Assessing Stakeholder's Collaboration in the Management of Municipal Solid Waste in Monrovia, Liberia

[1]C. Wonleh Sei Slehkie*, Prof. Niu Dongjie**

*UN Environment Tongji Institute of Environmental for Sustainable Development, College of Environmental Science and Engineering, Tongji University, Shanghai 200092, China. Email: cwonlehslehkie@gmail.com
**Shanghai Institute of Pollution Control and Ecological Security; State Key Laboratory of Pollution Control and Resources Reuse; Key Laboratory of Yangtze River Water Environment, Ministry of Education, Tongji University, Siping Rd 1239, Shanghai,200092, People Republic of China. Email: niudongie@tongji.edu.cn

DOI: 10.29322/IJSRP.11.04.2021.p11210
http://dx.doi.org/10.29322/IJSRP.11.04.2021.p11210

Abstract: The collaboration of stakeholders in the management of municipal solid waste is a common challenge that affects Monrovia, in Liberia. any such device poses a dynamic relationship between actors with various stakeholders, decision-making authority, and stakeholders with influence, as well as an atmosphere that is beneficial or disabling. This study used the techniques of social network analysis (SNA) and stakeholder analysis (SA) which can be effectively extended to better understand the position and behavior of participants, and evaluate the motivating factors of stakeholder collaboration, as well as recognize connectivity blockages that influence everyday operations or strategic planning for the future. Stakeholders were interviewed and invited to prioritize features and partnerships that are especially relevant for the sustainability of the scheme and system growth. Government authorities, such as the Environment Protection Agency, Monrovia City Corporation, and other institutions responsible for municipal solid waste management, have the highest power and maximum interest in municipal waste management, whereas key players have both high power and maximum interest with regard to policy regulation and pollution control of municipal solid waste management in Monrovia. In addition, stakeholders, such as waste service providers including Libra Sanitation and Community-Based Enterprises, Paynesville City Corporation etc. are directly involved in waste collection and disposal operations at various dumpsites in Monrovia, with a lot of interest and secondary decision-making power in municipal waste management. For instance, household waste generators are involved in waste sorting at source, with a lot of interest and little power, but are not encouraged to participate in the policy-making process. Moreover, the knowledge and information of most stakeholders are insufficient and inaccurate. Academia and Research Institutions like the University of Liberia and Stella Maris Polytechnic University are involved in assisting stakeholders in the decision-making process but are not directly involved in the process of pollution control, despite their strong interest in the sector. Therefore, effective communication and collaboration among stakeholders are essential, in order to enhance the proper implementation of policy regulation.

Keyword's- Stakeholder's Collaboration; Collaboration; Municipal Solid Waste Management; Monrovia, Liberia.

1. Introduction

Solid waste, still remains a major challenge particularly in rapidly developing cities around the world[1]. Because a city like Liberia has various features in terms of the geographical landscape as well as administrative organization, civic capability, financial capital, socio-cultural and socio-economic contexts, there is no single solution possible. To provide reliable, productive, and sustainable solid waste management, many management decisions are required; such decisions have an impact on several actors as well as are affected by several of them. It's possible to classify stakeholders by "collaboration" [2]. Depending on the problems and concerns you want to tackle, the classification of' stakeholder groups' differs. Clear concepts of how to consider a possible stakeholder can, though, be implemented[3]. In addition to the technological and administrative dimensions of preparation and administration of solid waste systems, the definition of solid waste management (SWM) illustrates the need to recognize the human element [4].

Experience in developed nations shows that beneficiaries of facilities should be actively involved to ensure the sustainability of solid waste services. In specific, the effect on persons connected with waste management and publicly available are communities that guide the implementation of an (SWM) system [5]. Similarly, all these things must be integrated while capitalizing and evolving from current situations, so that decision-makers may adapt this information and extend it to their local contexts [6].

Experts in solid waste management must also provide a strong and detailed understanding of the scenario and context, taking into account many factors, including the dynamic involvement of mutual partners in the process. In reality, multifaceted environmental decisions such as the problem of solid waste can only be adequately be tackled through multidisciplinary expertise, including environmental and social sciences, politics, and ethics. Understanding what boosts waste management project performance and what hinders it is critical. In particular, some initiatives, while theoretically and economically well planned, failed in waste management because of a lack of collaboration between stakeholders that represents social, ethical, and political problems[7].

Over the past 30 years, many attempts have been made to better understand and analyze all problems relevant to solid waste management. Two opposing waste management goals are optimized by Galante et al [7],and both the net expense and the environmental effects are reduced. These are the standard quantitative parameters utilized in other experiments focused on multi-criteria decision-making research, which often requires a certain degree of ambiguity [8].

Only a few studies have used social parameters; for example, Kaya considers organizational capacity while also considering a public response[9], which is defined by a proxy measure of the waste plant's distance from residential areas. Many methodologies for quantifying stakeholder collaboration have been gradually extended by adding different aspects of life cycle assessment (LCA) approaches that have integrated the working environment, such as occupational health and indoor emissions.[10]. Nevertheless, it is impossible to consider certain aspects effectively in broad terms, since expectations of health and safety, risk acceptance, etc., differ greatly. Based on national cultural and ecological environments, agreed with workplace exposure, microbiological dose-response relationships, and preferences as specified by staff, officials, and community differ from country to country.

Until now, though, little attention has been given to the collaboration and characteristics of stakeholders, their interactions, and how they impact each other. In reality, stakeholder networks are sometimes viewed as a group of actors that are separated and not subject to constant contact[11]. Instead, utilizing a network view suggests believing that relationships are meaningful and can be seen as material or immaterial flows (e.g., money, goods, or information, trust). Actors are thus interdependent rather than independent, and network mechanisms may either strengthen or hinder communications with partners and affect the success of initiatives. Assessing the structure of the infrastructure and then presenting the findings to members will increase their engagement and enable them to collaborate on new network initiatives[12].

The aim of the research presented in this article was to gain a better understanding of non-technical aspects of stakeholder cooperation in municipal solid waste management in Monrovia, Liberia, in order to assess their importance in waste management, daily operation, and future strategic planning. In particular, the research centered on the cooperation of stakeholders (their interactions), including social dimensions, organizational power, and structural support, beginning with the comprehensive method suggested by Zurbrügg [13]. The study of the social network (SNA) and stakeholder analysis (SA) have been used as methods to assess these non-technical factors and to determine which of them are considered to be of greater significance for the sustainability and performance of waste management in Liberia than others[14].

