Macrothink Institute™

International Journal of Regional Development
ISSN 2373-9851
2017, Vol. 4, No. 1

Urban Sustainability and the Economic Impact of Implementing a Structured Waste Management System: A Comparative Analysis of Municipal Waste Management Practices Developing Countries

Oladipupo Salau

Samuel Osho

Lalita Sen

Dept. of Urban Planning & Environmental Policy, Texas Southern University

Tel: 1-713-313-7448. E-mail: Sen_lx@tsu.edu

Gbolahan Osho

Dept. of Management and Marketing, Prairie A&M University

Tel: 1-936-261-9280. E-mail: gsosho@pvamu.edu

Moriam Salau

Texas Southern University

Tel: 1-713-313-7448. E-mail: m.salua1338@student.tsu.edu

Received: July 10, 2016 Accepted: October 10, 2016 Published: November 1, 2016

doi:10.5296/ijrd.v4i1.10005 URL: http://dx.doi.org/10.5296/ijrd.v4i1.10005

Abstract

Implementing a structured municipal waste management system in urban spatial context revolves around integrated municipal solid waste system (IMSWM) that comprised all major actions in waste management. The institutional structure of IMSWM entails a much wider scope of responsibility that marked a departure from the traditional municipal waste management system that seeks to reduce risk to public health by removing waste from homes and cities to the landfill. Integrated waste management incorporates, in addition to reducing risk to public health and the environment, resource conservation and material recovery that promotes social inclusiveness and urban sustainability. The economic implication of implementing a balanced structured MSMW is enormous; not only in terms of financial burdens on the government but also the revenue it generates for local economy and its macroeconomic effects. This study makes use of secondary data and compares municipal

waste management systems operated in three developing countries by looking at MWM strategy that optimizes economic efficiency and promotes sustainable development in urban cities that can be applicable to other developing countries.

Keywords: Waste Management, Urban Sustainability, Resource Management, Planning

1. Introduction

Municipal solid waste management system poses a major challenge to both developed and developing nations due to the environmental risks associated with waste and the public health concerns it raises. More important is the financial burdens it places on municipalities in the developed and developing world responsible for providing municipal waste services to the public. Thus, as towns and cities around the world expand and population grows volumes of waste produced increase and the challenge of managing the waste increases. According to the United States Environmental Protection Agency (USEPA, 2011), the US generated 250 million tons of waste in 2011, while on the global scale, the upward trend of municipal waste generation remains exponentially incremental. For instance, it is estimated that the current worldwide waste generation of 1.3 billion tons per year will increase to 2.6 billion tons by 2025. An increase of 63.3% in 13 years, with an annual growth rate of 5.3% and 97% of this growth will be in Asia and Africa (Halbach 2013, World Watch Institute 2016). According to Economic Cooperation and Development (ECD 2013), a group of 34 industrialized nations lead the world in MSW generation at nearly 1.6 million tons per day and sub-Sahara Africa produces less than 1/8 of that producing about 200,000 tons per day. Therefore, a sustainable waste management system would be a strategic planning mechanism for implementing a sustainable urban development.

2. Prior Studies

The UN Environmental Program (UNEP 2010) estimates that the market share for municipal waste management from collection to recycling is expected to be above $400 billion worldwide. In the same vein, the cost of managing MSW is expected to rise by 82.9% from $205 billion per year to $375 billion in 2025. In low-income countries, municipal waste management takes the largest share of the government budget and serves as one of the largest employer of labor, hence improving waste management would be an effective way of strengthening overall municipal management that engenders urban sustainability (Daniel and Bhada-Tata, 2001). Therefore, strategic planning is the key to a sustainable waste management system that allows for effective waste services that meet the needs of end users in an urban setting (World Bank, 2012).

According to the UN-habitat (2011), strategic waste management planning is based on a city-wide scale planning which designs and implements an IMSWM that is responsive to the dynamic demographics and industrial growth of the city. This starts with the formulation of long-term goals based on the urban local needs, followed by medium and short-terms action plans that meet those needs. Hence strategic planning must go beyond purely technical considerations and embrace appropriate measures that incorporate political, economic, institutional, social, financial and technical aspects of MSWM. Therefore, strategic planning,

cost analysis and community participation are the epitome of sustainable waste management that guarantees urban sustainability (UN-Habitat/ UMP, 2011).

To this end, Megutu and Onsongo (2011) argue that while collection, transportation and disposal of solid waste remains the traditional functions of the MSWM, modern realities dictate that monitoring of waste materials, recycling, and resource recovery are critical components of waste management that fosters environmental purity and promotes sustainable development. Hence, the general goal of the IMSWM to protect public health, promote environmental conditions, and ensures efficient use and conservation of resources, could only be effective if it supports the efficiency and productivity of local economy by creating jobs and income for the local population (UNDP/UNCHS/UMP, 2011). A structured sustainable waste management system marks a transition from end of pipes MSW treatment and landfilling to a low carbon, resource efficient and socially inclusive waste management strategy; anchored on the principle of economic growth, investment, environmental quality and social inclusiveness (Jacobi & Gina, 2011).

3. Comparative Waste Management Practices in Lagos State, Mumbai and Rio De Janerio

Comparative analysis of municipal waste management systems in the above mentioned cities of developing countries is intended to showcase and illustrate the structural institutions of MSWM practiced in these cities as a reflection of their waste management strategy for a sustainable urban development that strengthens municipal management and boost local economy. The following table illustrates the totality of the municipal waste management structures in these cities in terms of their composition, amount of municipal waste generated and recycled as well as employment opportunities provided.

