Municipal Solid Waste Management: Towards the Realization of Sustainable Management in the Context of Sri Lanka's Kandy Municipal Council

Kodagoda Withanage Harshani Chathurika Bandusena, Shadi Kafi Mallak, Mohd Armi Abu Samah

ABSTRACT---Over the past decade, generation of Municipal Solid Wastes (MSW) in Sri Lanka has increased due to rapid economic growth, industrial and urban development. Thus, the management of MSW in Sri Lanka can be considered relatively poor and inadequate. This study conducted, among residents and workplaces in the Kandy municipal council area. It proposes to study the knowledge, perception, and concern of the respondents. The questionnaires were distributed among 340 respondents. The findings of this study show that only 56.5% of respondents' have proper knowledge of solid waste management practices. Basically, in at the same time, the results had been showed lack of perception and concern as percentage 59.8% and 60% among considered respondents. The results revealed that there is a lack of knowledge, perception, and concern of respondents towards municipal solid waste management. The study further provides potentials of MSW management system for sustainable environmental development in KMC.

Index Terms: knowledge, perception, concern, municipal solid waste management, Kandy Municipal Council (KMC)

I. INTRODUCTION

Through urbanization and population growth, the complexity and volume of municipal solid waste (MSW) tend to increase significantly; prompting the need for proper management [1]. Globally, about 1.3 billion tons of MSW are produced annually. Indeed, the amount has been predicted to increase to an annual rate of 2.2 billion tons per year (by 2025) [2].

Indeed, one of the greatest challenges facing authorities in various cities, especially in the developing world, involves MSW management. Also, the municipal budget continues to be strained because of the increase in the volume of the MSW that is generated. Hence, MSW management has proved costly, a problem compounded by a perceived lack of understanding regarding different factors affecting or shaping various stages of MSW management; besides some of the feasible solutions through which the entire management channel could be handled [3]. Also most of the Asian countries have witnessed growth in industrialization, which has had a trickle-down effect of rapid economic growth. Due to unmonitored and uncontrolled urbanization, waste disposal and management have proved problematic [4]. In Sri Lanka, this challenge is prevalent and forms one of the national concerns in the country. Also, the National Action Plan of Sri Lanka has identified the hazardous ways of solid waste disposal as one of the major contributors to environmental degradation but open dumping dominates MSW management and disposal in the country [5].

In Colombo municipal zone, the MSW challenge is also prevalent; especially in the suburb. Apart from this region, the country's operations are mostly shaped by operations of the public sector, as well as urbanized municipalities. Particularly, MSW management forms one of the promising avenues that offer employment to residents. Also, most of the MSW expenditure is directed to the collection and transportation of the waste, making the disposal and treatment phases wanting [6].

Based on the observations above, the current state of MW management in the country has reached unacceptable and environmentally unfriendly levels; especially regarding the procedures of collecting and treating the wastes. From a report by the National Solid Waste Management authority, a 2011 documentation by JICA (Japan International Cooperation Agency), 6,400 metric tons of garbage were collected among 311 local authorities (per day), implying that the garbage collected annually stood at about 2.3 billion metric tons [7]. The implication is out of the total amount of waste generated daily, garbage accounts for 39 percent. Of importance to note is that this wanting or dire situation comes at a time when Gohagoda has been selected for pen dumping in Sri Lanka, a poor waste collection and management option [8].

II. METHODOLOGY

From the scholarly observations documented above, this study employed a structured questionnaire as a data collection instrument. The main aim of this instrument was to ensure that the perception, concern and knowledge of the citizens were assessed relative to MSW management. Also, the objective was to discern if the participants understood the correlation between appropriate MSW management and the concept of sustainable development. In the questionnaire, three sections were presented. The respective sections sought to gain insight into the following issues:

The participants' knowledge regarding the MSW management process

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The participant' perception and knowledge about the relationship between MSW management and sustainable development

The participants' concern about environmental sustainability in relation to the current MSW management practice in Sri Lankan context

For each interviewee, permission was secured before prompting them to give opinions regarding the type of facility they preferred to be situated at Kandy Municipal City. Some of the options with which the participants were presented included a recycling facility, a landfill, and an incinerator. To determine the accuracy of the sample size, hence representativeness, the equation that was adopted was as follows [9]:

$$S = \frac{(1.96^2 * 13753829 * 0.5)\,(1-0.5)}{(0.05^2 * (1368216 - 1) + 1.96^2 * 0.5\,(1 - 0.5)}$$

Once all answered questionnaires were gathered and raw data available, statistical analysis was carried out using the descriptive statistic for summarized large set data, include frequency, relative frequency, and cumulative frequency.

III. RESULTS AND DISCUSSION

A. Knowledge of respondents of the MSWM practice

Indeed, one of the critical challenges facing the majority of developing countries involves MSW management, as well as the disposal of wastes. This challenge points to the criticality of embracing sustainable waste collection and disposal procedures, especially due to the need to achieve environmental friendliness, as well as safeguard the health of the affected populations [10].

