

## Assessment of Municipal Solid Waste Management Practices in Juba City, South Sudan, Challenges and Practical Considerations: A review

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**Abstract:** During the last few decades, the problem of MSWM (Municipal Solid Waste Management) have acquired an alarming dimension in the developing countries due to high rate of population growth accompanied by wide spread economic activities. South Sudan is a developing country emerging from conflict situation and experiencing alarming solid waste problem in Juba city. The objectives of this review paper are to assess the MSWM in Juba city, highlighting the challenges and thereafter recommending some practical measures as solution to the problem. The average waste density of Juba city is  $118\text{kg/m}^3$  lower than that of an African setting. MSWM in Juba is simply based on waste collection, transportation and dumping at the dumpsite with relative recycling by informal waste pickers. MSWM in Juba encounter several challenges including: lack of solid waste awareness and education, technical issues, poor coordination, inadequate funding, ineffective policies, poor governance, weak institutions, strong international influence and inadequate or unavailable market for recyclables. The method used for this review paper ranges from documents, reports and publications about solid waste management in Juba city as well as in depth literature search and journals of SWM ( Solid Waste Management ) in developing countries. Knowledge about the dumpsite and other sites visited during the previous field visits helped in preparing this paper. Therefore, MSWM is technically inappropriate with inadequate organizational capacity and cooperation among stakeholders accompanied with several challenges on top which is poor governance where accountability, participation and transparency are lacking. As a result, strong political will, multi-sectorial approach, public awareness and participation, strategic planning, adequate funding and the adoption of ISWM (Integrated Solid Waste Management) concept that strives to minimize solid waste through the 3Rs is the recommended SWM system required in Juba.

**Keywords:** Solid Waste Management, Juba city, South Sudan

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### I. Introduction

**1.1 Background:** During the last decades, managing solid waste is a complex task that requires appropriate technical solutions, sufficient organizational capacity and cooperation among wide range of stakeholders.<sup>[1]</sup> According to Seadon,<sup>[2]</sup> the interdisciplinary and multisectorial considerations needed for the proper management of solid waste highlights the interaction and complexity between the physical components of the system and the conceptual components that include the social and environmental spheres.

ISWM, the current paradigm that has been widely accepted throughout the developed world, emerged from the policy shift away from land filling and the push for a broader perspective that begun in 1990s. While the modern SWM practices that begun in 1970s were defined in engineering terms – technical problems with technical solutions.<sup>[3]</sup> The concept of ISWM strives to strike a balance between three dimensions of waste management: environmental effectiveness, social acceptability and economic affordability.<sup>[3][4][5][6][7]</sup> ISWM also focuses on the integration of the many inter-related processes and entities that make up waste management system.<sup>[4]</sup>

To reduce environmental impacts and drive costs down, a system should be integrated (in waste materials, sources of waste and treatment methods), market oriented (i.e. energy and materials have end-uses) and flexible, allowing for continual improvement.<sup>[4]</sup> ISWM systems are tailored to specific community goals by incorporating stakeholders perspectives and needs, to the local context (from the technical, such as waste characteristics to the cultural, political, social, environmental, economic and institutional) and the optional combination of available, appropriate methods of prevention, reduction, recovery and disposal.<sup>[3][4][8]</sup>

During the last few decades, the problems associated with municipal solid waste management (MSWM) have acquired an alarming dimension in the developing countries. High population growth rate and increased economic activities in the urban areas of developing countries, combined with the lack of training in

the modern solid waste management practices complicate the efforts to improve the solid waste management services. As a result, developing countries face the challenge of rapidly increasing waste volumes beyond what their current infrastructural and organizational, institutional and financial arrangements can cope with. In developing countries, the per capita generation of solid wastes in urban residential areas is much less compared with the developed countries, however, the capacity of the developing countries to collect, process, dispose or reuse the solid wastes in a cost-effective manner is significantly limited compared to the developed countries.<sup>[9]</sup>Waste generated by human settlements and the associated problems are similar in the developing countries with variances between regions and locations based on geographic, socio-cultural, industrial, infrastructural, legal and environmental factors.<sup>[10]</sup>

Challenges associated with waste management in developing countries include underdeveloped countries, collection and transportation capacity; inadequately managed and uncontrolled dumpsites and the problems with governance also complicate the situation. Weak institutions, chronic under-resourcing and rapid urbanization exacerbate the challenges.

South Sudan, a newly emerging and developing country, gained its independent from Sudan on 09/07/2011 after decades of civil war. South Sudan is bordered by Ethiopia and Kenya in the East, Uganda and Congo (DRC) in the South, Central Africa Republic in the West and Sudan in the North. The Republic of South Sudan is divided into several levels of government; the national government, the states, counties, payams and Bomas and municipalities in prominent cities. Armed conflict broke out again on 15/12/2013, reversing much of the development progress achieved by this new nation. The lack of infrastructure, low level education and insecurity due to conflicts, pose challenges to the local economy. The government is also confronted with the need to establish strong and efficient institutions, support human capacity and skills building and develop regulatory and legal frameworks, while also ensuring that the general public has access to basic services such as education, health care, waste management, etc.

