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**Research article**

**AN ANALYSIS OF PUBLIC PERCEPTIONS OF DOMESTIC SOLID WASTE MANAGEMENT: THE CASE OF THE MAKE ZAMBIA CLEAN AND HEALTHY PROGRAMME IN LIVINGSTONE**

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**ABSTRACT:** Solid waste management (SWM) continues to be a major concern in Zambia in spite of the several mitigation efforts by government. This study was conducted to analyse public perceptions of domestic SWM by evaluating the Make Zambia Clean and Healthy (MZCH) campaign in the city of Livingstone. An eclectic approach was employed for this study. Three representative localities (low, medium and high density) with a total of 3940 households were surveyed out of which a total of 202 respondents were proportionately sampled through simple random and systematic methods. Data was collected between February and March, 2013. Coded data were entered into the SPSS version 16.0 to generate descriptive statistics, and application of MANOVA. MANOVA results show that only two independent variables [monthly income having:  $F(6, 376) = 3.55, p=0.002$ , Wilks' Lambda ( $\lambda$ ) = 0.89 and partial eta squared = 0.054]; and residence classification having: ( $F(6, 392) = 2.09, p=0.05$ , Wilks' Lambda ( $\lambda$ ) = 0.94 and partial eta squared = 0.031)] reached statistical significant multivariate differences at  $p \leq 0.05$ . This result indicates, first that the demographic factors did not influence public perceptions of the effectiveness of the MZCH programme. Second, there were no major differences in public perceptions of the domestic SWM system among the different socioeconomic households of the city of Livingstone. Further, results of this study suggest that the campaign was viewed as being ineffective and so largely unsuccessful, as the local community members largely felt they did not participate in the decision making and implementation processes of the programme. This was despite 77.0 percent of the respondents having indicated that they had heard about the campaign. Therefore government should involve the public in identifying future SWM solutions and to provide information to all concerned persons about practical aspects of waste management.

**Keywords:** Domestic Solid Waste Management, Households, Livingstone, Make Zambia Clean and Healthy Campaign, MANOVA, and Perception.

**ACRONYMS**

SWM: Solid Waste Management

MZCH: Make Zambia Clean and Healthy

SW: Solid Waste

MSW: Municipal Solid Waste

DSWM: Domestic Solid Waste Management

MLGH: Ministry of Local Government and Housing

SPSS: Statistical Package for Social Sciences

ZMW: Zambian Kwacha (Official National Currency Symbol)

DSW: Domestic Solid Waste

RDC: Resident Development Committee

CBO: Community Based Organisation

ZCCM: Zambia Consolidated Copper Mines

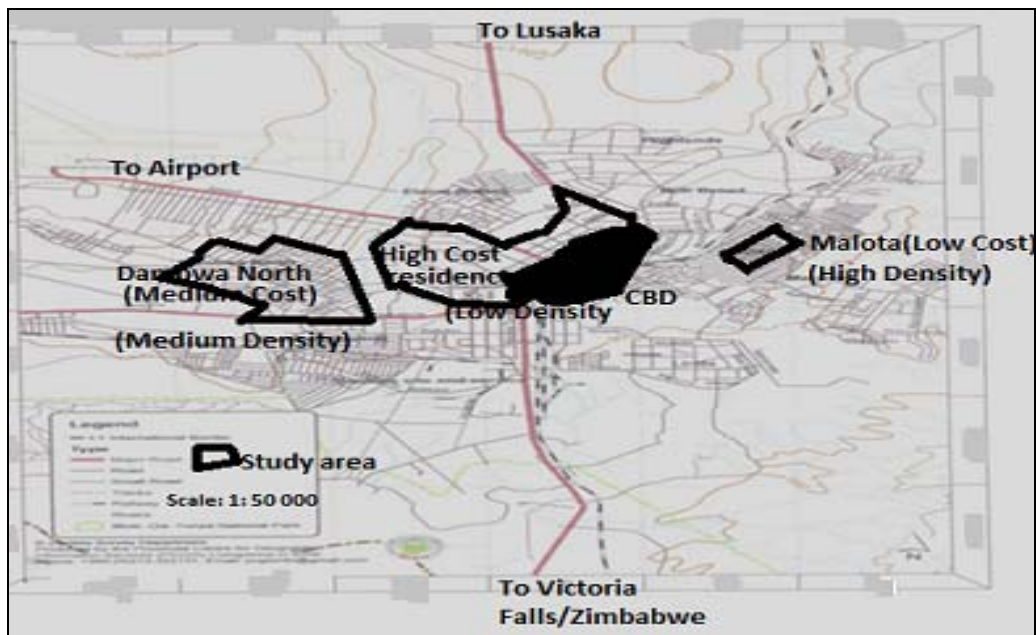
## INTRODUCTION

The processes of living, eating, working, playing, and dying all utilise consumer goods whose production and use, generate waste. [39], estimated, for instance, that each person in the world generated 200 kg of solid waste (SW) per year in the late 1990s. The rapidly increasing quantity of waste was owed to urbanisation, industrialisation, and the inadequate investment in infrastructure. The introduction of new consumer products on the market also contributed and continues to contribute to the problem of waste management in the Third World cities. Of concern, particularly in Zambia, is that generation of waste continues to outweigh the capacity of local authorities to manage it adequately. For instance, of the two million tonnes generated in 2006, only 20 percent was collected and disposed of at designated sites [14]. In fact, in many other cities and towns, particularly, the situation is even worse. For example, according to [19], the estimated generation rate is 0.6 kilogrammes per capita per day for Lusaka. Further, according to [13], in Lusaka the annual average amount of SW had been increasing and was expected to grow from 220, 000 tons recorded in 1996 to 530, 000 tons in 2011, an increase of 141 percent. On the other hand, past works indicate that in Lusaka about 90 percent of the 1 400 tonnes of the Municipal Solid Waste (MSW) produced daily, was left uncontrolled, even though the private collectors complemented the local authority by collecting two percent of MSW on a commercial basis [30; 29]. Further, in the city of Ndola, Zambia, until the early 1990s, SW was collected from residential areas at no cost to households; because like many other urban areas of Zambia then, the city council could afford a free collection and disposal of SW due to a vibrant city economy [13]. [13], however, reports that due to most companies in the city of Ndola having had been privatised or folded due to lack of capacity to compete with imports beginning the year 1991, the Council's revenue base drastically reduced; therefore, Solid Waste Management (SWM) in the city completely collapsed in 2000 especially with the Zambia Consolidated Copper Mines (ZCCM) having been privatised and the new owners having been no longer interested in SW collection and disposal. The new mine owners wanted to concentrate on the core business of mining. Similarly, in the city of Livingstone (Zambia), the underlying causes of the majority of the environmental problems were attributed to inadequate spatial planning, unemployment and poverty as well as the poor management practices, among others. In this regard, a UN-Habitat [38] survey revealed that while the Central Business District (CBD) of Livingstone was kept fairly clean with regular collection services, areas outside the CBD were not serviced and waste in residential areas was either disposed of in backyard pits or dumped in open spaces, a matter that gave rise to vermin and diseases. This was so despite the many mitigation efforts that government continued to put in place such as the ongoing Make Zambia Clean and Healthy (MZCH) campaign. The MZCH campaign, launched in 2004, is an ongoing multi-faceted programme partly aimed at collecting and disposing of garbage appropriately [28]. Reasons are abound for DSW challenges continuing to ravage communities of cities such of Livingstone albeit the MZCH campaign ongoing. For instance, from the governance perspective, the recent upsurge in waste collection and disposal problems stems from the fact that attitudes and perspectives towards wastes and the rating of waste management issues in people's minds and in the scheme of official development plans have not been adequately considered [20; 3]. Because available literature reveals that no study has been done to evaluate the effectiveness of MZCH programme in the city of Livingstone; this study attempted, therefore, to analyse the public perceptions of domestic SWM by evaluating the MZCH campaign in the city of Livingstone. Further, because Livingstone is Zambia's tourist capital, an environment free from waste is crucial. Therefore, effective DSWM is vital. The findings of this study are anticipated to enhance knowledge for policy makers and the general citizenry in their quest for more effective SWM strategies.