As modified for the chosen case study, the survey, in particular, SNA and stakeholder collaboration (SC), may be extended to other frameworks that follow the same organization. The survey instruments have been tailored to the specifics of the case in compliance with the knowledge available, although the basic methodology is theoretically applicable for any solid waste management scheme. If it is utilization-focused, such a method will contribute to a successful assessment of a framework[15]; SNA and SA will make a valuable contribution as stakeholder engagement and debate that is necessary to promote decision-making and understanding of many topics relating to developing stakeholders collaboration within the sector[16].

2. The Area of the Study

The case of assessing stakeholder collaboration in the municipal solid waste management in Monrovia, Liberia was chosen because the city of Monrovia has experienced a significant increase in waste production over the years as a result of rapid urbanization, population growth, changes in

consumption habits, and other factors. Situational Analysis of the Country[17] [18].

Monrovia is home to nearly 33.3 percent of all Liberians, according to the Country Situational Analysis report[18]. The condition in the city has further deteriorated due to a lack of adequate ability for technology, technical financial, and human capital, along with a lack of adequate collaboration between stakeholders. With this in mind, this study endeavors to analyze SNA and stakeholder collaboration (SC) in Monrovia and make relevant policy recommendations for-long sustainable waste management in Monrovia.

Monrovia is the Capital City of the Republic of Liberia, and one of the fastest-growing cities in the Mano River region. Geographically Monrovia is located approximately between latitudes 6.3'North and longitudes 10.8074'West and with the Land Size area of Monrovia at 194.25km2. According to the Liberia Institute of Statistic and Geo-Information Services' 2008 National Population and Housing Census (NPHC) (LISGIS),estimated the population of Liberia at 3,476,608, and with the population of Monrovia at 1,010970, and also the population density of 44.33 per sq. km [19]. Monrovia is the country's most populous city, accounting for 29% of the country's total population. Liberia is a low-income country with a per capita GDP of USD 454 in 2013.

Despite the fact that real GDP growth was expected to be 5.8% in 2014, it was reported to be 2.5 percent due to the Ebola outbreak [20]. Whereas, in January 2020, current economic growth is expected to slow significantly, to 3.2 percent points below the pre-COVID baseline projection.[20]. Monrovia has a tropical wet and dry climate and is situated near the equator, with an annual average precipitation of 4,624mm 182.0 in of rain per and a maximum annual temperature of about 26.4C (79.5F).

3. Methodology

To collect and analyze data from secondary and primary sources, different methodologies were used. Documents of the Government Authority on waste management; waste services provider; and academia and research at the beginning of the study. Then other data was gathered from respondents at all the above-mentioned institutions.

The purpose of these interviews was to characterize the performance and connections (networks) of stakeholders, as well as the elements that aided the historical development of waste management in Monrovia, Liberia. Such interviews also assisted the researcher in identifying additional stakeholders to include on the list of stakeholders. The study was carried out from November to January 2021 and was dedicated to organizing and implementing field activities and preliminary data analysis for approximately two months.

The use of stakeholder analysis (SA) and social network analysis (SNA) models were demonstrated as a useful approach to study the environmental & resource management and public governance issues[21] (Reed et al., 2009; Lienert et al., 2013). SA methodology first emerged as an approach for strategic management in the mid-1980s (Emshoff, 1980; Freeman, 2010).

In addition, the social network analysis model demonstrated the ability to investigate the activities and interactions of various stakeholders. A special emphasis was placed in the analysis on analyzing stakeholder characteristics and interactions from a network perspective.

3.1. Social Network and Stakeholder Analysis

The first list of stakeholders and interviewees, primarily members of organizations, was focused on the knowledge available and verified by selected respondents and specialists in the area of local waste management. This stakeholder list was discussed and incorporated during interviews. Interviewees have been instructed to think twice about who is not on the list nor who should be on the list[22]. Thus, the stakeholder list was constantly revised during interviews with new stakeholders selected by the stakeholders themselves from the 12 originally scheduled interviews, eventually, 16 were performed[23]. Following the method were future by Schmeer (1999), semi-structured interviews were planned, as illustrated in (Appendix- A). While more recent papers on guidance explicitly tailored for the solid waste management sector are accessible and are implemented in countries with low and medium incomes level[24].

These techniques are available on the internet and are part of human Resources Action Framework for Waste Management's collaboration portion (Global Health Workforce Alliance, 2013).The characteristics and collaboration of stakeholders are called powerful variables of mechanism creation and sustainability[25]. Thus, SNA complements SA by investigating relationships, but also by presenting a proposal for a hierarchy of stakeholders to discuss the problem and maximize services. In reality, as well as data triangulation, SNA may provide substantial indicators for stakeholder recognition[26].

To model the real-world dynamics at the center of organizational information and learning processes, SNA is a research methodology that focuses on defining and comparing the relationships inside and between persons, communities, and structures. While an organizational map displays structured role and obligation relationships, SNA helps to illuminate casual relationships with who knows who and who shares with whom. SNA may be more accurately described as organizational network analysis in the case under review, as a vast majority of stakeholders are structured and representative entities in practice[27].

The position of the organization in the waste management system was examined in this case by the collaboration of stakeholders in the municipal solid waste management in Monrovia, Liberia, awareness of the organization, attitude towards it, degree of involvement in it, the existence of collaboration related to the functioning of the system, resources available attributed to the system, and system leadership and details[28]. Where appropriate, interviewees were asked to provide ratings on topics and relationships on a one to ten 1-10 scale (Table 1), utilizing a predefined contextual description to clarify the significance of each ranking. After each interview, a social network map was created with the interviewee, showing the platforms and accuracy of knowledge he or she might use.

Based on a predefined tabular structure, the stakeholder was asked to list all of the actors he or she believed may have some role in the case study, as well as some specific task or feature. Then, if there was any interaction with these actors and how routine and intense it was, they were questioned. Each interviewee proclaimed realistic interactions, as well as the degree of interactions, leading to the drawing up of a global social network map[29]. Finally, the stakeholders were asked to assess each other's viewpoints on the waste management situation. Then the last issue in the segment was regarding some collaboration between stakeholders that all agree that they were aware of some level of collaboration, but not in totality.

Clarifications were sought if the responses were contradictory, or if they were vague or incomplete. An adapted version of stakeholder characteristics and collaboration concepts, a method suggested by Schmeer [14], was used as a guide for continuously collecting knowledge relating to the topic under discussion.