**South Sudan Population:** 12,340,000 (United Nations world population prospects 2015 estimate)

**Population density** : 13.33/Km<sup>2</sup>(34.52/mi<sup>2</sup>)

**Total area** : 619,745Km<sup>2</sup> (239,285mi<sup>2</sup>) (42<sup>nd</sup>)



**Figure 1:** Map of South Sudan; Source: <https://www.cia.gov/library/publications/the-world-factbook/>

**1.2 Climate:** The climate of South Sudan is tropical in nature and is characterized by a rainy season followed by a dry period. May is the wettest month with slightly lower temperatures, higher humidity and greater cloud coverage. Average temperatures for South Sudan range between 20 to 30°C in July and 23 to 37°C in March (weather-and-climate.com).

**1.3 Area of study:** Juba is the capital city of the Republic of South Sudan is selected for the present study which is the seat of the government of Central Equatoria State, headquarters of Juba County and where Juba City Council or Municipality lies.

**1.4 Location:** Juba city is located on latitude 4°51'N and longitude 31°36'E and 518 meters above sea level. Juba city lies on the western bank of the White Nile. The city council or municipality comprises of three Payams (Districts) namely; Juba Payam, Munuki Payam and Kator Payam.



**Figure2:** Location of dumping site; Source: Google maps

**1.5 Case description:** Due to many years of civil war (1955-1972 and 1983-2005) in South Sudan (the then Southern Sudan), basic sanitation infrastructure for solid waste management was not given importance as a result, juba city is lacking facilities to manage solid waste. Due to lack of garbage collection services, most people use roadsides, open spaces, football fields, river banks, drainage channels and even grave yards as dumping sites. Some wastes are burned in residential areas, on the streets, etc. leading to air pollution with probable potential health hazards. The situation was made worse by the return of refugees from the neighboring countries and IDPs from Sudan as well as the influx of migrants from Congo (DRC), Eritrea, Ethiopia, Kenya, Somalia, Sudan and Uganda when the CPA was signed in 2005 that brought relative peace and economic boom in the country.



**Figure.3** Waste dumping in drainage channel; Source: By the Author

Garbage is collected in parts of Juba at a fee but the service is irregular with 95% of Juba's residence having no access to waste collection service.<sup>[11]</sup> Cholera and other waterborne diseases are common in Juba with major cholera outbreaks in 2006, 2007, 2008 and 2014 and the latest in 2015, with 1,597 cases including 45 deaths.<sup>[12]</sup>

**1.6 Juba Municipal Waste Characterization:** Twice analysis of Juba's municipal solid waste was undertaken in December 2012 during the dry season and in September 2013, during the wet season, in order to capture seasonal variation in the waste composition through the wet and dry seasons.<sup>[13]</sup> Waste consignments from the three Payams of Juba municipality (namely Juba, Munuki and Katorpayams) were used in the analysis. Methods used in the analysis are the ASTM (American Society for Testing and Materials), Standard Test Method for the Determination of the Composition of unprocessed Municipal Solid waste D5231-92(2008) and UNEP/International Environmental Technology Centre, Developing Integrated Solid Waste Management Plan Manual, Volume1, Waste Characterization and Quantification with projection for Future (2009). The objective of the analysis is to support/advice/suggest Juba City Council and other municipal units in improving their waste management system.<sup>[13]</sup>

**Table.1** Waste composition in waste characterization study, September 2013

No	Waste component	% Weight
1.	Organics	40.0
2.	Plastics	21.0
3.	Paper and cardboard	13.0
4.	Soil/sand/ash	11.0
5.	Metal	5.0
6.	Glass	4.0

7.	Textile	3.0
8.	Other wastes	2.1
9.	Special care waste	1.0
	<b>TOTAL</b>	<b>100.0%</b>

Source: UNEP, Juba Waste Analysis Report – September 2013<sup>[13]</sup>

The average density for Juba’s solid waste in the September 2013 operation is 123Kg/m<sup>3</sup> as compared to the average of 112Kg/m<sup>3</sup> for the waste characterization in December 2012.<sup>[14]</sup> This slight increase in density is a result of a higher proportion (9% more than 2012) of organic waste, which inherently has a higher density and moisture content than other waste types<sup>[14]</sup> as well as abundance of vegetables and fruits. The average waste density—118kg/m<sup>3</sup> over the two exercises is a low density for an African city, which would typically start at the range of 180kg/m<sup>3</sup> and could be as high as 500kg/m<sup>3</sup>.<sup>[13]</sup> Rather, the waste density figure for Juba falls more in the range of what would be expected within an OECD (Organization of Economic Cooperation and Development) case study, which typically would have a higher plastics and lower organic content.<sup>[13]</sup>

However, the lower density is probably that Juba itself is unlike a typical African city because it has a very large international humanitarian and development community with higher levels of income and more packaging material waste (plastics, cans, boxes and papers), all of which possess low densities.<sup>[13]</sup> The low density value for household waste in Juba is also likely a reflection of the co-collection of household waste and waste produced by commercial centers such as small shops, guest houses and restaurants, which would typically result in a high ratio of packaging material waste and thus, lowering the overall density figure for municipal waste.<sup>[13]</sup>

1.7 Overview of MSWM practice in Juba City:

Table2: Overview of MSWM practice in Juba City

Street Sweeping and Waste Collection	Door to door Waste Collection in Affluent Neighborhoods	Waste Collection from Storage Points
Transportation of Waste	Transporting Waste by compactors, tippers, trucks, tractors with trailer	
Final Disposal	Dispose waste at the dumping site	Relative recycling by informal waste pickers at the dumping site

MSWM in Juba is based on waste collection, transportation and disposal at a dumping site in line with the South Sudan Development Plan.<sup>[15]</sup> The solution chosen for SWM in the development plan is the establishment of landfills on the outskirts of Juba city with recycling to reduce space for waste disposal. However, the problem of waste management is now beyond the capacity of Juba City Council due to abrupt population explosion and its related waste production which requires significant resources of waste management which are unavailable.<sup>[15]</sup>



Figure 4: Waste Transportation to the Dumpsite; Source: UNEP, Juba Waste Analysis Report-September 2013.

