The Effectiveness of Municipal Solid Waste Management and the State Duty of Care

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Abstract- In 2007 Sri Lankan government introduced the National Policy of solid waste management and allocated LKR 5.7 billion in 2007 and LKR 44.24 billion in 2017 but the major waste management practice adopted by the Western Province even by the year 2020 is dumping to sanitary landfill without resource recovery. This practice contradicts to the 4-R principles advocated by the National Policy.

Accordingly, in the present study, research questions made were whether current solid waste management practices in the Western Province are effective or not in terms of the 4-R principles as perceived by respondents, if current solid waste management practices are not effective – why they are not effective, and what strategies make the solid waste management in the Western Province more effective?

The research was designed to build a theory with qualitative methodology to explore the answers to research. Preliminary data were organized as open coding according to their properties and dimension and then recoded as axial coding. Then the validity of axial coding was confirmed using the Pearson correlation coefficient before embedded them to the theoretical paradigm. Then these confirmed axial codes were integrated into a core category viz. selective coding to refine the theory to explain current effectiveness of solid waste management in the Western Province. Results confirmed that the solid waste management practices in the Western Province are not effective. The effectiveness is correlated to the awareness of authorities (r = 0.924), the awareness of citizens (r = 0.879), the facility development by local authorities (r = 0.910) and to the strength of legal framework (r = 0.564).

The model developed explains that the current ineffectiveness of solid waste management in the Western Province is due to the negative state duty of care, the insufficient negative awareness of the citizens and top-down approach of the execution. The model unveils the mafia as a hidden factor that affect the waste management. The research recognized that the increase of awareness of citizens and adopting the bottom-up approach as the solutions to increase the effectiveness of solid waste management and recommends creating community based participatory development projects for solid waste management.

This social theory and the recommendations are applicable to other provinces of Sri Lanka as well as to all ex-colonial countries where the corruption perception index is high as highlighted by the Literature Review.

Index Terms- Effectiveness of Solid Waste Management, the Western Province of Sri Lanka, National Policy of SWM, 4-R principles, Awareness, State Duty of Care, Legal Framework, Mafia

I. INTRODUCTION

Solid Waste Management (SWM) is defined as the discipline associated with regulating of waste generation, storage, collection, processing and dumping of waste in a way that best addresses the public health, preservation, economics, aesthetic, manufacturing and ecological concerns (Leblanc 2015).

The problem is justified by existence of abusive backyard and roadside dumping that have contributed to the increment of the Dengue epidemic to the highest level in the WP. Moe than 50% Dengue patients reported from entire Sri Lanka has been reported from the WP for the past decade.

Following research questions have been formulated based on the statement of the problem narrated in Section 1.2.1 above:

i. Are the current SWM practices in the WP effective or not in terms of 4-R principles and have the correct final disposal means been established by the National Policy of SWM?
ii. Why are the current SWM practices in the WP not effective in terms of the outcome theoretical coding/variables selected?
iii. What are the factors influencing the effectiveness of current SWM practices?
iv. What are the strategies that should be taken to make the SWM in the WP more effective?

The present study which is designed to analyze the effectiveness of the SWM practices can be considered as an important study because the study investigates how citizens have perceived the effects of execution of the National Policy of SWM along with the effects of the role of state officers legally bound to implement the National Policy of SWM. The study will also evaluate whether the actual solution that are in execution viz. transporting mixed or unsorted waste to Aruwakkalu dumpsite could increase the effectiveness of the SWM practices in the WP.

II. LITERATURE REVIEW

Charmaz (2006, p. 165) agrees with this idea that a novice Grounded Theorist should avoid observing facts through the lenses of other researchers. Notwithstanding this non-mandatory

requirement of the literature review until theoretical paradigm is built, the literature review is useful in theorizing especially in the process of building story line.