Interviewers debriefed during each interview, to get a better understanding of the system and experiences, and to properly handle future interviews. Responses were recorded in the first database for each interview, while remarks, statements, and ambiguous aspects were placed on a separate digital sheet, so scores were triangulated in the same interview with qualitative answers provided to accessible questions to verify internal accuracy. To distinguish potentially contradictory viewpoints or ambiguous elements of the method used, the results were contrasted with previous interviews results.

3.2 Identification of Stakeholders

The method of identifying relevant stakeholders requires a significant amount of time and effort. [30]. Subsequently, to provide effective sustainable MSWM services, a strong collaborative effort among various stakeholders is imperative. Emphasizing the potential for a public-private partnership, the mean by communities becomes more important in term of its potential performance in MSWM [31]. According to scholars, Hemmati (2002) argues that identified stakeholders should be interviewed in order to find out who else is involved. In most cases, the recognition, classification, and management of stakeholders in the waste sector seem "scattered and unconnected," with stakeholders ranging from ''anyone and anything [32].

Failure to consider stakeholders' desires, needs, concerns, powers, goals, and views is a significant flaw in thinking, as their actions are often predictable and can lead to poor results, outright failure, or even catastrophe for the City[24]. As a result, including stakeholders in assessments has become standard practice all over the world.

Unfortunately, the complexities of recognizing and engaging stakeholders in evaluation, as well as capturing their viewpoints, embracing their concerns, and accounting for political sensitivities, are underappreciated [24], particularly when evaluators are operating with restricted budgets and time. Partnerships, for example, have emerged as a possible MSWM alternative to the government's conventional service delivery. Therefore, collaboration among stakeholders in municipal waste management range from a generation at source, collection, transportation, treatment, and disposal, and as whereas monitoring policies and mitigation [31]

Table 1

Variables and meaning scales used in the questionnaire for the stakeholder interview

Variables	Value Scale Recoded
Sharing information: this variable applies to the case's self-reported general information as accessible from relevant sources to the stakeholder interviewed. Based on cross-checking with other data points, this value was also further updated and normalized;	5 groups answer on a 1–10 scale 1. Very low quality (1–2) 2. Low quality (3–4) 3. Acceptable quality (5–6) 4. Good Quality (7–8) 5.Very good Quality (9–10)
Knowledge of other stakeholders: This adds importance to the awareness of the interviewed stakeholders regarding the tasks, duties, and obligations of other stakeholders. Responses were cross-checked with accessible data and eventually sorted, taking into consideration the description given by other stakeholders;	5 Groups (no recoding) 1.Low knowledge 2.General knowledge 3.Complete knowledge
Collaboration: This describes the degree of contact between the interviewed stakeholder and other stakeholders, showing the frequency of interaction;	5 Groups (no recoding) 1. Rare interaction 2. Quite frequent interaction 3.Frequent collaboration
Interest in the case study: This describes the interviewed stakeholder's self-reported level of involvement in the subject as quantified by the interviewee. This value was also updated and normalized based on cross-checking with other data sources and continuity with other quantitative and qualitative responses.	5 groups answer on a 1–10 scale, 1. No or minimum interest (1–2) 2. Limited interest (3–4) 3. General interest (5–6) 4. High interest (7–8) Primary interest (9–10)
Professional knowledge: This represents the self-reported degree of awareness about the event by the stakeholder interviewed. In view of the given definition of the situation and the awareness of the stakeholder, self-	5 groups answer on a 1–10 scale, 1. Minimum knowledge (1–2) 2.Lacking knowledge (3–4)

defined knowledge was checked, highlighting four groups;	3.General knowledge (5–6) 4.Deep knowledge (7–8) 5.Complete knowledge (9–10)
Stakeholders Power: The autonomous experience of force, centered on the availability and access to incomes and capacity to mobilize them, is recorded;	3 Groups answer on a 1–10 scale, 1.Low power (1–3) 2.Medium power (4–7) 3.High power (8–10)
Stakeholders Attitude: The interviewee's opinion on the case is reported with 7 possible qualitative answers**.**	7 Groups 1.Strongly positive 2.Positive 3. Slightly positive 4.Neutral 5.Slightly negative 6.Negative 7.Strongly negative

3.2.1 Governmental Authorities

There are several institutions in this category, and they include government institutions, policymakers, local and national authorities as well as regulation and law enforcement agencies. Environmental Protection Agency of Liberia (EPAL) is the major administrative body charged with the responsibilities to establish national guidelines and enforcing legal and regulatory frameworks associated with solid waste management in Liberia, at the same time, ensuring all the frameworks covering all stakeholders be developed, enforced, and coordinated, monitor, supervise, and provide environmental quality standards, and ensuring compliance for pollution control, audits or inspections, and environmental licenses or permits for healthcare waste treatment plants. In short, they are considered to have the highest power and maximum interest in municipal waste management, whereas key players have both high power and maximum interest with regard to policy regulation and pollution control of municipal solid waste management in Monrovia.

Monrovia City Corporations (MCC) is in charge of enforcing city ordinances, municipal solid waste disposal, parks, public education and awareness, and environmental health and sanitation services. MCC shall implement its statutory mandates to ensure adequate garbage collection and disposal within its jurisdiction.

The City corporations enforce their responsibilities that cover environmental sanitation primarily in the areas of street sweeping, collection and disposal of solid waste, and beautification and to ensure clean and sanitary environmental conditions in the territory under their jurisdictions as granted by existing laws, public health, and environmental safety law.

Ministry of Interior Affairs (MIA) is responsible for mobilizing and ensuring participation of Municipal and Local Government Entities in national development and provide technical and planning support for rural or urban municipal services including support for governance relations between local government entities and between citizens and local government through adoption and follow up actions on standard operating procedures (SOPs).

The Ministry of Health (MoH) is mandated through its environmental and Occupational Health division to assess the environmental health of the population. This division has the power to conduct sanitation inspections and ensure compliance with the Public health law. Preventive Health, occupational health, and health waste management are amongst its key mandates. Furthermore, the Ministry of Health is very interested in HCW management. Given its role in overseeing and regulating activities in hospitals and clinics, however, it is more concerned with waste generation and, to a lesser extent, what happens to waste once it leaves the hospital and clinic grounds.

The Ministry of Public Works (MPW) is responsible for providing solid waste management facility direction, design, and development, as well as technical and engineering services to Municipal and Local Government Entities. Given its regulatory position, the ministry of public works has the authority to influence the operation of solid waste management infrastructure such as the production and construction of transfer stations and the guidance of engineered landfill sites for non-hazardous waste created by healthcare facilities.