1.8 Solid Waste Management (SWM) operation at the dumping site: However, a solid waste dumping site was identified in 2007, located at RejafPayam off the Juba-Yei road about 13Km from Juba town. The dumping site is operated by Juba Municipality with JICA as the consulting agent. Uncontrolled dumping started in 2006 along the main road with actual controlled dumping procedure as of September 2012 and is undertaken by JICA.<sup>[16]</sup>

Dumping is carried on daily basis, organized in cells and covered with soil. A wheel loader or bulldozer is found on site depending on availability.<sup>[16]</sup>

Sources of solid waste to the dumping site are Juba payam, Munukipayam and Katorpayam which make up Juba Municipality plus some parts of Rejafpayam with a total population of approximately 0.8 to one million.<sup>[16]</sup>

Total area of the dumping site is 25,000m<sup>2</sup> (500m\*500m) and volume of daily waste disposal in tones is approximately 500 tones (approx. 60 to 70 trucks \* 8 tones).<sup>[16]</sup>



**Figure 5:** (a) Open dumping and (b) waste pickers; Source: UNEP, April 2013

**1.9 Waste Picking:** waste pickers come to the dumping site daily in search of plastics such as PET bottles, nylon sacks and tyres and metal scraps like aluminum cans, etc. which they sell to recycling companies.<sup>[16]</sup> Most waste pickers are locals, who live on the outskirts of Juba city in Durupi, Lokwilili, etc. whereas others come from Terekaka County.<sup>[16]</sup> The waste pickers range from children to adults (both sexes). Some are even lactating mothers.<sup>[16]</sup> However, these waste pickers are informal scavengers who lack protective gear; as a result, they are vulnerable to a variety of health risks associated with waste picking activities.<sup>[16]</sup>

**1.10 State of recycling:** There are around 15 companies operating in Juba specialized in recycling and mainly dealing with four types of recyclables.<sup>[15]</sup> These include:

1. Scrap metals: most targeted, collected and sold in Kenya or Uganda.
2. Blow/hard plastic: widely targeted, shredded and sold in Kenya or Uganda.
3. Small-scale recycling initiatives where bottled water companies shred their defect plastic bottles and export to Kenya or Uganda.
4. Aluminum and especially beverage cans are collected, melted and formed into gate ornaments or simply compressed together and sold in Kenya or Uganda for melting.

However, the two main players are the companies Philing Environmental and Southern Express. The Southern Express for instance was registered in 2006 and is one of the companies contracted in 2008 for garbage collection and disposal with 12 trucks and one loader but most of the equipment has broken down.<sup>[17]</sup>



**Figure 6:** Picked material for recycling (a) Plastic bottles and (b) Beverage cans; Source: UNEP, April 2013<sup>[16]</sup>

**1.11 Juba Solid waste Management Stakeholders:** This stakeholder's forum was proposed to comprise the National Ministry of Environment, Ministry of Finance, Ministry of Physical Infrastructure, relevant state ministries, City Council and other local governments, Business sector, NGOs, CBOs, UN and international development agencies.<sup>[15]</sup> However, Juba City Council, health officers from the three payams (Juba, Munuki and Kator), Juba County, RejafPayam, ERP, UNEP and JICA are improving waste management within the city but it is still at the beginning of the process. JICA and UNEP are providing the technical assistance in MSWM at present with funding from USAID, UK, etc.

**1.12 Challenges of solid waste management in Juba city:** However, so many challenges exist in regards to recycling and solid waste management in Juba and South Sudan at large, which can be categorized into the following categories.<sup>[15]</sup>

**1. Awareness and education**

- Lack of awareness for recycling among government officials and other key stakeholders.
- Negative attitude and stigma towards waste collection and recycling by the population due to local norms and culture.
- Lack of health and environmental education in the community.
- Lack of skilled personnel able to work in SWM or recycling.
- Language barrier among stakeholders making cooperation difficult.

**2. Technical issues**

- Lack of (access to) recycling equipment in Juba or South Sudan.
- Waste workers lack technical skills related to recycling processes and equipment.
- Lack of infrastructure and power to operate recycling equipment.

**3. Co-ordination**

- Lack of co-ordination among key stakeholders.
- Public health officers not involved in waste management.

**4. Funding**

- Lack of government funding and financial resources in SWM sector.
- Lack of private sector interest and funding in recycling business.
- High operational costs and expensive SWM and recycling equipment.
- Private investment deterred by insecurity.

**5. Policies**

- No clear or adequate policies on SWM and recycling.
- Lack of clear regulations on SWM.
- National, state and local authorities unable to enforce policies and regulations.
- Inefficient SWM system.