The progression of humankind from the primitive civility to advanced civilities makes the general consumption -a rapid growing phenomenon, not only in volumetric portent but also concerning variation of product range. Parallel to the industrial revolution during the late 18th century, this phenomenon, the mass consumerism started to increase exponentially. Thus, to regulate the remaining after human consumption, a new discipline – the SWM was born (Strasser 2015).

In fact, human beings in the past 50 years have exterminated more resources than they have consumed during the entire human history of millions of years (United States EPA 2009, p.5). This finding agrees with the finding of Strasser that the modern SWM issues have a history no more than one and half century. Exaggerated consumption means a creation on new problem over remaining of consumed resources generally termed as waste. This waste issue is aggravated further adding remaining waste of the extraction, production and distribution channels. This explanation is in line with the consumer sequence which is the connexion among extraction, production, distribution, consumption, and disposal (Fellow 2000). Since this relationship has a linear relationship, it should be respectfully disagreed with the denomination by Fellow that above chain as the consumer cycle. In fact, Paletta (2019) describe more correctly that the present global consumer behaviour is take-make-dispose which is a linear relationship.

Narrowing the discussion from global sustainable development goals to goals fixed in Sri Lanka in 2007, the National Policy of SWM (2007) states that the waste generation in country is 6400 MT/day and just 42% is being collected by the 325 local authorities. The source clarifies indirectly that the non-collected portion of waste is visible as roadside dumping in the WP. This situation shows that sustainable development goals of UN fixed 28 years ago are far from Sri Lankan context even by the year 2020.

Narrowing the discussion to waste generation of the Western Province (WP), the WP alone produces 3500 MT/day (WMA-WP 2014). The WP consists of 49 local authorities. The main waste generator in the WP is the Colombo Municipal Council (CMC). It produces 800 MT/day or 23% of total waste generated within the province.

Policy statements 5, 5.11 and 5.21 of the National Policy of SWM admit respectively the need of building infrastructure facilities for SWM, increase of awareness and strengthening the existing legal framework at all ranks. These ranks intended by the section 5.21 of the national policy of SWM can be interpreted as citizens and authorities.

Further, the policy principle 4.1 of the National Policy of SWM states that SWM will manage according to 4-R principles and final disposal of residuals will be done applying suitable cure before the dumping (NPoSWM 2007). Therefore, evaluating criteria of the effectiveness of SWM has been selected as 4-R principles namely reduce, reuse, recycle and recovery with the criterion final disposal.

As regarded in the discussion about the awareness of authorities, the duty of reduction of consumption is a sustainable obligation of all levels of citizens and corporate citizens. Many researchers have found that citizens are readily prepared to discharge their environmental duties (Stofejova 2020). Basnayake et al (2020) citing CEA (2016) express their view that in Sri Lankan context authorities have implemented awareness programs through mass media addressing the sustainable development in order to increase the awareness of the citizens. In the WP context, a study conducted within the Dehiwala Mount-Lavinia Municipal Council area suggests that people are prepared to pay for the waste generated by them (Welivita 2014). Findings of these environmental responsibility show that citizens have a good level of awareness about SWM. But any of above studies do not indicate how this increment of awareness could be measured or evaluate. Therefore, these researches have not significant academic value and leave readers to presume that there is no significant increment in awareness of citizens.

It is the commonly understood that the meaning of establishing facilities and infrastructures for SWM as establishing facilities for final disposal of waste. However, facility development for SWM include provide facilities for the collection, storage, transportation, recovery, treatment and final disposal of waste (Herath 2013). These include collecting vehicle with or without compactor facilities and with or without separated space for different types of waste, sorting facilities and different types of final removal facilities viz. incineration, composting, raw dumping or sanitary land filling.

Basnayake et al. (2010) define that the legal framework concerning the SWM consists five major components viz. the constitution, National Environmental and Pradeshiya Sabha Acts, Municipal Council Ordinance, Provincial Statutes, regulation and guidelines and by-laws of the local authorities. This is an inaccurate definition since legal framework of the subject matter has a very wide meaning. To re-correct what Basnayake et al have expressed as the legal framework, they are quoting nothing other than some source of laws in Sri Lanka.