The Ministry of Lands, Mines, and Energy (MLME) is in charge of guiding geotechnical investigations of engineered landfill sites, overseeing the development and management of natural resources, especially water resources, which are critical to the water and sanitation sector, and conducting scientific and technical investigations needed for environmental assessments. Therefore, the ministry shall provide support to Municipal and Local Government Entities in providing access to land in consultation with the Land Commission.

The Liberia Marketing Associations (LMA) was founded in 1976 with the “sole purpose of doing business and controlling all markets and their facilities within the territorial limits of the Republic of Liberia. In most instances, LMA collaborates with the MCC in the implementation of waste collection and disposal from various markets. Members of the LMA are required to pay certain fees to meet their tax obligations and help in running the operations of the organization. Besides, the daily fee is utilized to cover operational needs (e.g. pay staff, clean the market, and purchase supplies), city government tax, and garbage collection. The interest of MCC and EPA concerning waste management is high. MOH, MPW, SWMD interest concerning waste management is medium. Industrial Waste Generators (IWG) is responsible for pollution of air, the soil,

or nearly water sources, eventually ending up the sea and it's also mixed into municipal solid marking accurate assessment difficult for the city. Household Waste generator (HG) is the major MSW generation source in Monrovia and as a service user, they are currently responsible for MSW management occupies a rather small part comparing with other stakeholders but are also involved in waste sorting at source, with a lot of interest and little power, but are not encouraged to participate in the policy-making process

3.2.2 Private Sector Organizations

There are several organizations in these categories that are waste services providers. Waste Services Provider (WSP) is the main unit under the councils or municipal authority tasked with the operational services of waste management from collection to disposal. They understand the importance of haulage, collection, care, and disposal, but since this is not their responsibility, they are not involved in any decision-making or strategic planning in this field. It is possible to encourage the private sector's potential position in solid waste storage, transportation, processing, and recycling (Cointreau-Levine, 1994). Competitive incentives may be established by the municipal council, performance-based requirements and contracts are written, contracts and public priorities are controlled and governed.

However, they are interested in the development of the sector as any change in the system may affect the service fee they collect from households. From this viewpoint, they are interested in finding the most convenient solution for waste disposal at the lowest service fees for households. Interest and active involvement would probably increase significantly if ideas were voiced to raise the collection fees.

Currently, the Paynesville City Corporation is the main stakeholder in charge with the responsibility of providing solid collection and disposal services for households and to various market sites in and around Paynesville city, which also collected waste disposal fees from Liberia Marketing Associations (LMA) to dispose of the waste at When town dumpsite some 25 km away from the city around. Furthermore, their knowledge of new technology for waste management such as incineration seems to be very limited or in some cases not available at all. Their role and interest woold certainly increase in and when City Corporation of Monrovia (CCM) starts discussing and planning and modern facilities or new alternative strategies for solid waste management in Liberia.

Community-Based Enterprise (CBE) is responsible for the collection of primary solid waste from households and small business owners within the city and which requires the waste collectors to carries the waste at the MCC scape-buckets or other designated disposal sites around the city. In short, waste collectors are important because waste collection is often one of the primary functions of local government, and there is increasing recognition of the importance of this service and of different modalities for delivering the service which has a great impact on the behaviors of the communities. Libra sanitation is responsible for the collecting of secondary waste from one collection point to another and they are also involved in the transportation of municipal solid waste to Whein Town dump-site outside the city.

Since they already have a significant interest in the system, it is necessary that they fully recognize their potential to have more power and be able to be rightfully included in the decision-making process. That can be achieved through inner alliances, alliances with powerful stakeholders, as well as, with the stakeholders that are part of the Crowd.

3.1.3 Academia and Research Institutions

Academia or universities, education and training institutions, and research centers, and innovation are important areas that require attention and are considered in this study. The various academia and research stakeholders such as UL, School of Environmental studies, and Climate change Development, or the University of Liberia have a high human resource capacity and knowledge which they use in training, analysis, planning, and consulting. Academia and Research Institutions like University of Liberia and Stella Maris Polytechnic University are involved in assisting stakeholders in decision making process but are not directly involved in the process of pollution control, despite their strong interest in the sector. Though financial resources are limited and the opportunity to conduct any activity always depends on funding sources. Specifically, since other stakeholders value their knowledge, their opinions have an indirect impact on activities related to municipal solid waste management.

In short, they show a strong interest in what is going on and make an effort to stay updated, despite the fact that it is a subject on which they have a particular academic interest. They do not have direct decision-making influence, but they do have some influence as they are consulted by other stakeholders. Academics themselves see their research work as having an impact and influence especially on medium- and long-term prospective decisions to be taken by other key stakeholders.

Academia and research institutes also see themselves as looking at the larger framework and its complexities, taking into account the broader implications of urban waste management practices, and considering various points of view. (e.g, health, general view, specific technology, material recycling). In this respect, Stella Maris Polytechnic University is unique in that it is more regularly involved as a consultant and teacher of waste management personnel. As a result, it seems like it wields more influence over key stakeholders who either carry out waste management-related operations or make strategic decisions.

3.1.4 Civil Society-NGOs, Local Community, and Media

The main consideration for an NGO is resource utilization of waste and reduction of waste. It also emphasizes the promotion of household waste classification and composition, urging the government to adopt an environmentally friendly approach. Furthermore, they are regarded as key stakeholders, but no NGO directly involved or even directly interested in the study could be found, so they were considered as a one-of-a-kind actor.

The attention of NGOs appears to be low at the moment, but given the issue of waste municipal solid waste and the diversity of environmental organizations within the field, this could change quickly. For instances, some are

concerned about environmental management issue, and others were involved in MSW strategy plan over the years.

An NGO raised the possibility of using various technologies for garbage collection and treatment, as other countries in the region like (e.g. Ghana do not allow HCW incineration): perhaps it had a limited impact on the system, as approximately stakeholders did not consider such points as appropriate and others had never heard about it. It could be important to note that about 5 years ago some NGOs raised public opinion against the possibility of building an incinerator for Monrovia city MSW.

However, it seems to be a general distrust of incineration technology, unrelated to waste management. The local culture is fascinating: some of the few people who live next to the dumpsites work in waste management, while others work in nearby towns. They are, however, unaware of what is burned in the open dumpsites. Furthermore, they are impacted by issues (smell, noise, trucks moving frequently) related to MSW management rather than infectious waste care.