**6. Market for recyclables**

- No demand for recyclables in South Sudan.
- Transportation within South Sudan and to Kenya or Uganda is difficult and expensive.
- Low earnings from recyclables.
- Low quantity of segregated solid waste to be recycled.

**7. Stakeholders forum**

- Lack of SWM and recycling stakeholder's forum that will coordinate among the different bodies (government, NGOs, CBOs, private sectors and funding institutions) involved in SWM.

## **II. Methodology**

The methods used in this study are mainly based on:

- I. Documents related to MSWM in Juba city including Juba waste analysis report, first national planning workshop on recycling report, Juba landfill environmental assessment report, data on cholera outbreaks, various references, scientific journals, published papers and research papers and publications from internationally recognized institutions (UNEP/IETC, The World Bank, UN-Habitat, etc.) on MSWM and their challenges especially in developing countries were thoroughly searched to obtain as much information as possible for writing this review paper.
- II. The author's observation during the previous site visits to Juba dumping site, off Juba-Yei road and other sites and interaction with Municipal and RejafPayam officials at the site during University of Juba students field visits in 2012 and 2014 is an advantage in accomplishing this review paper.

## **III. Discussion**

As mentioned in the UNEP/ERP Workshop Report,<sup>[15]</sup> MSWM practice in Juba is based on waste collection, transportation and disposal at a dumping site. Though waste collection rates are supposed to be more frequent especially in warmer climatic regions like South Sudan and for this case Juba city, collection system is inadequate in the sense that it is irregular as piles of waste can be seen accumulating in storage sites in market places, on road sides and in government institutions, generating stinging odour and providing breeding grounds for disease vectors, etc.

Transportation becomes another problem especially during rainy season when roads become impassable due to poor road conditions that cause frequent breakdown of the trucks. Overloading the compactor vehicles with very dense market waste (organic waste) results in malfunction with the hydraulic compaction mechanism as it is unnecessary to compact the dense market waste of this nature. These further accelerate the rate of breakdown of these vehicles compounded with the poor road conditions.

Appropriate technical solution to municipal solid waste management (MSWM) practice is completely lacking in Juba city. For instance, the official at the dumping site have no knowledge of waste management practice. He only oversees and directs the trucks that transport waste to unload their contents appropriately. The only management practice is covering the unloaded waste with soil and then compacted by a bulldozer. Co disposal and random dumping practice of MSW at the dumping site poses health threat to informal waste pickers who pick material for recycling without using protective equipment. Such practices expose them to injuries due to presence of sharp objects like needles from general hospital wastes that carry with them infectious agents like bacteria, virus etc. Overall, the dumping area has become an excellent breeding ground for disease transmitting vectors like flies and generating odour from decomposing organic matter leading to degradation of the quality of environment in the surrounding area. The co disposal of MSW without proper provision for subsequent leachate recovery system poses problem to surface and ground water in the vicinity of the dumping site. The high volume of daily MSW disposed, compounded with random and co disposal practice will fill the present only available landfill within short period of time, taking into consideration the size of the landfill area. However, segregation of some items like beverage cans, scrub metals, plastic bottles, etc. carried by informal waste pickers would have been done prior to disposal of waste to cut down the cost of transport.

Therefore, with the present volume of waste generated in Juba city, due to explosion of population, accompanied by urban sprawl now taking place in Juba, and the fact that people are becoming aware of the problems posed by landfills in their backyard, integrated solid waste management (ISWM) is the only solution to the MSWM which if correctly implemented will achieve environmental effectiveness, social acceptability and economic affordability.

However, the implications of increasing amount of waste are not just environmentally. Increased waste means increased disposal costs, which ultimately have to be met. As a result, MSWM in Juba city can best be managed through the waste management hierarchy, which in essence means waste prevention at the source, reuse, recycle, recovery of material and lastly, dispose the unwanted material. In such cases, only a small volume of waste will go to landfill which becomes environmentally, socially and economically appropriate.

The cultural and socio-economic context also influences the waste composition generated by the population<sup>[18][19]</sup> which will dictate a unique management practice pertaining to the waste composition. For instance, the waste characterization undertaken by UNEP in 2012 and 2013 found the waste composition and density typically of OECD countries, because of the big number of humanitarian and development partners personnel in Juba with relatively higher income, as such, unique pattern of consumption. Inappropriate technologies are instead practiced in Juba MSWM. For instance, the compactor vehicle is not appropriate for collection and transportation of very dense organic wastes from market places where such wastes have high soil and sand content, which is very abrasive, and will further wear and damage the compaction component of the vehicle.

Organizational capacity is very poor in the sense that as noted by Seadon,<sup>[2]</sup> the interdisciplinary and multilateral considerations needed for proper management of municipal solid waste highlight the interaction and complexity between the physical components of MSWM system and the conceptual components that include the social and environmental spheres. The lack of communication, coordination and cooperation among stakeholder as well as absence of strong and effective stakeholder's forum to deal with SWM issues aggravate MSWM system in Juba.

According to the UNEP/ERP Workshop Report,<sup>[15]</sup> so many challenges exist in regards to recycling and solid waste management in Juba and South Sudan at large.