## MATERIALS AND METHODS

### Study Area:

The study was carried out in the city of Livingstone, Southern Zambia. The City of Livingstone lies about 473 kilometres south of Lusaka, the capital city of Zambia. It is approximately defined by Latitude 17° 51'S and Longitude 25° 52'E. The City of Livingstone spatially is the smallest in Zambia with an urban area of about 69 km<sup>2</sup>. Three localities were surveyed each representing a low density (area North-West of the city's CBD), a medium density (Dambwa North) and a high density (Malota) residential areas, respectively (Figure 1). The City of Livingstone, until the year 2011, the regional capital of the Southern Province, is the tourist capital of Zambia. Arguably, it has potential to be the number one tourist destination in Southern Africa. Among the tourist attractions, the city boasts of the Victoria Falls, the Seventh Wonder of the World and a renowned world heritage site. Due to its border location, Livingstone City is a gateway by air, rail and road to Southern Africa.



**Figure 1: An enlarged view map of the city of Livingstone showing the three surveyed (study) areas**

*Source: Adapted from the Provincial Centre for Geographic Information Services (2008).*

Total population of the city stood at about 61,296 in 1980, 83,780 in 1990, 103,288 in 2000 and 136,897 in 2010 [9]. The total number of households in the city in 2000 were about 18, 856; however, the total number of households for the representative three study areas stood at 3,940 [8].

### Study design

The design of this study is a survey. A survey design enables obtaining of research data aimed at generalising, in this case, public perceptions, from the sample to a population so that inferences can be suggested [11]. Also, three other recognisable advantages of the survey method include the rapid turnaround in data collection, suitability to obtaining the targeted sample size and the economy of the design [11].

### Standard questionnaires (Interview Schedules)

A closed-ended standard questionnaire was administered to households' representatives by the researcher with the help of research assistants. All in all, a total of 202 questionnaires were successfully filled in and retained for the data analysis of this research, which represented a more than 100 percent response rate since initially the targeted sample size was only 200 (Table 1). The age range for the respondents was 18 to 81 years. Further, in order to maximize the retention of the distributed questionnaires and enhance data collection within the limited time period, the researcher and/or research assistant interviewed the respondents in the appropriate language. Thereafter, the researcher filled in the questionnaire on behalf of the respondents especially where evidence or a suspicion existed that the respondents were of low education standard ('illiterate') and so likely to inhibit the understanding, and therefore diligent answering of this research instrument. This survey instrument was designed to collect data on the following nine themes: respondent's demographic characteristics, public perceptions on the importance of DSWM, awareness (knowledge) of the existing DSWM system, and the effectiveness of the MZCH programme. Other areas included the public perceptions on what constitutes common DSWM, extent of local community's participation, socioeconomic and ecological affects, ability of the public to improve DSWM and preferred DSWM approaches. In total, 71 items were listed under the above mentioned themes of the questionnaire. Further, the respondents were asked to rate their level of perception of various DSWM concerns such as importance, awareness, community participation, socioeconomic affects and effectiveness on a five point Likert Scale. The Likert Scale is used in order to measure the strength of the respondents' perception of the domestic waste management issues under consideration [32; 18]; 37].

Likert scaling ranged from 1 to 5 for categories like; ineffective to very effective for the outcome (or effectiveness) measure, strongly disagree to strongly agree for the public participation's influence measure, very low to very high for the public participation rating and system's affects on socioeconomic and ecological issues measures, and not important at all to very important for the importance rating measure. Other categories included; not informed at all to very well informed for the awareness rating measure; and never to very frequently for the frequency of the community members' working together measure, respectively. By Likert's method, a person's perception and hence attitude are measured by combining (adding or averaging) one's responses across all items.

### Interview Guides

Information and data from key informants was acquired through interviews. With the initial target key informants comprising the Livingstone city council employees (MLGH), the other key informants were established by applying a snowballing sampling technique. Two authorities were interviewed at Livingstone City Council, namely, the Deputy Director and the Solid Waste Manager, both from the Public Health and Social Services Department. Further, two community leaders (one from Dambwa North) and another from Malota were also interviewed. And finally, two employees of a private firm that is involved in the collection of garbage from households and private organisations were also interviewed. These were the Director and a driver of the firm called Essential Environmental Services based in Elaine Britel residential area in the city of Livingstone. The firm operates as a franchise. It is worth mentioning here that the actual names of the key informants have deliberately been concealed because the researcher assured anonymity to the respondents. However, the researcher assumes that the mentioning of their (interviewees') designations and organisational identities would suffice.

### Data Collection Procedures

Preliminary (secondary) data was collected through a review of available literature. The collection of primary data was carried out between March and April, 2013. Initially, the researcher identified and engaged a total of seven research assistants bearing in mind that there was limited time within which to do the exercise and also that the sample size was too large for one person to handle effectively. A one day training meeting was facilitated by the main researcher to acquaint the research assistants with interviewing skills and terminologies used in the survey instrument, and the sampling formalities. The main researcher was also actively involved in data collection as much as providing the necessary supervision to the assistants. However, the collection of data from key informants was solely carried out by the main researcher. This was after all the data was collected from the households in the three localities. This was done within the same period mentioned above.