As a result, their view on open dumping is more inapplicable than unavailable. While the media were not consulted since they may be a rather heterogeneous community, they were taken into account since they were mentioned by other stakeholders. They are included in the civil society category because they were seen as a source of knowledge for both individuals and NGOs, as well as a way of amplifying their views and actions.

3.1.5 Other Stakeholders

There are several key actors include in this categories, some of which includes (City planners, senior citizens, unemployed youth, children, vendors or shop owners, corporations, etc.,), Starting with Prem Ananth [33], certain classes are established with some adjustments to include their key goals. In this regard, only formal businesses were included within the private sector, as the informal sector has not been nominated by the interviewees, nor has it been shown to play an important role in the control of infectious waste.

Public health institutions are also listed in such a category since they may be selected not to cope with their contagious waste individually, though they do so mostly on an economic basis. Based on this, the author described the stakeholders as those players who were involved and concerned with waste disposal in Liberia and communicated with them. Based on their expertise, influence, interest, and positions, the stakeholders were separated into different groups. As a snowball impact, the original list of stakeholders was revised, where new stakeholders were defined and included in the list depending on the recommendations provided by the interviewed stakeholders.

3.2 The Dimensions of Integrated Sustainable Waste Management

Integrated sustainable waste management (ISWM) is a holistic strategy that takes into account three major elements: owners, structural components, and strategic aspects. The multiple measurements are interrelated and their interconnections make the overall functionality of the structure, U.N. Habitat (2010). As a result, ISWM considers municipal solid waste management not only as a technological mechanism of infrastructure and facilities that facilitates the handling and disposal of MSW, but also as a management framework that relates to and deals with a number of other factors, such as socioeconomic, financial, and other factors.[34].

The aforementioned argument corroborates with U.N.Habitat (2010), where it is mentioned that when the ISWM system was adopted in many developing nations, it became apparent to municipalities that solid waste management issues were not scientifically dependent primarily because the effectiveness of waste management needs active participation from service consumers and also that solid waste depends on organizations.

4. Data Processing and Analysis

When all the interviews were done, data entry was accompanied by the descriptions of stakeholder characteristics in a spreadsheet, called the stakeholder table. To help facilitate the data entry process, the transition reference table method was used, connecting questions with database areas. Many of the instruments used in this study were adapted from Schmeer's work (1999).In the event of an apparent internal and general discrepancy, all the answers were triangulated together to verify general accuracy (e.g. a stakeholder overestimated his understanding of the system), such a value was corrected. A stakeholder with a different understanding, or a poor awareness of a certain issue, may create inconsistency. Such bad information may be either acknowledged by the interviewee or was not admitted.

However, more questions calling for clarity after the interview contributes to a more coherent interview, acknowledging a mistake. Discursive queries (e.g., a summary of responsibilities and activities) should validate the extent of expertise or include additional detail to equate the responses to that presented by other respondents if they do not meet the objective. Almost all the scores were consistent, both internally and collectively, on the characteristics provided by the stakeholders, so only a few had to be changed by triangulation. Similarly, almost no adjustments were required in the degree of contact between stakeholders, while knowledge sources were simply published. Qualitative details were used simply for triangulation (e.g., on device elements and other stakeholder roles), and to offer additional evidence for the results.

In a small number of categories, scores were finally reported (Table 1), since the scale of 1-10 was too detailed. Characteristics of all stakeholders were separately regarded (attitude) or combined (e.g. power versus interest grid), and graphs were created. From the maps produced during each interview, the overall social network map of knowledge was generated, reflecting all the proclaimed information flows with arrows (oriented ties), and all stakeholders and information sources were described with nodes. The position of the arrow shows who is perceived by whom to be a source of knowledge and the quality assigned is represented next to the source of information by a value of 1-5. The arrow is double-headed, with two meanings, in the case of two stakeholders who share information and collaborate. The

interaction diagram was established using the same method, describing the declared frequency of interaction.

The creation of graphical representation was carried out using UCINET software [35], a well-known predictive visualization software for social networks [36], which is still widely used. It is also possible to use other computer programs, such as PajekIgraph, or state, in reality, none are substantially stronger and simply complement one another.

5. Results and Discussion

5.1 The Results of the Assessing of stakeholders' Power, Interest, and Knowledge

The grid of power versus interest shown in Figure 1, makes it easier for the researcher to following four groups in classifying the stakeholders[24]. Government authority (have both interest and high power): Environmental Protection Agency Liberia (EPAL); Monrovia City Corporation (MCC); Ministry of Health and Social Welfare (MHSW); Ministry of Public Works (MPW); Ministry of Lands Mines and Energy (MLME).

Waste Services Provider – Subjects (have an interest, but low power): Libra Sanitation NC Senator Community-Based Enterprises; Paynesville City Corporation; Solid Waste Management Universities (University of Liberia, Stella Maris Polytechnic University, etc.

Waste Generator. – (have power, but little direct interest): Ministry of Health, Industrial Waste Generators; Liberia Marketing Associations; Household Waste generator et c., and finally Private Sector – Crowd (have both low interest and low power): media, NGOs, ISO, Hospital Accreditation (HA), and the local community.

Government authorities are the only dominant player, while Waste Generator may be treated as either a small player or a subject. There is a range of explanations for the participants to be involved in contagious control, but they did not display considerable strength. Even if individual divisions should have a more involved function, MoH is a simple background setter. Finally, such stakeholders are very heterogeneous and do not play a significant role, yet even an amorphous crowd may become a quite interested one in the event of inappropriate contact[27].

It is obvious that as long as a stakeholder is involved in the system, a stakeholder has awareness of the system, although the same is not valid concerning power: some interviewees claimed they had very little power, but were quite active and understood the system very well. This degree of comprehension may be either optimistic or negative: positive if the method performs perfectly, negative if any difficulties could become a liability. To defuse any possible adversary and to get legitimate help, stakeholders with such high levels of both involvement and awareness should be more interested. A thorough review was carried out, taking them separately into consideration, which is stated here.

The interest of MoH in the management of waste is strong. However, considering its position in supervising and overseeing procedures in hospitals and clinics, its interest is mostly about the facets of waste production and, to a lesser extent, what happens to the waste after it exits the premises of the hospital and clinic. His special involvement in the incineration of infectious waste is also less clear. The EPA, as part of the Ministry of Land Mines and the Atmosphere, is more involved in the management of infectious waste, is worried about contamination and initiatives to mitigate it, and centers its attention on the incinerator as a way of treating pollution control. Concerning strategic planning, waste management is concerned, in general, with the creation of treatment choice directives and, if appropriate, even with the discovery of alternatives to incineration. Given its regulatory position, the EPA body has the authority to influence the process of the incineration of infectious waste to safeguard the atmosphere or to establish strategies for the disposal of infectious waste.