Lack of awareness for SWM or recycling among government officials and other key stakeholders is a big challenge which needs to be overcome so that government officials and other stakeholders will become knowledgeable of so many appropriate SWM options and chose out of these options that best suit their environmental, social and economic conditions, hence, provide reasonable service to service users. Negative attitude and stigma towards waste collection and recycling by the population of Juba in particular and South Sudan at large due to local norms and culture is a setback towards making most of the citizens engaged in SWM activities. Therefore, the structure and functioning of SWM system are founded on the behavior patterns and underlying attitudes of the population, factors that are shaped by the local cultural and social context.<sup>[19]</sup> The substantial diversity of social and ethnic groups that often exists within rapidly expanding cities and even within individual residential communities greatly influences municipality's capacity to implement SWM strategies.<sup>[19]</sup> This diversity of social and ethnic groups is evident in Juba from over the states of South Sudan, the neighboring countries and from overseas which makes up the international humanitarian development communities and UNMISS personnel. Public awareness and attitudes towards waste can affect the entire SWM system from household storage to separation, interest in waste reduction, recycling, demand for collection service, willingness to pay for SWM system, opposition to proposed location of waste facilities, the amount of waste in the streets and ultimately the success or failure of SWM system.<sup>[19][20][21][22]</sup> Waste disposal is also greatly influenced by social attitudes. Some social groups always dispose of waste in the appropriate disposal

location whereas some householders and city officials alike may have no interest in whether waste is dumped illegally or sent to a proper disposal facility, as long as it is removed from the urban zone.<sup>[18]</sup>

Lack of health and environmental education in the community is another challenge to South Sudan in general and Juba city in particular. As mentioned by Konteh,<sup>[23]</sup> that the primary focus in some urban areas is still on food, shelter, security and livelihoods. Waste will become a problem only when these basic needs have been met and only becomes an issue when public health or environmental damage impacts these priorities.<sup>[24]</sup> In fact, the government in Juba is facing the challenge of providing security to the citizens and food commodities at the moment to address the looming prospect of hunger or famine due to food gap which has already taken its toll on citizens of Unity, Upper Nile and Northern Bahr El Ghazal states. The outbreak of cholera in 2006, 2007, 2008, 2014 and with recent one in 2015<sup>[12]</sup> shows that public and environmental health is not a priority up in the budget expenditure hierarchy to the government.

Lack of (access to) SWM or recycling material and equipment in Juba or South Sudan such as garbage collection vehicles, bulldozers and other heavy equipment used at the final disposal site, operation and management of facilities are in short supply or not available. The only bulldozer at the dumping site was recently procured by JICA for operation at the dumping site. Otherwise, the municipality does not have bulldozers for covering and compaction operation at the dumpsite. Waste workers lack technical skills related to SWM or recycling processes and equipment. Formulation of national policy and plan is a challenge that in most cases is accomplished by agents like JICA through the "Project for Capacity Development on Solid Waste Management in Juba, (2011-2014)". Lack of infrastructure for SWM is a chronic problem since South Sudan was in unity with Sudan. There was no garbage collection service, waste was either burned or dumped in open spaces, given the small volume generated and the composition was not highly risky compared to the present situation. But numerous cases have been documented in which expensive, sophisticated composting and recycling plants have failed for a wide range of reasons such as the use of imported, inappropriate technology that is too expensive or difficult to maintain; limited development of a market for recyclable materials; absence of technical personnel with operational and management capacity; failure to adequately consult significant stakeholders and the public.<sup>[21]</sup>

Poor co-ordination among key stakeholders poses problem to SWM. The participation of and collaboration of all relevant parties, including governments (national, state and local), NGOs, community groups and private sector is achieved through good governance<sup>[23]</sup> where policy decisions are democratically done.

The planning process for MSWM does not have a clearly defined rational process which should evolve from definition of goals and objectives to decision-making on how the goals and objectives will be achieved. As mentioned earlier, such planning process does not involve a broad range of stakeholders or multi-sectorial and interdisciplinary approach. As a result, the MSWM sector faces environmental, social and economic challenges due to upholding the planning process to the waste sector alone. However, it has been difficult to fully integrate stakeholders and ensure public involvement,<sup>[5]</sup> this is in large part due to the fact that citizens didn't shape the SWM systems they depend upon. These systems were shaped by technically minded experts who defined and designed the system in engineering terms. Therefore, a successful planning process not only defines programs but opens up lines of communication often among parties that rarely spoke to one another before the process. This communication results in consensus building. This however helps define what management practices are really needed and which are most likely to succeed. The effective public involvement and coordination in SWM planning and program development provides the mechanism for addressing public concerns and values at each stage of the planning and decision-making process.

Poor government funding and financial resources allocation in SWM sector in Juba is a major issue which needs to be addressed. To the central government, MSWM is not a priority. As Konteh,<sup>[23]</sup> observed, primary focus for governments is security and food, as is the case in Juba at present and waste will become a priority only when these more basic needs are met. However, waste will only become an issue when public health or environmental damage impacts these priorities,<sup>[24]</sup> with a good example when cholera epidemics hit Juba in 2006, 2007, 2008 and 2014 with the latest in 2015.<sup>[12]</sup> Financing operation costs is the most challenging issue in MSWM. Municipal government performance in the collection of waste service fees is often poor. People are reluctant to pay for municipal waste collection services which are perceived to be unsatisfactorily, at the same time, poor payment performance lead to a further deterioration of service quality.