According to Transparency International Sri Lanka, the Corruption Perception Index (CPI) of Sri Lanka is 93/180 (Transparency International 2020). To understand CPI, the rank of 93 of Sri Lanka has to compare with the rank 1 of a clean country like Sweden out of 180 countries selected. The rank of 93 has been attributed to Sri Lanka because the law enforcing authorities such as Police, environmental agencies and court system are highly corruptible. Therefore, the effectiveness of SWM practices in the WP should be interpreted in light of the Corruption Perception Index. The Commission to Investigate Allegations of Bribery or Corruption (CIABOC) officially admits the validity of the observation of the Transparency International (CIABOC 2018, p. 5).

III. METHODOLOGY

The qualitative approach followed by the Grounded Theory (GT) strategy (Glaser and Strauss, 1968). GT strategy follows the interpretivism philosophy. The adaptation of the GT strategy as the research strategy was justified since behavioural patterns of citizens as waste generators and behavioural patterns of state officers as executors of SWM are lying in the social arena. The epistemology of this philosophy stands on the base of the investigation whether the current Solid Waste Management

(SWM) practices in the Western Province (WP) are effective or not and if not effective, why they are not effective.

The sampling technique adopted in this research was purposive judgemental sampling technique. In the GT strategy, there is no importance about the size of the sample. Instead, it counts the data densities of coded concepts that are the basic building blocks of theorizing process. The sample size in the GT strategy may be very small because Grounded Theorists are keeping sampling until categories or concepts are saturated with data densities. This logic should be well distinguished and contrasted from general sample size theories adopted in quantitative approaches (Glaser, 1992, 1998, 2001; Stem, 2001 as cited in Charmaz 2002, p. 114). This theoretical saturation notion is not possible to compare with the proportional sampling size determined in the quantitative approach.

The type of data selected for this part of study was semi-structured deep interviews. Interviews were semi-structured to facilitate interviewees to remain focussed on the subject matter SWM. A total of 26 semi-structured deep interviews were conducted expressly - a total of 7 deep-interviews at Moratuwa Municipal Council area, a total of 8 deep-interviews at Maharagama Urban Council area and a total of 11deep-interviews at Homagama Pradeshiya Sabah area.

The first step of coding in GT strategy is known as open coding. It is the initial analytical process used in this research. Data were fractured and some concepts were identified according to properties and dimensions of concepts. The initial step of the coding process is open coding. It is the process in which basic concepts are being identified through properties and dimensions discovered in data.

At the end of this process some conceptual building categories were identified. The next step is clustering these mutually relevant concepts into major-groups according to their patterns. This process was helpful to reduce a huge amount of data into manageable links technically known as Axial Coding.

The Pearson correlation coefficient is one of the best statistical measures to calculate correlations between items in similarity metrics (Kent State University 2019). The quarry option: cluster analysis that had incorporated into the data management software NVivo® facilitated to conduct correlation calculations between two or more concepts.

The Pearson correlation coefficient between two concepts exampled as x and y is denoted as r or r_{xy} can be computed as:

$$r_{xy} = \frac{cov(x, y)}{\sqrt{var(x)} \cdot \sqrt{var(y)}}$$

where cove(x, y) is the sample covariance of x and y; var(x) is the sample variance of x; and var(y) is the sample variance of y. In this research the symbol x was represented by the cause concepts. They were axial coding; awareness of local authorities, and awareness of citizens, facility development by local authorities, facility development by citizens and the strength of the existing legal framework. The symbol y in the formula was referred as the outcome concept -the effectiveness of the SWM in the WP.

The sign r_{xy} indicates the direction of the relationship between the outcome concept - the effectiveness of SWM and cause concepts. It ranges between the -1 and the +1. The value -1 indicates a perfect negative relationship and the value +1 indicate that there is perfect positive relationship between concepts under

investigation. Likewise, the value 0 indicates that there is no relationship between concepts. Therefore, the magnitude of the correlation (how it closes to -1 or +1) is the measurement that considered as the strength of the relationship. Statistically, correlations values less than 0.5 are considered as weak correlations, between 0.5 and 0.8 are considered as medium or moderate correlations and correlations greater than 0.8 are considered as strong correlation.