### Sampling Frame

The sampling frames used in this study were Zambia's national population census reports of 2000 and 2010 by the CSO from which the study areas' population and consequently sample sizes were obtained.

### Sample Size

Considering that the combined total number of households for the three sampled study areas was 3,940 [8]<sup>2</sup>, a total of 202 (Table 1) respondents from a random sample of multi-persons households in single-family dwellings were selected to represent the target population for this study. This is in accordance with the recommendation by [40], for a minimum five percent sample size requirement where there is a population of between 1001 and 10,000. However, using stratified random sampling, proportionately 43 (21.3 percent) respondents were selected from the high income - low density residential area North-West of the city's CBD; 75 (37.1 percent) respondents from Dambwa North (middle income – medium density residential area); and 84 (41.6 percent) respondents from Malota (low income – high density residential area), respectively (Table 1).

**Table 1 Classification of residential areas and corresponding number of households sampled**

Classification of Area	Total Households (N)	Selected No. (n)	%	Area Name
Low Income/High Density	1680	84	41.6	Malota
Middle Income/Density	1397	75	37.1	Dambwa North
High Income/Low Density	863	43	21.3	Area NW of CBD
<b>TOTAL</b>	<b>3940</b>	<b>202</b>	<b>100</b>	

Source: Adapted from [8] Report

A  $\frac{1}{20}$  ratio[f] (or five percent) was used to derive the number of respondents per study area (i.e.  $f = \frac{n}{N}$  [2; 7]; where f is the ratio used to calculate the number of respondents per area of study, n is the sample size, and N is the population size).

### Sampling Procedure of Respondents

Through a systematic (interval) sampling method, the household units were selected from which respondents by proxy were obtained. The following formula was applied to arrive at the interval length ( $k$ ) for households from which respondents were obtained in each socioeconomic household stratum. Formula:  $k = \frac{N}{n}$  [7], where;

- $k$  is the interval length (i.e. in this case, implies that every  $k$ -th household in a given number of households [population]);
- $N$  is the size of the population (total number of households); and
- $n$  is the size of the sample (number of households/respondents).

Therefore, applying the above formula and starting with a randomly chosen household unit between 1 and  $k$ , both 1 and  $k$  inclusive, from a pre-determined street in each stratum, the following pattern was followed in selecting the household units from which respondents were obtained. Given that  $n=200$ ,  $N=3940$ , it follows therefore that  $k = \frac{3940}{200} = 19.7 \approx 20$ . This means that the researcher began with selecting a randomly identified household unit between 1 and 20 (both 1 and 20 included) in a pre-determined street, and then picked a respondent from every 20<sup>th</sup> ( $k$ -th) household unit in each stratum.

### Data Analysis

Most of the data in this study was analysed quantitatively. Analyses involved obtaining descriptive statistics (percentages and frequencies, means and standard deviations), and applying a one-way between groups Multivariate Analysis of Variance (MANOVA) to examine whether the population's public perceptions are different by demographic characteristics or socioeconomic status households. Some qualitative data obtained from the seven key informants through interview guides were analysed thematically. This qualitative information was fused into the quantitative data to solidify the findings on DSWM system in the city of Livingstone. The coded data from the 202 correctly completed questionnaires were entered into the SPSS version 16.0 to perform quantitative analyses. Respondents on average gave responses to 71 attributes of public perceptions of DSWM in the city of Livingstone. Data analysis procedures and brief discussions for each analysis follow.

### Generation of Descriptive Statistics

Descriptive statistics were generated from the coded survey questionnaire data. These statistics (percentages, frequencies, means and standard deviations) were used to analyse most of the specific objectives and their respective research questions.

### Multivariate Analysis of Variance (MANOVA)

To examine whether the public's demographic factors can generalise their perceptions of DSWM in the city of Livingstone, MANOVA was conducted. The independent variables were eight demographic factors. These were: gender/sex, age/generation, marital status, education, employment, monthly income, residence, and position in family. The dependent variables were perceived public awareness, participation and effectiveness of the MZCH campaign. Procedurally, the three dependent variables were entered simultaneously while the eight independent variables were entered individually. In accordance with guidelines by [36], some groups of five variables were collapsed to obtain better statistical results in this study since some original categories had small samples or too few responses. In this regard the *age* variable was collapsed into three groups, namely: young (18 – 28 years) [35.1 percent], mature (29 – 40 years) [34.7 percent] and older (40+ years) [30.2 percent]. The *education* variable was also collapsed into three groups: up to primary (18.8 percent), secondary (53.0 percent), and post-secondary (28.2 percent). Further, the *marital status* variable was re-coded into two groups. Hence, the resulting marital status variable had categories as follows; unmarried (39.6 percent) and married (60.4 percent).

Further, some groups of *monthly income* variable range were combined and resulted in a total of three groups: income range less than ZMW500 (25.3 percent), income range between ZMW501 and 2000 (50.0 percent), and income  $\square$  ZMW2000) (24.7 percent). The *position in family* or *household* variable was collapsed into three groups: household head (43.1 percent), spouse (female) of household head (35.6 percent), and household representative (21.3 percent). Preliminary assumptions for MANOVA that were tested to find out whether the data conform to these MANOVA assumptions include: sample size, normality, outliers, linearity, multicollinearity and singularity, and homogeneity of variance-covariance matrices [33]. However, some of these tests (e.g. normality) were not strictly necessary given this study's relatively large sample size of 202 subjects that is far much greater than the minimum sample size requirement of 30 cases. MANOVA is an extension of analysis of variance (ANOVA) for use when you have *more than one* dependent variable; therefore, it is used to compare two or more groups in terms of their means on a group of dependent variables [15; 33]. These dependent variables should be related in some way, or there should be some conceptual reason for considering them together. MANOVA compares the groups and tells you whether the mean differences between the groups on the combination of dependent variables are likely to have occurred by chance [33]. To do this MANOVA creates a new summary dependent variable, which is a linear combination of each of your original dependent variables. For MANOVA to be valid, three of the several assumptions that needed to be met are: (1) observations must be independent – responses in each cell are not made independently of responses in any other group, (2) variance-covariance matrices must be equal for all treatment groups – in MANOVA, Box's Test of Equality of Covariance Matrices shows whether this assumption is violated or not [15]. A significance value that is larger than 0.001 means no violation of this assumption [33], and (3) normality – this assumption is that all the variables are multivariate normal. Although it underlies most multivariate techniques, there is no direct test available for multivariate normality [15]. Considering the fact that univariate normality of each variable is tested, Mahalanobis distance is commonly used [33]. Mahalanobis adjustment application also helps to answer the question, 'Do levels of each of the statistically significant independent variables differ on all of the dependent measures, or just some?' In its simplest form this involves dividing your original alpha level ( $p$ ) of 0.05 by the number of analyses that you intend to do [33]. Like the application of ANOVA, the null ( $H_0$ ) and alternative ( $H_1$ ) hypotheses were stated accordingly as follows:

$H_0$ :  $\mu_1 = \mu_2 = \mu_3$  (the population means [ $\mu$ ] are the same i.e. the mean public perception scores of the effectiveness of the MZCH programme as a DSWM system are the same for the three socioeconomic status households);

$H_1$ : At least two mean public perception scores of the MZCH programme as a DSWM system between the three socioeconomic status households differ.

## RESULTS AND DISCUSSION

### Sample size: by sex and age

This study focused on three community settlements chosen for inclusion in the field surveys. In total 202 respondents participated in this survey comprising of 38.6 percent males and 61.4 percent females. This sample consists of a broad cross-section age range of 18 to 81, with a mean age of 35.4 years.

**Table 2: Survey results of major community problems ranked in order of perceived importance from (i) – most important to (v) - least important)**

Malota (n=84)	Dambwa North (n=75)	CBD Area (n=43)
(i) Waste all over the place (60.7%)	Erratic electricity supply (72.0%)	Waste all over the place (48.8%)
(ii) Bad roads (53.4%)	Bad roads (65.3%)	Bad roads (39.5%)
(iii) Not enough toilets and other sanitary services (50.0%)	Waste all over the place (61.3%)	Not enough toilets and other sanitary services; & erratic electricity supply (37.2%)
(iv) Not enough drinking water (47.6%)	Not enough drinking water (54.7%)	Not enough drinking water (16.3%)
(v) Erratic electricity supply (36.9%)	not enough toilets and other	much disease like malaria (13.9%) Sanitary services (30.7%)

(Source: Filed data, 2013)

**Perceptions of the importance of community problems including Domestic Solid Waste (DSW)**

One of the questionnaire items asked respondents to rate by ranking in order of importance issues believed to have had an impact upon waste management. Ratings were made according to ranks ranging from 1<sup>st</sup> (the most important) and then perceived importance decreasing in that order to 5<sup>th</sup>. A similar analysis of ranked data was carried out in an investigation of employee perceptions of the SWM system operating in a large Australian contracting organisation: implications for company policy implementation [22]. The process is mathematical and involves translating a series of rated data into ranks to allow comparisons to be made among subpopulations. Results indicate a high degree of variations in responses between different socioeconomic status household respondents as summarised in Table 2. Most important is the observation that, with the exception of respondents in Dambwa North, the problem of waste was perceived as a leading community problem.

However, when asked about whether or not the residents viewed the issues of DSW collection and disposal important, 70.8 percent of the respondents from the three areas surveyed combined perceived the two issues important. This left a smaller percentage (29.2 percent) of respondents who felt the two issues were unimportant. However, variations in the perceptions of the same issues were observed by respondents in the respective localities, with the high density residential area respondents having a higher perception percentage. In this regard, 78.6 percent of the respondents in Malota viewed the problems as important. On the same, 64.0 percent of the respondents in Dambwa North said the problems were important. About 67.4 percent of the respondents in the low density residential area North-West of the city's CBD perceived DSW collection and disposal as important. Further, of all the 143 respondents who viewed DSW collection and disposal as important issues in their localities, 53.1 percent, when asked to rate the importance of the two issues, rated them as being very important. However, the rating of the two issues as being very important varied only slightly across the three localities surveyed. In this regard, 49.3 percent of the respondents in Malota rated the issues as being very important while 53.0 percent in Dambwa North and 56.6 percent in the low density residential area North-West of the city's CBD, did so, respectively.

**Public perceptions of the current Domestic Solid Waste Management (DSWM) Practices in Livingstone**

From the household survey questionnaire, results show that public perceptions regarding waste management practices varied from one locality to another. When asked about their view on the most common waste collection system in their communities, most of the respondents, that is, 60.7 percent in the high and 58.7 percent in the medium density residential areas said none existed. However, in the low density residential area, the majority (44.2 percent) of the respondents, elected *others*, that included the residents paying for the collection service to a private collection firm and what they termed as 'personal arrangements'. By and large, it is clear from the survey results that the city authorities did not collect waste regularly from the households as evidenced by only 7.1 percent, 4.0 percent and 9.3 percent of the respondents in Malota, Dambwa North and the residential area North-West of the city's CBD, respectively who felt the council did collect. Regarding why respondents felt there was no recognisable collection system; most (over 90 percent) of all the respondents of this study cited the reason that the local city council authority was not collecting waste from residential areas. In this regard, and in a similar manner, past research works elsewhere suggest that historically, the public held the view that the concerns in SWM were viewed as a sole responsibility of local authorities [5; 13].

Asked about the main reasons for the non-collection of waste, responses varied from one residential area to another. For example, the majority of the respondents in Malota, that is, 55.1 percent, elected that the city council authorities did not collect waste. In contrast, most of the respondents in Dambwa North (53.1 percent) and the low density residence North-West of the city's CBD (58.6 percent) perceived '*other reasons*' to have been more important. However, one common major reason among respondents in the three localities was lack of dump sites. This compares well with the research by [31] in Perak state of Malaysia who found that more than 52 percent of the respondents complained that a waste facility could not be easily accessed; therefore, undoubtedly the householders were discouraged to engage in meaningful DSWM. In the same vein, [1], concluded that distance and access to the bins is obviously an incentive to waste management. On the contrary, according to the interview with the Livingstone city council's SW manager, the reasons for the non-collection of waste from residential areas were due to the city council's lack of capacity in terms of finances and transport facilities. This situation is, nonetheless, similar to the findings of [13]'s study in the city of Ndola, Zambia, where it was found that the city council was largely incapacitated in terms of finances, skilled manpower and transport logistics.

This was attributed mainly to the collapse of most of the companies and the subsequent reduction in revenue base of the city of Ndola. Further, [13] particularly point out that the SW collection system in Ndola completely collapsed in 2000 because the ZCCM that also ran a vibrant DSWM system was privatised. Similarly, a previous study carried out in Hanoi, Vietnam by [35], where it was found that local authorities faced inadequacies in labour force, finances and other logistics, attest to this.