In many cities of the developing world as well as in Juba, solid waste revenue flow into general municipal account where they tend to be absorbed by overall expenditures instead of being applied to the intended purpose of waste management. The danger of such misallocation of funds is even greater when locally collected fees and revenues are transferred to the state or central government before being redistributed to the local level. Besides, the simple fact of reducing funding for waste management, the absence of linkage between revenues and the actual levels of service provision tends to undermine the accountability of local waste management institutions and remove their incentives to improve and/or extend services.

Increasingly, public-private partnership (PPP) has emerged as an alternative to improve municipal solid waste service performance at lower costs.<sup>[25][26][27]</sup> But even with a new partnership approach, the financial aspects of MSWM remain critical for ensuring sustainability of the system eroding the private sector interest and lack of funding in SWM and recycling business. Adequate budgeting, cost accounting, financial monitoring and financial evaluation is essential to the effective management of solid waste systems. In many cities, however, officials responsible for MSWM do not have accurate information concerning the real costs of operations. These are often the result of unfamiliarity and/or lack of capacity to use available financial tools and methods.

According to the World Bank and USAID, it is common for municipalities in developing countries to spend 20-50% of their available budgets on SWM, which often can stretch to serve less than 50% of the population. High operational costs and expensive SWM is incurred by municipalities because of lack of proper budgeting, cost accounting, financial monitoring and evaluation aimed at recovering sufficient revenue to cover operational expenses of waste collection as well as saving money for new investments or large scale maintenance. These methods are inadequately used and the municipality rarely knows the actual cost of providing the SWM services.<sup>[28][29][19][30]</sup> However, before taking any decision on SWM, it is indispensable to establish a full understanding of the current costs for provision of the services and respective revenues.

In most cases, private investments are deterred by insecurity. South Sudan is experiencing insecurity at present which has reversed the development progress so far achieved during the relative period of peace. Conflicts and political instability has contributed to the growing SWM problem in low-income urban areas by forcing millions of displaced people seeking refuge in major cities.<sup>[31][23]</sup>

Policies play significant role in SWM system, becoming itself a serious challenge in most developing countries. In Juba South Sudan, no clear or adequate policies on SWM exist. Sign boards can be seen on which is written "Keep Juba Clean" and how this can be achieved is not clear as you find no dustbins on the streets. The structure, functioning and governance of SWM systems are affected by the relationship between national, state and local governments, the role of party politics in local government administration and the extent to which citizens participate democratically in policy making processes.<sup>[19]</sup> In developing countries, the greatest challenge is to strike the right balance between policy, governance, institutional mechanisms and resources provision and allocation.<sup>[23]</sup>

Policy weakness are some of the critical causes of failed SWM systems in many developing countries including South Sudan, as inadequate formulation and implementation of realistic policies are common.<sup>[23]</sup> However, in the case of South Sudan, the Environmental Management Bill, a significant bill which will pave the way to a regulatory legal framework has been delayed since 2012 pending approval in the council of ministers and the legislative assembly. While developed countries address their SWM needs by putting in place effective functioning policy measures, "in many cities of the developing world remedial measures have been elusive, efforts are uncoordinated and the resources invested in the sector inadequate".<sup>[23]</sup> Additionally, civil unrest and political instability has contributed to the growing SWM problem in low-income urban areas by forcing millions of displaced people to seek refuge in major cities.<sup>[31][23]</sup> South Sudan was engulfed in civil unrest since 1955 when it was within the united Sudan with a temporary short period of stability from 1972 to 1983, until its independence in July 2011. However, after independence from Sudan, the relative stability achieved from July 2005 through to December 2013 collapsed when conflict broke again destroying or impeding the relative development progress so far achieved in the short period after independence. During all these civil wars, Juba city harbored so many displaced people from the other states exacerbating SWM problems. SWM is also not a priority for local, state and national policy makers and planners. Other issues with more social and political urgency may take precedence and leave little budget for waste issues.<sup>[21][32]</sup> In some countries like Guatemala, serious SWM project continuity problems arise because all municipal office workers, including those not involved in elections are replaced during any change in government.<sup>[21]</sup> Projects can also be shelved due to political fallout between different political parties and local authorities.<sup>[20]</sup>

Good governance requires the participation of and collaboration of all relevant parties, including governments, NGOs, community groups and private sector.<sup>[23]</sup> According to the Asian Development Bank, the four principle elements of good governance are accountability, participation, predictability and transparency.<sup>[33]</sup> However, in most developing countries all these elements are not adhered to so long as these elements are best practiced in an ideal democratic setting. What is found in most developing countries is one party system. But with the new world order, pressure from the international community and the Western world, these governments have resorted to mimic democracy to avoid economic and other sanctions that strangle their economy and hence the grip on power. But in essence, they are lions in goat skins. Good governance allows low income groups to influence policy and resource allocation<sup>[34]</sup> and therefore, it is essential for equitable, effective and efficient SWM. However, in developing countries, the low income groups are been deprived SWM services because of their inability to afford paying for these services and their voices are not heard because they are silenced. Service can get to them at the will of the government. Indeed, the efficiency together with the effectiveness of

SWM in a city is some of the indices for assessing good governance.<sup>[33]</sup> AsBhuiyan<sup>[33]</sup> summarized it, it is now incumbent upon us to judge for ourselves through these indices whether or not there is good governance in Juba, Nairobi, Kampala, Khartoum, etc. Developing countries tend to lack the appropriate governance institutions and structures typically found in developed countries, such as public policy research institutions, freedom of information laws, judicial autonomy, auditors general and competent, representative local government, the lack of which creates barrier to proper SWM. Political jostling for power means that local authorities base decision making on the interests of their parties.<sup>[20][22]</sup>

Petty and high profile corruption are also rampant in many countries. South Sudan has been hard hit by corruption of every level and magnitude and the worst thing is that it is left unchecked. While it has been widely recognized that corruption retards economic growth, distorts the political system, debilitates administration and undermines the interests and welfare of the community, corruption remains one of the most pervasive and list confronted challenges facing public institutions in developing countries.<sup>[33]</sup> South Sudan was listed as one of the corrupt countries in the world by Transparency International.

