, [12], discovered that 521 tons of waste is generated per day in Bukavu City averaging to a daily generation of 0.51kg of waste per person. Figure 3 shows that the majority of inhabitants (70%) were emptying their garbage on a weekly basis. One of the key interviewees working with a government functionaries said 'this is due to the fact that the town does not have a solid waste management functioning garbage collection system. Through physical observations by the researcher, it was noted that waste was never segregated or separated at any stage of waste management process within the study area. Thus, the solid waste collected in different homes and disposal sites within the study area was disposed of without separation. Hence, the study area was practicing mixed solid waste at household level, market places and at the disposal sites, where by solid waste is never subjected to separation.

CONCLUSION

The study concludes that the solid waste management system in Bukavu City is still lacking the adequate apparatus that will encourage the city's total environmental sustainability. This includes the creation of awareness and education of the inhabitants to enhance knowledge on the systems, as well as empowering the public to participate in the management of their solid waste. It is also noted during this study that the contribution of the city and central governments have not been visible in the system nor a convincing workable waste management policy identified. This, apart from the non-availability of satisfactory and essential waste management machinery, will encourage urban environmental sustainability.

RECOMMENDATION

The study, therefore, recommends an inclusive and all-encompassing sustainable urban governance that encourages effective community participation in its process. This must have primarily the intent of environmental sustainability as its background and include the diverse waste management processes expected for the city health security. Hence, it must come along with effective sensitization, education and communication to the community of its environmental concerns which include its solid waste management. This must not only be a pro-government issue, the city government must also encourage the non-governmental organization, community organization and faith-based organization to be included in the enlightenment program for its effectiveness. This is because adequate community participation is expected to enhance effective participation of citizenry and the giving of their supports to the adopted process. Therefore, the city needs a sustainable waste policy that will embrace the legal and institutional frameworks and shoulder the waste management technologies.

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