The selective coding process is described as the process of integrating and refining the theory (Strauss & Corbin 1998, p.143). Integration is mixing data with the concept that has combined axially along with the meaning of concepts. In this process, the investigator may draw reasoning lines interpreting what the participants intended to say or what they have forgotten to say about SWM practices in their respective local authority area.

IV. RESULTS

It should be appropriate to re-produce the definition of open coding given by Strauss and Corbin as 'the analytical process through which concepts are identified and their properties and dimensions are discovered in data'. The principle open codes were created isolating central concepts and their properties of these central concepts, their dimensions and evidence by participants' words.

Strauss and Corbin have defined the axial coding as the process of relating categories to their subcategories. The reference densities of open coding were considered in construction of axial coding. This had been done by re-grouping of open codes by their common properties and dimensions.

Accordingly there were 455 or 70.22% coding references in the axial node - the SWM in the WP is ineffective. However, there are moderate number of coding references, viz. 193 or 29.78% coding references in the node - the SWM in the WP is effective.

At this point correlation between outcome and cause concepts could be measured.

Pearson Correlation between the Effectiveness of SWM Practices in the WP and the awareness of local authorities was 0.924. It was a very strong positive correlation. This result confirmed that the effectiveness of SWM practices in the WP is highly correlated to the awareness of local authorities.

Pearson Correlation between the effectiveness of SWM practices in the WP and the awareness of citizens was 0.879. It was a very strong positive correlation. This result confirmed that the effectiveness of SWM practices in the WP is highly correlated to the awareness of citizens.

Pearson Correlation between the effectiveness of SWM practices in the WP and the facility development by local authorities was 0.910. It was a very strong positive correlation. This result confirmed that the effectiveness of SWM practices in the WP is highly correlated to the facility development by local authorities.

Pearson Correlation between the effectiveness of SWM practices in the WP and the facility development by citizens was 0.562. It is a positive correlation. The results confirmed that the effectiveness of SWM practices in the WP is moderately depending on the facility development by citizen.

Pearson Correlation between the effectiveness of SWM practices in the WP and the strength of legal framework was 0.564.

It was a moderately strong positive correlation. This result confirmed that the effectiveness of SWM practices in the WP is moderately is correlated to the strength of the legal framework.

As discussed in the previous the theoretical saturation is the point in category development at which no properties, dimensions, or relationship emerges during the analysis. After the exploration of three major selective codes emerged viz. the state duty of care, awareness of citizens and the bottom-up approach as the solution, the project could claim the theoretical saturation because no additional concepts with considerable data densities were emerged from the data.

Strauss and Corbin (1998) explained that theorizing process is the process of giving a statement that systematically inter-related well-developed categories (p. 22). The present study has identified the three well-developed selective coding or factors that made SWM in the WP ineffective: as the lack of state duty of care, negative awareness of citizens and the top-down executor approach of the execution of the National Policy of SWM. This lack of state duty care and its wide social acceptance has led to make 4-R principles advocated by the National Policy of SWM null and void. This acceptance is the base of littering behaviour of citizens as well as the dumping behaviour without segregation by local authorities. On the other hand, this acceptance has facilitated racketeers their profit making practice at the expense of the national economy, damaging the environment, the public health and social order by collecting municipal solid waste and dumping waste without applying 4-R principles.

Effects of this state behaviour have copied by the citizens and vice versa. These effects have been embedded into the social fabric in the WP as well as Sri Lanka. This means a wide social acceptance has been received to sustain and to guarantee the durability of this lack of duty of care behaviour.