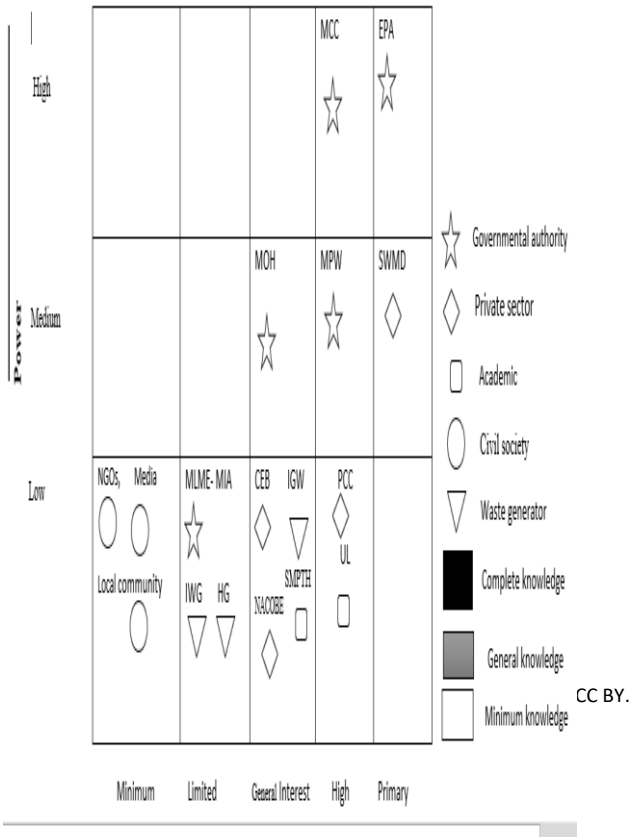


Figure 1. Power Versus Interest Grid

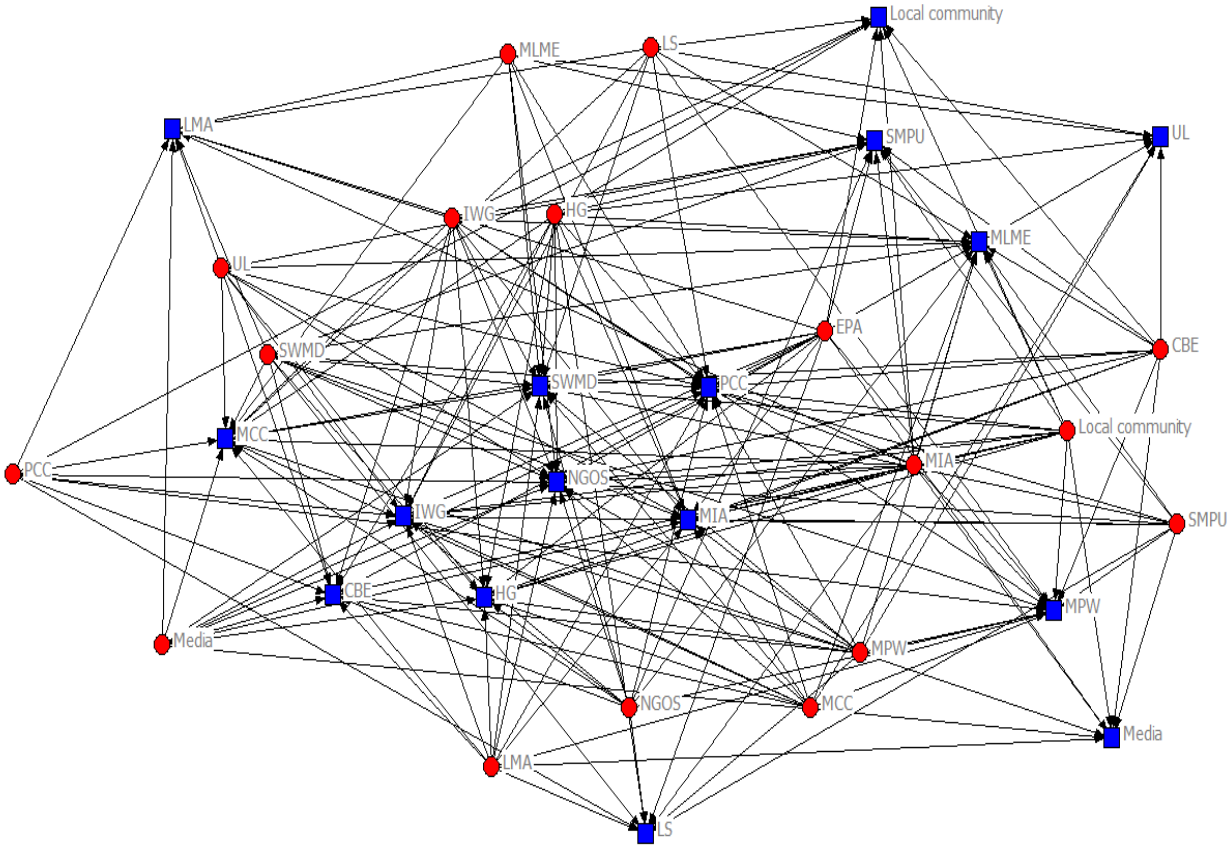
5.2 Results from Stakeholder Attitude

The assessing stakeholder's collaboration in the management of municipal solid waste in Monrovia, data on the attitude of stakeholders towards the incineration on waste management in Monrovia reveals a broadly positive picture (Fig. 2). Primary decision-making members with a large degree of influence are welcoming. This comprises the PPC and all the government regulatory authorities on waste management in Liberia. However, the study reveals that, at present, a significant number of secondary stakeholders are either neutral or insensitive to existing waste management activities and serve various sectors that are not well linked and do not indicate any clear partnerships between them. This nevertheless constitutes a certain danger for core stakeholders such as the EPA and MCC, because such a vast number of stakeholders will alter their minds quickly if a negative incident happens. One of the primary stakeholders' tactics may be to establish strong contacts with all of these stakeholders and to follow an accessible and clear line of communication

such that they are acknowledged as being in control and consulted directly if possible.

There is a need for special attention to municipal solid waste because it is very challenging to determine since there is so much spread throughout the whole region. In general, the findings suggest that they are pleased with the method since, relative to an internal care approach, they consider it very inexpensive. It is also fairly straightforward for them since, in compliance with the criteria for the collection, they just need to supply waste. Nevertheless, they have shared reservations regarding incineration as an effective alternative in interviews, even if they did not know of a better solution at hand.