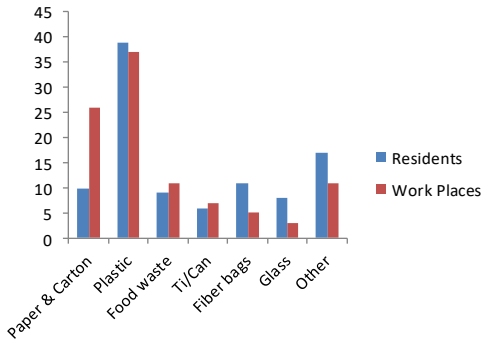

Figure I; Types of generated MSW

These statistics indicate that the resident mostly discarded food waste (39%), paper and carton (17%) and glass wastes. However, workplaces mostly discarded paper and carton (26%), plastic (37%) and food waste (11%). This result supported by, [10, 11] reported that 38% of food waste and 40% of plastic waste are the most common wastes generated from households. In the study has been done by [12] the maximum percentage of generated wastes allocated to food and plastic wastes.

However, altogether 49% from residents (food waste and other) and 37% from workplaces discarded organic waste. The results supported by [13] which estimated 40% of households and workplaces were generated food waste.

According to statistics of [14], 23.1 Tons of solid waste is generated in Kandy town per day. Similarly, knowledge is considered as an important measurement explaining the municipal solid waste management practices by the individuals [15].

As shown in figure II: below, most of the residents and workplaces empty their collected waste every day. The respondents in who had been successfully answered regarding how often the waste container emptied nearby the places [10].

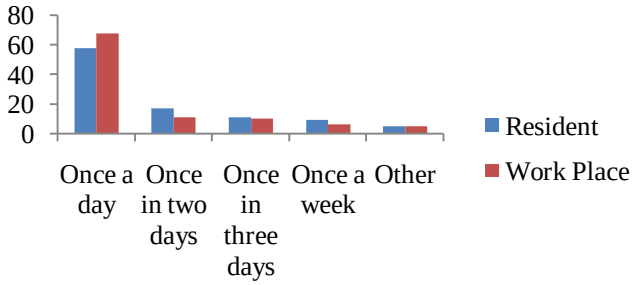

Figure II; Dispose of time of collected MSW

Approximately, 58% of residents and 68 % of work Places empty their MSW daily. The similar results were identified by [12], [16] as 61 % of the households and 70 % of workplaces dispose of their waste daily. About 17% of residents and 11% of workplaces dispose of the waste once in two days while 11% of residents and 10% of workplaces dispose of the waste once in three days. Notably, 9% of residents and 6% of workplaces personnel dispose wastes at least once per week.

As illustrated in figure III; the availability of public waste bins for residents is 12% and workplaces 35%. The result was in line with the previous study like [15] who mentioned that around 15% of the availability of public bins for residents in the KMC area in Sri Lanka. And 88% of residents and 69% of workplaces do not have public bins nearby to dispose of MSW.

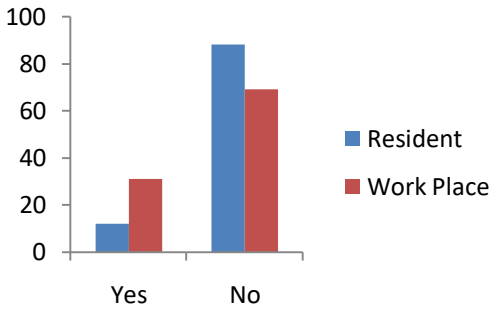

Figure III; Availability of public waste bin

In other studies [18, 19], findings demonstrate the absence of public bins in areas such as workplaces and

residential zones. In the Indian context, a similar trend holds whereby most of the public arenas lack enough public bins for waste disposal, especially MSW. The eventuality is that most of the waste is disposed improperly [20]. The emerging trend is that the lack of adequate public bin has contributed to improper MSW management practices, with KMC unexceptional.

B. Concerned about MSWM practice for sustainable environmental development

Figure IV illustrate the opinions of the participants regarding issues surrounding MSW management in the research context. From the outcome, it is evident that MSW management plays a crucial role towards the realization of environmental sustainability or friendliness, a trend calling for the need to adopt an evidence-based approach in planning for and implementing ideal and informed MSW management strategies. In so doing, it is predicted that a region such as Sri Lanka's KMC might realize a pleasant and healthy living environment.