V. DISCUSSION

The first objective of the study was to examine whether current SWM practices in the WP are effective or not in terms of the principle 4.1 of the National Policy of SWM. Two axial coding that was created to achieve this objective in the qualitative Grounded Theory (GT) strategy: 'SWM is not effective' had 70.22% coding references density to confirm the ineffectiveness of SWM practices in the WP.

The second objective of the study was to examine why the current SWM practices in the WP are not effective. Findings have identified related issues such as, the negative awareness of authorities, the negative awareness of citizens, the lack of the facility development by local authorities and the weaknesses of the actual legal framework.

The third objective of the study was identifying issues relating to the current SWM practices in the WP. The theory generated through the model by the present research explains that the factors related to the effectiveness of current SWM practices are state duty of care, awareness of citizens and the implementation approach of SWM practices. In practical terms the lack of state duty of care, the negligence of citizens and the actual top-down implementation approach resulted as major issues determining the current ineffectiveness of SWM practices in the WP.

The Literature Review discussed the relationship of lack of state duty of care and mafia found by other researchers. In particularly, the study by D'Amato, Mazzanti & Nicoli (2015) have found that in local authorities where the mafia has penetrated, the effectiveness of SWM practices has been compromised. Additionally, through the history of Karadiyana dump site it was revealed how the state agencies were dominated by the mafia. Furthermore, the Literature Review brought evidence that the Corruption Perception Index (CPI) of Sri Lanka is very high as 93/180 citing the Transparency International (2020). This literatures confirms the lack of state duty and care as a individuate factor that increase the effectiveness of SWM practices.

The fourth objective of the study was to find out strategies that should be taken to make the SWM in the WP more effective. These strategies consist increasing the state duty of care to a satisfactory level, increasing the awareness of citizens and implementing SWM with bottom-up approach.

SWM is a vast social phenomenon that ingrained roots with every point of social, economic and political aspects of the society. Even though data in the present research was sufficient they were not adequate to represent the vast social phenomenon under investigation.

Charmaz expressed 'All is data' (2002, p.16). Higher the volume of data analysed, the internal and external consistency any research increases. To achieve internal and external consistencies in a practical way, all future researchers are strongly recommended to collect data of SWM through 'NCapture,' the feature of data management program used in this research NVivo®. This will enrich data by capturing data through videos, articles, online discussion groups and social platforms which was not allowed in this study.

Further, future grouped researchers are highly recommended to collect data from focussed groups, compare and contrast them in net-working as collective tasks.

VI. CONCLUSION

As per first objective of the study: in examining whether solid waste management practices in the Western Province of Sri Lanka is effective or not, the study confirmed that solid waste management practices are not effective.

In examining as to why the current solid waste management practices in the Western Province are not effective the study confirmed that the effectiveness of the solid waste management practices in the Western Province is significantly depending on the awareness of citizens and authorities, facility development by authorities and the strength of the legal framework.

The study has confirmed that issues relating to the current solid waste management practices in the Western Province are, insufficiency of: awareness of authorities, awareness of citizens, facility development by authorities and the weakness of legal framework. The study have introduced a model based on the social theory, which the effectiveness of solid waste management is depending on three components viz. state duty of care, awareness of people and the strategy of implementation of solid waste management.

The social theory built in the Grounded Theory strategy identifies strategies that should be taken to make the solid waste management in the Western Province more effective are

implementing strategies to increase the state duty of care, increase the awareness of the citizens and to change the present top-down approach.

As the model of the study suggests, the increase of awareness of citizens is the determinant factor that could increase due state duty of care and change the present irregularities in solid waste management approaches. If this happens, the same will be the end of waste mafia.

In conclusion, achieving an effective solid waste management through a sustainable development has revealed a myth rather than reality as understood by some researchers in Sri Lankan context (vide Atapattu 2002). The present study has demystified why sustainable waste management advocated by the National Policy of Solid Waste Management has not been achieved by bringing a novel knowledge identifying barriers to achieve an effective solid waste management through the model presented. This model opens the hidden door for the future researchers facilitating to develop the concepts further to achieve an effective solid waste management for the Western Province of Sri Lanka.

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