In view of the method in general, the perceptions of stakeholders were largely favorable because they understood improvement: nevertheless, certain stakeholders displayed a generic distrust of waste incineration as well as plant management in particular. They were largely concerned with possible implications concerning incineration, primarily concerning dioxins. With periodic accredited flue gas review (by a private firm or NGOs), even pollution management systems do not look like an adequate assurance. Then, both in terms of procedures and facilities, the maintenance of the plant is usually deemed not to be fully satisfactory. NGOs are usually pessimistic regarding the incineration of waste, as previously stated, but they are not convinced about its application to the infectious waste market. However, because the mechanism is operating, NGOs may only be deemed mildly hostile since they have not presented any concrete concerns and no one opposes them.



Stakeholders Attitude Towards Waste Management in Monrovia Figure 2

5.3 Stakeholders Collaboration Analysis

Regarding the flow of knowledge between stakeholders, the overall evaluation (Fig. 2) indicates that few stakeholders are either isolated or just partly linked with others; nonetheless, no one recorded feeling cut off from the flow of information throughout the analysis. For most stakeholders, it is usually simple to access all the relevant details from the few sources of information to which they are connected. An example is a local group which, according to this study, has no direct links to any other stakeholder and has very restricted access to knowledge. The LMA was often regarded because it releases pollution permits for factories, including the incinerator, but it may not have a particular function in waste management.

The study showed that communication in the network is not reciprocal. Another accurate stream of knowledge good information content may be regarded by the stakeholders, but the flow can either be unidirectional or with a large variation in quality between the two paths. A potential interpretation may be that by assessing the extent of understanding of the stakeholder on what is currently in operation and how it works, certain knowledge deficiencies have been found. Only a few stakeholders are fully informed of the way Monrovia's waste management mechanism

functions. Such participants still may not demonstrate a strong interest in understanding anything about it. This is related to the fact that waste management in Monrovia at present is not a matter of popular discussion or concern. As such, no noticeable interest in this issue is displayed by the local government, media, and NGOs. This is often an indication that the scheme is working to the satisfaction of those stakeholders, or better, it does not lift their protests. This condition can therefore improve as discussions about modern incineration plants or new technology become more common in the media.

It is also vital to take into account the extent of collaboration between stakeholders, as seen in (Fig. 2). A person with repeated encounters with others should be able to gather data faster and of better quality, while providing a clearer view of the method. Once again, the local group is not related, since it is not known and only PPC and MCC itself are officially represented. Similarly, the public is not taken into consideration, since they are not currently involved in the issue, so both the media and the local population are not properly portrayed.

Information is very divided about who plays a central position and has control and a clear understanding of the structure and who has little influence and little real interest, if not or just marginally interested. In the knowledge and communication sharing networks, NGOs are key, with strong relations with all other major players in the government, academia, and the private sector. In view of its close links to hospitals and clinics, MOH is also central. It serves as a hub for the health sector's stakeholders. Academia has a major part in the sharing of knowledge as well. Academia achieves this by way of its regulatory role, through its teaching and advisory services. When it is viewed as autonomous and evidence-based rather than serving government or corporate agendas, Academia is well-positioned and regarded by all stakeholders as a valuable partner. In this sense, it will be wise to improve the relations between hospitals and clinics and the health sector in general, so that academia can play a better position as an information broker between the waste management engineering industry and the health sector. The EPA, which reflects the general interest in environmental matters, has a strong view of the scheme and gathers all the essential details from the key stakeholders. Academia will theoretically serve as intermediaries and autonomous actors that connect waste management organizational units to civil society organizations. The prolonged concerns concerning incineration and its environmental effects will be further addressed by the dissemination of an optimistic message about incineration.

5.4 Contribution to Literature

The evaluation of stakeholder collaboration indicates that the scheme is functioning well and is welcomed by part of the stakeholders as a positive option, whilst the others are predominately neutral because not well-informed or not especially concerned about it. Quite seldom stakeholders like NGOs' approach are not overwhelmingly pessimistic as shown in Table 1, this is contingent on the general notion of considering cooperation in the sector is a big problem. Nevertheless, the coordination device efficiency can be deemed somehow acceptable, as particular grievances have never been registered, yet. The institutional agreement of the waste management retaining control and accountability of the mission when contracting as a commercial company to run the facility may be deemed quite acceptable. The customers, the hospitals and clinics, are pleased that they do not have to take charge of waste treatment and are content to pay the respective payments, and their amount has been rising over the last twenty (20) years according to the study. The method of waste management underlies specific regulatory guidelines and is regulated by EPA. Network research reveals that EPA is well linked to a broad variety of other players such as academia, regional and national agencies, and, of course, even the key clients, e.g. major hospitals. Other small players recognize how they could access details but currently prefer not to since they are not particularly worried about the existing procedures of infectious waste management. As the contagious waste incinerator currently offers little cause for complaint, the vast number of stakeholders are either neutral or rather in favor of the solution.

Considering the position of NGOs in Liberia to ban waste incineration, and that the present study shows NGOs on the line of negative attitude, the possible shift of attitudes with time should not be underestimated. A favorable attitude and relationship can shift rapidly to an unfavorable one in case of an accident at the facility or when technology selection and strategic decisions need to be made for the future. This would be the case soon when the machine is approaching full capability (Fig. 2), so it has to maximize its potentiality. In this respect, regularly accessible and clear correspondence of EPA with all stakeholders concerning waste management is advisable to enhance confidence in the existing technical solution.

While the framework is functioning to the main stakeholders' satisfaction, other players are not active nor well educated about the system. Preparation should take into account all single stakeholder characteristics findings from (SA) and their modes of interactions findings from (SNA). These signs can be precious in aiming at achieving (SWM), which needs to be inclusive [37]. The structure should be designed involving stakeholders, but according to their interest, influence, experience, and mindset, those who could specifically impact the system should be included, whilst the others should be at least adequately educated, with sufficient and frequent contact[24]. Actors may address future impacts of the method, including pollution management and surveillance practices with certain subjects that might provide a scientific perspective, including Academics, and an influential opinion.

Another stakeholder like hospitals should frequently consult and render the waste collection more functional and cost-effective e.g., change of collection plan, improved planning on quantity to collect as often all the demands cannot be fulfilled, the subjects may feel involved and considered, and will probably be more cooperative. Context setters should be told apart, maybe arranging special visits, to be confident that they will help the scheme if their enthusiasm grew.