When asked about what they did with their own waste, the survey results suggest that composting, recycling and re-using of waste were not common methods used among the respondents in all the three surveyed communities. However, as was anticipated, most of the respondents in the three localities indicated that burying, burning and dumping everywhere within the yards were prominent ways of disposing waste. For example, as regards burying or dumping of waste in a pit within the yard, 22.6 percent, 33.3 percent, and 44.2 percent of the respondents in Malota, Dambwa North and the low density residential area North-West of city's CBD perceived the method as being a major one, respectively. This result is similar to that of the [38]'s study which revealed that waste in residential areas of Livingstone is either disposed of in backyard pits or dumped in open spaces. One method that was, however, peculiar in the high density community (Malota) involved residents taking the DSW to a communal collection point, where approximately 29.8 percent of the respondents, said this was how they managed their waste. Notably, two communal collection points were said to have been only located at the extreme north and south-ends of the residential area, respectively, a matter that was perceived to have been yet another hindrance to effective DSW management in the area. Besides, through an interview with a former Resident Development Committee (RDC) member, this author learnt that residents of this area complained of irregular waste collection by the city council from these communal collection points for eventual disposal at the sole designated dumpsite of the city said to have been located at the extreme north-end of the city. The same former RDC leader further highlighted that, the residents ultimately resorted, more often than not, to burning of these mountains of garbage that accumulated over time at communal collection points. The burning of the waste was said to have caused a common nuisance of air pollution within the community and to areas in the vicinity. Meanwhile, while waiting to finally dispose of their garbage at the communal collection points, respondents generally said that empty maize-meal bags were used as receptacles to temporarily store the waste within their yards. When asked about how long they handled waste this way, there were slight variations in the responses across respondents. However, it is clear that the majority of the participants of the survey indicated that the above practices have been going on for a long time. For example, about 41.7 percent, 48.0 percent, 37.2 percent of the respondents in each of the three communities surveyed, namely, Malota, Dambwa North, and the area North-West of the CBD, respectively, listed that they had managed the waste by either burying or burning it within their yards as far back as 1964.

With regard to the type of receptacles the residents had commonly used, it is clear from the respondents of this study that an assortment of receptacles were used. Mostly, respondents indicated that they had improvised all sorts that included plastic bags (often those they got after buying groceries from super markets such as Shoprite and Spar chain stores), carton boxes and others. Plastic bags were said to have been commonly used by most respondents in all the localities of the city surveyed, for instance, 35.7 percent in Malota, 16.0 percent in Dambwa North and 27.9 percent in the low density area North-West of the city's CBD elected this as the receptacle they had commonly used. Notably, about 45.2 percent of the respondents in Malota also said empty maize-meal bags were listed among the other common receptacles used. A study by [24], in Mutare, Zimbabwe, revealed a largely similar picture where they found that residents used different types of waste receptacles, which were either formal or informal such as; hard plastic bins which were used by 60 percent of the residents, 17 percent used sacks, nine percent cardboard boxes, four percent metal bins and one percent bulk containers. Insignificant as it may appear, it is important to mention that there were quite a sizeable number of respondents (10.0 percent or less) across all surveyed communities who indicated that they were not using any receptacles.

#### **Perceptions about awareness of the MZCH Programme in the city of Livingstone**

The findings of this survey show that the community perceptions regarding their awareness of the campaign when asked whether or not the public had heard of the MZCH campaign's existence revealed that overall; 77.0 percent believed that they had heard about the MZCH campaign. However, the perceived awareness percentage of the campaign varied among the three localities. For example, it was lower among residents from Malota (72.6 percent) and higher among the participants from the low density residence (86.9 percent).



Nonetheless, of the 156 respondents who believed that they had heard about the campaign overall, when asked about how well informed they felt they were about the campaign, the majority of the respondents said their awareness of the campaign ranged from being 'less informed,' 'fairly informed' to 'well informed'. Only a few said that they were very well informed.

Interestingly, 45.9 percent of the respondents in Malota said they felt they were well informed; which was notably higher than that of the respondents in Dambwa North (30.5 percent) and the low density residential area North-West of the CBD (32.4 percent). Although there was no questionnaire item asking the respondents about how they got to be informed about the MZCH campaign, information given by the former RDC member through an interview, however, showed that it was through commemorative meetings that were organised by the government through the city council. Further, the former RDC member revealed that such commemorative meetings were held at market grounds or open spaces often in the high density locality. This therefore, may explain the observed apparent higher percentage of respondents who felt were better informed about the existence of the campaign among the participants in the high density residential area than the other two communities.

### **Residents' Perceptions of their Participation in the Waste Management System's Decision Making Processes**

With regard to public participation in the campaign, results of this study revealed very little degree of differences in responses among all respondents in the three communities. The majority of the respondents felt their participation ranged from being very low (0-20 percent) to being average (41 - 60 percent). About 37.9 percent, 28.0 percent and 37.2 percent of the respondents surveyed in Malota, Dambwa North and the low density residential area North-West of the city's CBD, respectively, perceived their rate of participation in decision making for waste management pertaining to the MZCH campaign as being very low. This result is comparable with the findings of [29]'s study in Ng'ombe and Kamanga high density residential areas in Lusaka where; they concluded that despite attempts in recent times not to force projects on communities, it seemed that some prioritised issues are those of instigators and not totally of the community. The same can be said about the research in Malaysia by [31], who indicated that despite the efforts, little has been achieved due to the lack of participation from the households. Nonetheless, when asked about whether or not respondents thought by working together with the city council authority, community members could positively influence decisions about waste collection and disposal, most of the respondents agreed. For example, approximately 54.0 percent, 55.0 percent and 74.0 percent of the participants in Malota, Dambwa North and the low density residential area North-West of the city's CBD, respectively, agreed that by working together with the city council authorities, residents would positively influence decision making processes on waste management. In the same vein, in a study in Hanoi, [35], concluded that, the local communities once given the opportunity to make decisions and being stakeholders to developmental strategies, they are capable of engaging in adequate waste management. When responding to the survey item about who the survey participants perceived to have been making decisions regarding DSWM, responses across the three surveyed localities were largely homogeneous except for the respondents from the low density residential area. In this regard, over 55.0 percent, 57.0 percent and 72.0 percent of the residents in Malota, Dambwa North and the low density residential area North-West of the city's CBD areas, respectively, said they did not know who made the decisions. This may however, imply that local communities were not part and parcel of the crucial decision making process as regards DSWM strategies. Expectedly, therefore, the majority of the respondents, that is, 61.9 percent in Malota, 74.7 percent in Dambwa North, and 69.8 percent in the low density residential area North-West of the city's CBD, indicated that they had never attended any meeting in their communities which addressed DSWM issues. This (not holding meetings) may justify further the result that there was not much participation in DSWM decision making processes by the local community members.