Effective SWM requires the definition of clear roles and legal responsibilities of institution and government bodies to avoid controversies, ineffectiveness, inaction and making SWM system politically unstable.<sup>[19]</sup> Such controversies are common in developing countries including, Juba, South Sudan where the national government meddles in state government jurisdiction or the state gets into local government jurisdiction. Such controversies are only settled through the constitution. But it has been a common practice in the developing countries where violations of the constitution are so common and unlawful amendments of the constitution to suit the interest of the ruling party or an elite group in the ruling party is so frequent. Even though regulatory and legislative frameworks exist, governments with weak institutional structures are easily overwhelmed by increasing demands for SWM as urban populations explode.<sup>[35][34][23]</sup> However, such weak institutional settings are overwhelmed because they lack proper planning, clear objectives, experienced manpower, funding, administrative skills for management and operations and technology and compounded with undemocratic setting for accountability, transparency and participation.

A straight forward, transparent, unambiguous legal and regulatory framework, including functioning inspection and enforcement procedures at national, state and local levels is essential to proper functioning of SWM strategy.<sup>[18][19]</sup> According to Wilson,<sup>[24]</sup>“there seems to be general consensus that weak institutions are major issues or challenges in emerging and developing countries so that institutional strengthening and capacity building becomes a major driver” for SWM. Enforcement of laws governing regular SWM activities and new project implementation is often poor resulting in improperly functioning of SWM.<sup>[18][20]</sup> This is in part due to weak SWM institutions manned with inexperienced manpower that develop poor SWM plan which its implementation becomes difficult either due to shortage of resources or misappropriation of funds.

In the absence of strong political or cultural drivers in SWM sector, the challenge is that international financial institutions (IFIs) such as the World Bank, act as key drivers for SWM development. IFIs general have a strong focus on environmental policies, poverty reduction, institutional capacity building, good governance and private sector participation.<sup>[24]</sup> The approaches used by IFIs are not always appropriate for the particular context of the receiving country. The World Bank had several unsuccessful SWM projects in the 1990s (examples, Philippines, Mexico, Sri Lanka) due in part to weak institutions and governance issues, but in part also due to financial capacity in receiving countries to sustain the expensive facilities when bank funding run out.<sup>[24]</sup> Further challenge may emerge for instance, loans may be obtained from IFIs agents for infrastructure construction, known as capital expenses (CAPEX), in most cases, non are available for operational expenses (OPEX). This often leads to operational failure as IFIs focuses their attention solely on acquisition and building of infrastructure, not on its operation.

The rising urgency of urban environmental problems and need for capacity building at the municipal level has directed the attention of numerous bilateral and multilateral development agencies to SWM in recent years.<sup>[1][19]</sup> However, these donors may be motivated by bureaucratic procedures or goals of their home offices rather than an understanding of the local situation. Van de Klundert<sup>[3]</sup> makes several observations about this: donor biases exist towards certain technical approaches or insistence on the use of equipment that support their own export industries; the scale at which donors work is often inappropriate for local conditions, either too small, without sufficient consideration for various larger context or too large for a particular situation.

Coffey and Coad<sup>[18]</sup> reports that the objectives of many foreign aid programs for SWM in developing countries is to capture markets for supplying sophisticated machinery and related spare parts, which are more often not completely appropriate for local conditions. Such spare parts are very expensive, the cost of which drains the little financial resources at the possession of local government in a developing country.

Waste recycling activities are affected by the availability of industry to receive and process recycled materials. For instance, the recycling of waste paper is possible only when there is a paper mill within a distance for which the transportation of waste paper is economical. The weak industry base for recycling activities is a common constraint for the improvement of solid waste management in developing countries.

However, at least three recyclers from Uganda, Kenya, and China have ceased operations in the last 12 months, which is in part attributed to three interrelated factors: (1) high capital start-up costs for processing equipment; (2) high transportation costs to regional hubs within Uganda and Kenya; and (3) fluctuating and presently depressed, global prices for many recyclable materials, in particular PET.<sup>[13]</sup> Insecurity and poor conditions of the roads have contributed to the high cost of exporting the recyclables to Kenya, and Uganda.

#### **IV. Conclusion**

Municipal solid waste management in Juba city is still in its infancy, lacking appropriate technical solutions, sufficient organizational capacity and cooperation among wide range of stakeholders. However, the only appropriate practice is the recovery of the relatively small quantities of beverage cans, plastic bottles, etc. by informal waste pickers who are not organized by the municipality. The major practice is simply removing waste from the urban center at all cost without addressing the fundamental issues of the sources of the waste and how to prevent or minimize the waste so that a small quantity goes to the dumping site. Therefore, the SWM in Juba city is not environmentally, socially and economically effective or appropriate.