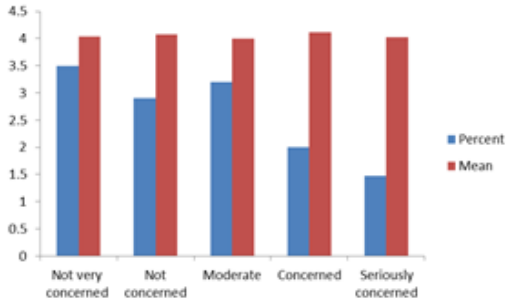

Figure IV; Percentage of the respondents concerned

According to figure IV, 83.9 % respondents concerned about recycling methods. More than half of the respondents' concerned that they used recycling methods to dispose the MSW properly, this is confirmed by (M =4.04 SD=0.659). This result supported by [15] who mentioned that around 85% respondents were concerned about the recycling method in the KMC area in Sri Lanka. About 79.5 % of the respondents concerned about the practice of composting of MSW, (M=4.08 SD=0.675), indicating that they have a positive concern on waste disposal. This finding was indicated by [15], [16] they found that only 81% of the respondents are concerned about the composting. About 83.5 % of the respondents concerned about the knowledge for practicing reuse the waste, mean and SD (M=4.00 SD=0.714), indicating more than half of the respondents' have a high concern about the waste disposal. This finding was indicated by [16], they found that only 81% of the respondents are concerned about the composting. Almost, 82% of the respondents concerned about the separation of waste for an efficient process, (M=4.12 SD=0.767), indicating the respondents have enough concern about waste separation for efficient waste disposal. A similar result of a study done by [13], [15] mentioned that 84% of respondents were concerned about waste separation. About 77.2% of the respondents' concerned about the sustainable environmental development of KMC, (M=4.03 SD=0.742), indicating that the respondents have possible concern for sustainable environmental development.

C. Perception of MSWM practice for sustainable environmental development

In Figure V, the opinions of this study's participants are summarized. The viewpoints ranged from those who were in strong agreement to those who were in string disagreement, governed by the five-point Likert scale.

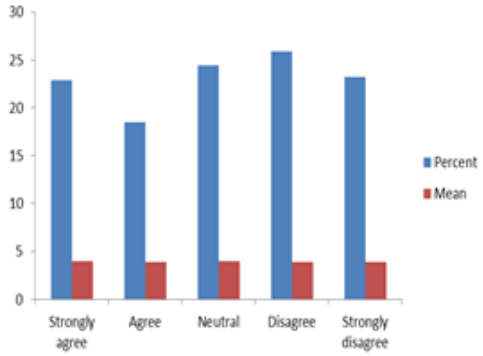

Figure V; Percentage of the respondents' perception

Approximately, 79.6 % of the respondents agreed thatthe waste management system is more crucial to manage municipal waste and confirmed by the weighted mean 4.01. This result in line with previous studies like [16], [17] who mentioned that around 80.3% of the respondents' have the perception that municipal solid waste management practices will be effective. About 81.3% of the respondents confirmed that burning garbage in every household is more essential to clean the environment, (M=3.94 SD=0.678), whereas 82.3% of the respondents were having the perception of dumping garbage in the river is another way to clean the environment, (M=3.96 SD=0.779), indicating that they have low perception of disposing waste. These results were indicated by [15] around 82% of respondent's practices burning and dumping the wastes in Sri Lanka. Also, 77.4% of the respondents mentioned to throw garbage anywhere far from their residence is more suitable, (M=3.94 SD=0.709), indicating that the waste disposed of in residents and workplaces based. Around the 77% of the respondents mentioned burying hazardous wastes underground is one of the methods to keep a clean environment, (M=3.87 SD=0.759).

IV. CONCLUSION

In summary, this study sought to explore the concerns, perception and knowledge of residents about MSW management in KMC, Sri Lanka. The motivation was to predict some of the feasible approaches through which sustainable development might be realized in the region, especially that which targets the physical environment and the attribute of public health. Form the results, the study established that MSW disposal and management is dire, especially due to poor implementation of relevant policies. As such, the study recommends that sustainable development is realized in KMC through the use of evidence-based and environmentally-friendly MSW

management procedures. It is also notable that in KMC, public bins are inadequate; a problem coming in the wake of the dominance of unlicensed waste disposal and management procedures. With MSW management laws and regulations highly flawed in the region, the study concludes that the state of waste disposal and management in KMC requires early intervention; including mechanisms such as waste separation and recycling.

According to this study identified MSWM as the mainstay of sustainable environmental development. Therefore, this study contributes to knowledge by determining the importance of MSWM for sustainable environmental development in the developing Gohagoda, KMC areas. The strength of this research study is the setting which is the newly organized area, KMC, Sri Lanka.

Based on the above results, we present the following recommendations.

- Need to be provided of satisfaction public waste collecting bins by KMC in cooperation within Gohagoda (Sri Lanka) area for proper municipal solid waste management
- It is recommended to provide separate waste bins for various groups of MSW in order to encourage waste separation
- Need to be establishing systematic observing processes for municipal waste collection
- KMC should be support for waste separation, recycling, and reuse
- KMC should again encourage the community to prevent MSW generation through public meetings and awareness programs

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