### **Public Perceptions about the MZCH campaign's Outcome/effectiveness**

One of the main questionnaire items asked respondents to give their opinion on how effective the SWM campaign was. On the same, in Malota, about 67.9 percent said the campaign was perceived as being ineffective (0-20 percent) to being barely effective (21-40 percent), while only 7.1 percent and 2.4 percent, believed that it was effective to very effective, respectively. On the other hand, about 53.3 percent of the respondents in Dambwa North perceived the programme as being ineffective to barely effective. However, only 16.0 percent and 9.3 percent of the respondents in Dambwa North said the campaign was effective (61-80 percent) to very effective (81-100 percent), respectively.

Similarly, 44.2 percent of the respondents in the residential area North-West of the city's CBD viewed the campaign as having been ineffective to barely effective, while only 18.6 percent felt that the campaign was effective to very effective. Interestingly, those respondents who viewed the campaign as being fairly effective did not show marked differences across the three surveyed localities. Approximately, 22.6 percent and 21.3 percent of the respondents in Malota and Dambwa North, respectively, felt that the campaign was fairly effective, although the perception of the effectiveness of the campaign was slightly higher (37.2 percent) in the low density residential area North-West of the city's CBD. However, when asked to voice their opinion on the waste collection and disposal system under the MZCH programme, the majority of the respondents in all the three surveyed areas felt that DSWM had not improved as compared to the pre-MZCH campaign period. In this regard, 70.2 percent, 36.0 percent and 53.5 percent of the respondents in Malota, Dambwa North and the low density residential area North-West of the city's CBD perceived the status of DSWM as being the same as before the launch of the campaign in the city. Only 13.1 percent, 12.0 percent and 11.6 percent of the respondents in Malota, Dambwa North and the low density residential area North-West of the city's CBD, respectively, said that the DSWM system was more effective after the campaign launch period. The rest of the participants either felt that the waste management system was less effective, did not know, or were not sure. The downside, nonetheless, of the MZCH campaign in enhancing DSWM was that many of the respondents felt that the programme did not exist. Approximately 46.4 percent, 40.0 percent, 44.2 percent respondents in Malota, Dambwa North, and the low density area North-West of the city's CBD, respectively, believed that the campaign did not exist. Furthermore, of those who thought the campaign existed, a good number of the respondents said the campaign was an event (that is, it was commemorated only at particular times of the year as opposed to it being an all year round, inclusive activity). In this regard, 30.9 percent of the respondents in Malota said the campaign was an event. Similarly, 36.0 percent and 41.9 percent of the participants in Dambwa North and the low density residential area North-West of the city's CBD, respectively, described the campaign as an event. The rest of the participants in each of the three surveyed communities either felt the campaign was a habit (an all year round activity), too new a concept for them to comment on or felt indifferent about its existence and effectiveness. Clearly, even when combined, this category of respondents was in the minority.

The respondents were asked to give their opinion on the ongoing MZCH campaign hosted by the MLGH. On the question about how effective the campaign was, overall, 82.7 percent of all the survey respondents believed that the campaign's outcome ranged from being ineffective to being fairly effective. This left a meagre 17.3 percent of the respondents who perceived the programme as having been effective to very effective. Asked for the reasons for the failure or challenges of the campaign, the perceived major challenges mentioned included, foremost, less information about the MZCH campaign. This was elected by the majority of the respondents from the low and medium density residential areas. Similarly, according to the study by [34], it was observed that the citizen's perceptions and attitudes depend on the knowledge they had about a facility. Important also was the lack of communal collection points and bins as was perceived by most of the respondents from the low density residential area surveyed. Others were; apparent long distances to the designated dump sites; and nobody cared because there were more other pressing issues in the community like water and poverty, local council authorities having had decided without community members' inputs; and high illiteracy levels for most respondents. Despite this study's finding of lack of communal collection points and bins in the surveyed localities in the city of Livingstone, elsewhere, [21], argued that the benefit a facility (in this case, a dumpsite or collection point) may bring to local residents is influencing public perceptions and attitudes of a DSWM system. In this vein, [1], commented that when citizens who are environmentally concerned have, for example, bins (or dumpsites/collection points) near to their homes, they appear to be willing to engage in DSWM than when they have to walk for a longer time to drop off the waste at a dump facility, due also to the inconvenience of carrying the large volumes that this type of waste usually occupies.

### **Demographic Characteristics and DSWM Perceptions**

One of the specific objectives of this study was to analyse how the public views the current status of the DSW regarding collection and disposal in light of the MZCH campaign in the respective study areas in the city of Livingstone. In this regard, a MANOVA was conducted to test the corresponding research question.

### **MANOVA**

A one-way between-groups MANOVA was performed to examine if public perception differences of the MZCH campaign's effectiveness in enhancing DSWM in the city of Livingstone existed by demographic variables.

Preliminary assumption testing was conducted to check for: (1) sample size, (2) normality (the test check yielded a Mahalanobis distance value of 10.22, which was less than the critical value of 16.27), (3) linearity, (4) univariate and multivariate outliers (found no Mah\_1 or case value larger than the critical value of 16.27), (5) homogeneity of variance-covariance matrices (Box's Test Sig. values of 0.692, 0.360, 0.774, 0.198, 0.694, 0.172 and 0.450 for the independent variables, all of which were greater than 0.001) and (6) multicollinearity. Following the preliminary assumptions testing, clearly no serious violations were noted.