Finally, the society will be aware of waste operations and all the practices to restrict and monitor all the impacts through conferences, meetings, or via the media, the participation of research collaborators, including Universities, and the active engagement of beneficiaries from the scheme, including hospitals, would allow the role of players more stable and effective. However, EPA, MCC, PCC, has the legal responsibility to adequately notify all the parties impacted by any eventual incinerator negative impacts, regardless of their degree of participation or awareness.

The (SA) strategies are currently deemed state of the art in nontechnical evaluation procedures. Such research, typically implemented at the start of a project period, maybe effectively applied even in further phases. In reality, an already developed framework may also be evaluated; maybe it needs some adjustments in terms of communicative strategy and stakeholder participation or maybe it may need to expand its capacity, as in the case study[38]. In such a scenario, while the framework may not have to be developed from scratch, it should be examined carefully, recognizing not just the stakeholders already accepted, but also those theoretically interested or concerned. Because a framework is already in operation, certain knowledge and a strong range of stakeholders are already available, but the concept of interviewing new players may not be well-accepted by key stakeholders. Thus to provide a successful review, from the very beginning main stakeholders should be aware of the goals and the approach[15]. This study indicates that SA and (SNA) are complementary and their incorporation offers additional advantages to help measure and appreciate the overall framework.

Furthermore, from a network perspective, the complex interaction among stakeholders of various types can be read in different ways, which is impossible with a simple SA (Savage et al., 2011).The stakeholder recognition method conducted by questioning the stakeholders themselves[23], was effective, as well as beginning from the paradigm suggested by Schmeer (1999); but other comprehensive studies [25], maybe checked in the sector. Using an interview-based mapping technique helped participants recognize, imagine, analyze, and propose changes in scenarios where several separate players might affect the results[39]. The usage of graphical resources facilitated interviewees to center their attention not just on expression but rather on a visual depiction of their opinions.

Using SNA as a method to lead interviews thus enabled not only to define the understanding of and stakeholder of who the primary and minor stakeholders are but also helped to identify new and unforeseen stakeholders and connections between them[40]. The network nodes (stakeholders) were identified by their government, private industry, academia, civil society, and other organizations, as well as their level of system knowledge, attitude toward the infectious waste management system, and participation and willingness to make decisions or influence efficiency. Concerning access to knowledge and level of contact, the network relations were analyzed. It was usually deemed useful to allow stakeholders to include assessment and self-evaluation of scores and was welcomed by the interviewees who liked the fact that perception and subjectivity were not in the possession of the interviewer but rather passed to the interviewee. However, in some instances, stakeholders expressed their unease in scoring other stakeholders, especially if their near partners were considered. The interviewer's consistent contact about knowledge confidentiality helped to ease the problem. The technique followed an interactive strategy consisting of data collection, data interpretation, new data collection and triangulation, and follow-up where anomalies were detected with more data collection; essentially, the conclusions were the result of the processing and synthesis of all evidence gathered.

The data obtained was beneficial since it incorporated knowledge on multiple dimensions, culminating in a holistic review[13]. To get a comprehensive image of a framework, the combined usage of SA and SNA could be effectively incorporated with other instruments, providing a strong idea of how to adjust and enhance it could be especially strategic in situations where the number and significance of stakeholder's collaboration are not obvious, and circumstances shift rapidly, as in many low- and middle-income countries like Liberia.

6 Conclusion

The author offered a comprehensive review from the point of view of stakeholders interviewed and scholarly articles on waste management in Liberia. The author thus defined the prevalent ontological and epistemological structures that took up in the literature, which take a normative functionalist perspective focused on collaboration between stakeholders in waste management in Monrovia. Although these prevalent structures have laid the essential and helpful foundations for this emerging sector, the author argues that this study needs to be complemented with critical and innovative points of view to a deeper understanding of the constraints and macro-incidences of waste management with the same financial power in Monrovia and other countries.

This article, therefore, encourages prospective scholars to combine structural agency and corporate experiences and reflect on the dynamic and processual nature of waste management. Waste management in Monrovia, which provides the storage and treatment facility, is handled largely by a unique organization. Like the EPA, MCC, PCC controls to track the environmental effects, and the service customer, regulator, and administrator, the public position is quite significant. Stakeholders are either happy with the scheme or are not particularly aware and worried about it. Some do not have any specific purpose to protest but do not totally trust waste management either, so claimed to be only neutral; only MOH and NGOs stated that they were against it, just again because of the technologies used. Almost all healthcare services have entered the system in the last decade, so the incinerator is approaching its full potential, needing preparation for growth. The appraisal indicates the introduction of a participatory strategy, the development of connectivity, and the strategic engagement of academics. The feeling against the framework could be strengthened by those stakeholders, confirming its successful efficiency.

The joint use of SA and SNA permitted both the characteristics of the stakeholders and their relationships to be

evaluated, offering indications on how to predict and handle potential reactions. In particular, the network methodology enables SA to be used not only throughout the validation process but also as an appraisal method to detect future problems and any need for change, including on the system's day-to-day basis. The results indicate that many of the stakeholders are not aware of the waste management partnership. Knowledge and communication about the system's possible positive and negative effects may be improved, for example, through sharing the system's success through multiple advertising activities and other communication channels to the general mass and stakeholders. Such a strategy was helpful because it aimed to connect technological and non-technical elements, looking at a framework that was sustainable and completely appropriate. Besides, it was especially useful to use mapping protocols to ask stakeholders to self-evaluate their functionality and the framework.

To achieve a holistic image, checking the integration with other methods is suggested. Finally, in those countries where the complexities of the structure are not entirely transparent and the position of stakeholders could theoretically differ, such a strategy appears especially helpful, it applies in the majority of SWM schemes. Every framework is different, and therefore such a solution will involve specific planning and modification, but it seems like a cost-effective way to take non-technical considerations into account.

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Authors:

First Author: C. Wonleh Sei Slehkie, UN Environment Tongji Institute of Environmental for Sustainable Development, College of Environmental Science and Engineering, Tongji University, Shanghai 200092, China**.** Email: slehkiecwonlehkie1986@gmail.com

Second Author: Prof. Niu Dongjie, Shanghai Institute of Pollution Control and Ecological Security; State Key Laboratory of Pollution Control and Resources Reuse; Key Laboratory of Yangtze River Water Environment, Ministry of Education, Tongji University, Siping Rd 1239, Shanghai,200092, People Republic of China. Email: niudongie@tongji.edu.cn