The challenges of MSWM in Juba are immense, ranging from lack of strategic planning, which is attributed to lack of capacity, being the overall challenge. Lack of capacity has resulted to a catch phrase, “Capacity Building”, often used by aid agents in South Sudan in all different sectors. Neglecting the public in decision making or planning adds to another challenge. The needs of the people are not understood, as a result, they will not be part of such programs. The commitment of leaders at the municipal levels to implement plans is eroded when controversies arise about the responsibility or jurisdiction of the waste sector leading to the failure of such projects.

Regarding the cultural and socio-economic aspects, Juba municipality faces the challenge of behavior pattern and underlying attitude of the citizens not oriented towards waste conscious behavior, factors that are shaped by the local cultural context. Most of the residents of Juba live in slum areas where SWM services are inadequate or completely absent. The challenge the MSWM faces is that no space among the densely packed settlement for refuse containers, narrow roadways, steep gradients and un-surfaced roads that standard collection vehicles cannot manage.

Financing municipal solid waste project pose another challenge in Juba city council due to lack of accurate information concerning the real costs of operations, the results of unfamiliarity with and /or lack of capacity to use available financial tools and methods. Inadequate waste collection revenue adds to another challenge as service users are reluctant to pay for MSWM services because these services are not proportional to the payment service user make. The central government budget items of priority are security, food and others with SWM becoming an issue when public health or environmental damage takes place. In Juba municipality, SWM revenue flow into general municipal account where it tends to be absorbed by overall expenditures instead of being applied to waste management. This affects the municipal ability to improve and / or extend SWM services. Frequent breakdown of the vehicles, overloading the compactors with very dense market wastes with high soil and sand contents and expensive spare parts are some of the burdens confronting Juba municipality.

The political issues in SWM in Juba, South Sudan are enormous, posing serious challenges to MSWM. Inadequate formulation and implementation of realistic policies are common. Civil unrests and political instabilities have contributed to in part growing SWM problems as wars displace people to take refuge in major cities and in part, the influx of returnees from refugee camps and economic migrants from neighboring countries also do contribute. Projects are shelved due to political fallout between different political parties and local authorities.

Lack of good governance is another challenge in South Sudan, where accountability, participation and transparency are paramount. In short, there is lack of true and ideal democracy. Petty and high profile corruption are rampant in South Sudan and to make it worse, it is left unchecked, retarding economic growth and undermining the interest and welfare of the community. Weak institutions are also major challenges in emerging or developing countries like South Sudan, where inexperienced manpower develops poor SWM plan which its implementation becomes difficult either due to shortage of resources or misappropriation of funds. In the absence of strong political or cultural will in SWM sector, international influence is exerted on countries with such conditions. The challenge is that international financing institutions (IFIs), such as the World Bank act as key drivers for SWM development. The approaches used by IFIs are not always appropriate for the particular context of the receiving country which can be exemplified by several unsuccessful World Bank SWM projects in the 1990s in the Philippines, Mexico and Sri Lanka due in part to weak institutions and governance issues, but in part due to financial capacity in receiving countries to sustain the expensive facilities when bank funding run out. Loans may be obtained from IFIs for SWM infrastructure building, but none are available for operational expenses leading to operational failure. The objectives of many foreign aid programs for SWM in developing countries are to capture markets for their export industries.

## V. Recommendations

- Interdisciplinary and multi-sectorial considerations are needed for the proper management of solid waste that highlights the environmental, social and economic spheres.
- ISWM approaches should be adopted in Juba, the approach that strives to strike a balance between the SWM dimensions of environmental effectiveness, social acceptability and economic affordability.
- The concept of waste management hierarchy should be adopted, which aims at extracting the maximum practical benefits from products and to generate the minimum amount of waste through the “3Rs”, Reduce, Reuse and Recycle.
- Strategic planning at the national, state and local levels is essential for utilizing the limited resources more effectively. And in the planning process, goals and objectives, inventory and assessment, identifying needs, evaluating management options, defining the recommended management system and developing an implementation strategy must be considered.
- Public awareness and education should be carried out by the municipality and others to reshape the local cultural and social behavior and attitude towards waste conscious citizens.
- Slum dwellings should be demarcated and redistributed as legal settlements to allow the provisions of SWM and other relevant services.
- Financing SWM should be based on budgeting and costs accounting, where the financial tools and methods should be used for financial monitoring and evaluation.
- Solid waste service revenues should not flow into the general municipal account so that it is not absorbed in the overall expenditures, instead the revenue should remain with waste sector in an autonomous accounting procedure, that make it easier to improve and/ or extend services.
- Better utilization of available manpower and equipment, improved maintenance of equipment, introduction of appropriate technology and elimination of inefficient and tedious bureaucratic procedures are fundamental.
- A democratic public process of SWM policy formulation is essential to determine the actual needs of the citizens and therefore, to prioritize the limited municipal resources in a just manner.
- Corruption must be confronted by all means available to promote economic growth and the interest and welfare of the community.
- Institutional strengthening and capacity building is required in the SWM sector for the proper functioning of SWM systems.
- Strong political will and cultural awareness towards SWM be practiced so that donors and aid agents do not impose inappropriate technologies or waste management systems that do not suit the local conditions.

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