Results (as presented in Table 3) show that only two independent variables (monthly income and residence classification) reached statistical significant multivariate differences ( $p \leq 0.05$ ). Specifically, the monthly income variable showed multivariate statistical significant difference on the combined dependent variables (perceived awareness, perceived public participation and perceived effectiveness) of the system:  $F(6, 376) = 3.55, p=0.002$ ; Wilks' Lambda ( $\lambda$ ) = 0.89; partial eta squared = 0.054. However, when the results for the dependent variables were considered separately using a Bonferroni adjusted alpha ( $p$ ) level of 0.017 i.e. original alpha level of 0.05 divided by 3 (the number of dependent variables), only two differences reached statistical significance. One such dependent variable that was significant was perceived awareness where:  $F(2, 190) = 4.29, p = 0.15$ , and partial eta squared= 0.043; and the other was perceived public participation with:  $F(2, 190) = 4.34, p = 0.014$ , and partial eta squared= 0.044. These effect sizes (partial eta 0.043 and partial eta squared = 0.044) for the two significant independent variables only accounted for 4.3 percent and 4.4 percent, respectively, of the variation in the respective dependent variables. According to generally accepted criteria, both cases are considered quite small effects [10]. Similarly, the residence classification (low, middle and high density) variable showed a multivariate statistical significant difference on the combined dependent variables (perceived awareness, perceived public participation and perceived effectiveness) with:  $F(6,392) = 2.09, p=0.05$ ; Wilks' Lambda ( $\lambda$ ) = 0.94; and partial eta squared = 0.031. Nonetheless, when the results for the dependent variables were considered separately, no difference reached statistical significance, using a Bonferroni adjusted alpha ( $p$ ) level of 0.017. It is worth noting that no follow-up analyses (post-hoc tests) were conducted to identify where the significant differences (i.e. whether Group 1 was different from Group 2; Group 2 was different from Group 3; etc.) lied considering that in both statistically significant cases, the independent variables had three levels.

This result of only two variables showing multivariate statistical significance translates into very little variance in the public perceptions between respondents from the different socioeconomic status households on the effectiveness of the campaign. This result further justifies the overall perceived ineffectiveness of campaign. However, according to the research by [23], in Lagos State, Nigeria, this perception is stronger among the low income socioeconomic group. Although, the public perceptions of DSWM in the city of Livingstone, according to this study, suggestively are not influenced by the public demographic factors; however, it should not be outrightly said that these factors are invalid to examine the public perceptions.

**Table 3: MANOVA Results by demographic variables**

Dependent Variable	Wilks' Lambda ( $\lambda$ )	F value	P value	Partial Eta Squared
1. Gender/Sex(df=1)	0.99	0.43	0.73	0.007
2. Age/Generation(df = 2)	0.97	1.04	0.40	0.016
3. Marital Status(df = 1)	0.99	0.14	0.94	0.002
4. Education(df = 2)	0.95	0.69	0.22	0.025
5. Monthly Income(df = 2)	0.89	3.55	0.00	0.054
6. Residence Classification(df = 2)	0.94	2.09	0.05	0.031
7. Employment(df = 1)	0.98	1.35	0.26	0.020
8. Position in Family(df = 2)	0.98	0.61	0.73	0.009

(Source: Field data, 2013). Note:  $p \leq 0.05$

This study suspects that if the demographic factors are used in combination with other circumstances (although out of the scope of this study); the results may be more consistent and significant. Although, the overall public perception about the importance of waste was substantially similar across the three surveyed areas, perceptions of the current DSWM practices largely varied, nonetheless.

Therefore, it may be deduced that there was a gap between perceived importance of current waste management practices, and MZCH campaign goals and implementation approaches. Similarly, in a study by [31], in Malaysia on household attitudes towards recycling of solid waste campaign, 90 percent of the respondents indicated that the campaign had failed due to non-participation of local community members. And in the context of the anomie theory, as aptly put by [23], which explains that deviance can arise by accepting culturally determined goals without the acceptability of cultural means, the public may have accepted the MZCH intervention but did not participate in it fully or totally rejected its design and implementation strategies, thus spelling failure of the campaign.

### **The public perceptions about the socioeconomic and ecological affects of the MZCH Programme**

The provision of waste collection, transfer and appropriate disposal services by the local community can have a substantial impact on the local environment. It can, for instance, improve the community appearance, increase the value of personal property and improve the health and wellbeing of residents. In this regard, one other objective that guided this survey was to assess the socioeconomic and environmental (ecological) effects of the current MZCH campaign from the point of view of residents. On the same, overall, results from this survey revealed that the campaign generally had a low (0-20 percent) positive effect on all the aspects assessed. Areas measured were: public health, aesthetics, sewer lines and other drains, odours, disease outbreaks and household income and/or expenses.

Clearly, a minimum of 48.0 percent of the respondents across the three surveyed areas, namely the low, medium and high density localities of the city felt the MZCH campaign had a low positive impact on the health of the public. Similarly, regarding the community appearance, between 44.0 percent and 46.5 percent of the respondents in all the three surveyed areas thought the campaign had a low positive impact. This may be as a result of the substantial waste amounts that were uncollected that made the community to largely remain unsightly. The situation was no better regarding issues of sewer lines and other drains; odours; disease outbreaks such as Malaria, and the households' expenditure on efforts of managing the waste and related issues. Literally, this low public perception on the positive impact of the campaign on the preceding community issues implies that: sewer lines and other drains were still facing the challenge of regular clogging; bad smells, and disease outbreaks resulting from large amounts of uncollected waste remained a serious threat like before.

Similarly, results of this study imply that there is no significant reduction on how much households expended on DSWM. In this vein, slightly more than 50.0 percent of the respondents aggregately felt that the positive effect was low (between 0 and 20 percent). In contrast, although with slight variations among the communities surveyed, results of a study carried out in Hanoi, Vietnam; by [35] on effects of a SWM system on socioeconomic and environmental issues reveal some notable perceived general positive impact of the system on most of the issues. For example, 35 percent of the respondents felt the system had substantially improved their health; notably 28 percent of the respondents felt community appearance had been improved by more than 75 percent; between 30-50 percent of the respondents did say that they thought that there had been a slight reduction in the cost associated with painting their steps, sweeping their steps or the street in front of the houses of respondents; indirectly, perhaps a positive economic return from the waste collection system [35]. The overall implication of the findings of this study of the largely perceived low positive effect of the MZCH campaign on all socioeconomic and ecological issues analysed in Livingstone is that the campaign was largely ineffective and therefore was to a large extent unsuccessful. Hence, the need for more participatory strategies in the planning stages of such future programmes, as demanded by the governance concept that seeks transparency of decision-making processes and responsibility of the relevant actors. In this vein, efficient governance appears to be a function of the reduction of state domination and the growth of vibrant spaces that constitute a crucial sign of political engagement [12].

### **Public perceptions of what constitutes common DSW types**

The changing economic trends and rapid urbanisation complicate SWM in developing countries. Consequently, SW is not only increasing in quantity but also changing in composition from less organic to more paper, packing waste, plastics, glass, metal wastes among other waste, a fact leading to the low collection rates [4].

The results of this study indicate that in the city of Livingstone, Zambia, the composition of waste is perceived slightly different in each of the three socioeconomic residential areas surveyed. Two common waste materials found in most of city's communities were plastic and paper. In Malota, a whopping 91.7 percent ranked plastic and paper as the most common DSW types. Similarly, 97.3 percent and 90.7 percent in Dambwa North and the low density residential area North-West of the city's CBD ranked plastic and paper as the most common waste materials in their localities, respectively.

Both plastic and glass bottles, ranked second among the respondents surveyed in Malota. In this regard, approximately 67.9 percent of the participants indicated that this type of waste was common in this high density residential area. In contrast, though, glass ranked second among the individuals surveyed in Dambwa North and the low density residential area North-West of the city's CBD, where about 57.3 percent and 53.5 percent, respectively said glass was perceived as such.

Ironically, about 47.6 percent of the participants in Malota felt organic wastes in form of food remains and vegetative materials ranked third as common DSW types, while respondents in Dambwa North and the low density residential area North-West of the city's CBD ranked the same as the fifth dominant types within their localities. However, approximately 52.0 percent and 48.8 percent of the respondents from Dambwa North and the low density residential area North-West of the city's CBD, respectively believed that plastic and glass bottles ranked third as most common DSW types. Ranked as fourth most common waste type in Malota were human excreta as highlighted by about 42.9 percent of the respondents. Worth noting also about this waste type is that it was peculiar to the high density residence (Malota); and that, although it was only ranked fourth by respondents in this locality, it cannot be ignored as it may be an indication of inadequate sanitary facilities such as toilets in this community. In sharp contrast, however, both groups of respondents in the middle and low density areas viewed cans as fourth most common waste type found in their localities. Approximately, 48.8 percent of the respondents in both Dambwa North and the low density residential areas North-West of the city's CBD listed cans as most common waste type. Ranked fifth by about 28.6 percent of the respondents in Malota were all sorts of cans. Most of these study findings are contrary to findings of others elsewhere. For example, [13] suggest that most of the waste found in Ndola city, Zambia, comprised food waste (50 percent of household waste in low density areas and 45 percent in medium density areas), while paper was among the least. Similarly, it was 72 percent (food remains) and 17 percent (plastic and paper) in Chirundu [25]; 40.4 percent (putrescibles) and 15.8 percent (plastic and paper) in Lusaka [16]; and 15.6 percent (vegetables); and 5.0 percent (plastic and paper) in low income cities of India [6]. These differences however, may be due to the fact that most of these recent research findings are those of MSW aggregately and not particularly household (DSW) waste type except for the Ndola city case study.

Overall, perceptions regarding what constituted most common waste types show some notable degree of variations among the three (high, medium and low density) communities surveyed. This may generally be a result of slight differences in life styles of the residents of the three localities as explained by [27]'s Anomie theory. According to anomie theory the relationship between humans and the environment is a function of, among other things, the level of society's technological development, the perceived magnitude of existing environmental problems and the level of education.

Although a host of other waste types were listed also by surveyed respondents, this study was, however, limited to discussing only those ranked between first and fifth in importance. Such waste types in the minority included (not in any order) scrap metal, hospital waste, pesticides and paints, wood shavings and textile materials.

### **Public perceptions about more effective (preferred) DSWM Strategies**

The final study objective involved finding out what the local communities' preferred effective DSWM strategies were. Although results of this study indicate that the respondents from across the three surveyed communities perceived prioritised DSWM interventions differently their differences were not strikingly marked, nonetheless. In this respect, most (59.5 percent, 74.0 percent, and 72.1 percent in the high, medium and low density residential areas, respectively) of the respondents ranked the strategy where the local council authorities collected and transferred the waste from households to the designated dumpsite as the most important approach. This was seen as the most effective collection system for refuse in the city. This is in tandem with the results of a study by [13] in the city of Ndola, where it found that until the late 1990s, SW was collected efficiently from residential areas at no cost to households by local authorities in the city. Similarly, other past studies elsewhere suggest that the public expect to be able to produce household waste in a largely controlled manner and are accustomed to an efficient local service of removal [17]. On the other hand, a small number of respondents indicated willingness to pay for the service. Evidently, albeit this strategy having been viewed as the second most important by respondents from the low density locality (area North-West of the CBD), sadly, the same was only ranked 4<sup>th</sup> and 5<sup>th</sup> most important strategy by respondents from the high (Malota) and medium (Dambwa North) density residential areas, respectively.

This may infer that unless the city council authorities were sufficiently funded in this regard and hence showed practical and consistent commitment to providing this service, the implementation of the same may be futile as most residents may not co-operate. However, according to the SW manager of the Livingstone City council, this strategy (collecting waste from all localities of the city at a fee) was envisaged to begin in earnest by the end June, 2013. On the same, the SW Manager told the author (researcher) of this report that the city council authority was anticipating to receive from government about ten refuse collection trucks to help implement this strategy. The manager however indicated that specific service charges (fees) were, at the time of the interview with the researcher, not yet finalised although he indicated that there was a likelihood of segmenting of the same according to local people's perceived income levels in different residential areas.

Other perceived important strategies are: ranking second in the high and medium density residential areas were issues of controlled dumping pertaining to the city council expected to place waste collection bins at strategic points within the communities; ranked third by respondents from the medium and low density residential areas was the issue of community members needing to participate in decision-making, whereas the same was ranked as the fourth most effective approach by respondents from the high density residential area. This strategy (all inclusive decision-making) was envisaged to include the formation of Community Based Organisations (CBOs) that could be charged with the responsibility of sensitising the community populace. This result is similar to those of other studies in Madras, India; and Hanoi, Vietnam; where it was found that the solution to MSW lied in the participation of the local people who generated the waste [26; 35]. Although the introduction of the extended producer responsibility was identified only by respondents from the medium density residential area and that in this area, it was merely ranked fourth most effective strategy, its significance should, in the view of the author of this report, not be underestimated considering that the generation of waste in the city outpaced the local city council's capacity to collect and dispose all the waste appropriately.

## **CONCLUSION AND RECOMMENDATIONS**

The public perceptions of DSWM regarding the MZCH campaign do not differ based on differences in socioeconomic status households in the city of Livingstone. Overall, the campaign was perceived ineffective, and so DSWM remains a major concern in the city. Most common DSW types are plastic and paper, glass, and food remains, although there is a slight variation in perceptions by respondents from different localities, perhaps an indication of a slight variation in people's life styles. The campaign having largely been viewed ineffective by the majority community members, implies that the perceived positive impact on socioeconomic and environmental issues is equally very low. Majority respondents felt the local authority should collect waste from communities to enhance DSWM. Therefore, there is need to involve the public (adopting a bottom-up approach) in identifying future waste management solutions.

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