Table 1. Comparison of waste management practices in three developing countries

Countries Cities	Indian Mumbai	Brazil Rio de janerio	Nigeria Lagos State
Municipalities	Municipal corporation of greater Mumbai (MCGM); City of Pune in Maharashtra, India 13 million people	Companis Municipal De Limpeze Urbana (COMLURB)	Lagos State Municipal Waste Management Authority
Population		6.3 million people	18 million people
Formal Sector in the municipal solid waste management system	MCGM in conjunction with the private sector	COMLURB consisting of 92 administrative municipalities responsible for waste collection services	LAWMA in partnership with PSP 346 registered PSP operators Serving 20 local government areas and37 local council development areas Total of 57 administrative areas
Informal Sector in	Rag Pickers in	Recycling	Over 15,000 waste pickers and

the municipal solid waste management system	Mumbai, Advanced Locality Management (ALM), The Dharavi's 13th Compound-a 15,000 single-room factory. In Pune, rag pickers union called kaged kach patra kashtakari (KKPKP)	Cooperatives-(Catadores) based on the reverse logistics program of the national waste management policy that embrace all sectors of waste management	scavengers that include house to house waste collectors Others include cart pushers, cart renters and cart builders
Tonnage of waste generated	Mumbai, 13 million populations, generates 7,000 tons of waste daily	Rio, population 6.1 million people, generates 9,000 tons of waste daily	Lagos State with a population of 18 million,13 metric tons per day
Percentiles of recycled waste	80% of waste recycled by the informal sector. No formal recycling in Mumbai	1% of waste recycled by COMLURB. Between 45-55% of waste recycled by informal sector	21% of waste recycled
Sectors Employment	35,000 people employed in formal sector. Informal sector employs over 250,000	Formal sector employs 22,000 people. Informal sector about 500,000 serve as catadores	10,000 by 346 PSP operators 25,000 indirect jobs through other government waste management agencies

Source: Researcher's construct based on secondary sources 2015.

4. Case studies of Lagos State, Mumbai and Rio de Janerio

4.1 Case Study of Lagos State, Nigeria

The waste management system in Lagos is a synergy of public- private partnership (PSP) that are engaged in different segments of waste management services. There are 346 private waste services companies serving the 20 local government areas and 37 Local Government Development Areas in the State. Lagos State generates over 10,000 tons of waste as of 2013, which translates to over 3.5 million metric tons per annum (LAWMA, 2013). By 2015, the daily generation had increased to 13 metric tons due to population increase (LAWMA). The waste composition of MSW in Lagos State consists of 45% vegetable/organic, 15% plastic, 10% paper, 5% glass and metal and 4% textiles amongst others (see figure 1). The waste collection rate is only about 50% of the total waste generated. This is due to the combined efforts of formal private sector and the informal sector as indicated in table 2, which account for 87.5% of daily waste collection while the remaining 12.5% are collected by LAWMA contractors and local government officials. Out of this, 79% end up in dumpsites while 21% is recycled.

The missing link in the value chain of the Lagos State MWMS is the non-recognition of the informal sector operators who alongside the private sector, also engage in waste management services from waste collection to disposal through material recovering and recycling which represents a net waste reduction volume in the waste stream of Lagos State (Wilson 2006, Adebisi, 2013).

Table 2. Distribution of waste collection, disposal and recycling in Lagos State

Waste Material Generals	Tonnage/% 10,000 tons/daily	Formal Sector	Informal Sector	LAWMA/Other Agencies
Collected	40-50	87.50	87.50	12.50
Dumpsite Disposal	79			
Total Recycled	21			

MSWM 2011 (Researcher's Construct based on LAWMA published data, 2013).

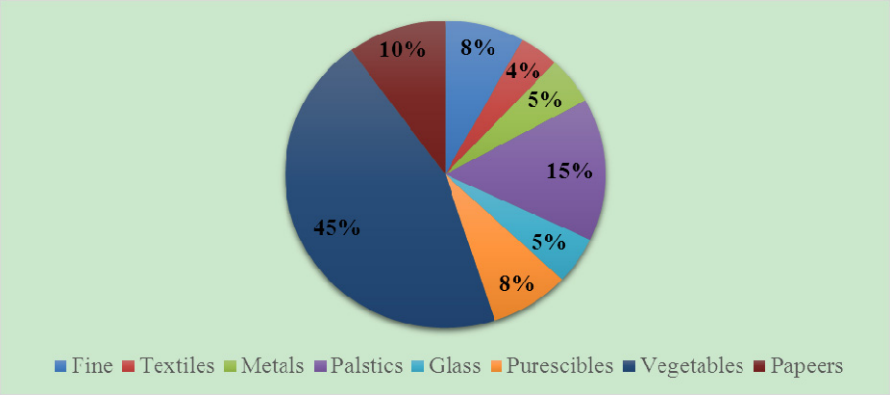

Figure 1. Waste composition in Lagos State

Source: LAWMA published Data 2013

Photo 1. NGO, S Waste Recyclers in Lagos Nigeria

Source: Recycling point organization, (2012)

Even though there is no official recognition of the informal sector in the Lagos State MWMS, it is becoming self-organized with the intervention of the NGOs and other community based organizations, hence the informal sector footprint is in every component of municipal waste management in Nigeria. For instance, as the above photo shows, NGOs organizations like Recycling Point, We Recycle and others have collaborated with the Nigerian Coca Cola company and the Nigerian Bottling Company in Lagos State to engage in buy back and recycling schemes that created jobs for over 1,500 scavengers (Adewole 2012).

As reflected in table 2, 87.5% of waste collection is jointly undertaken by both formal and informal sectors. According to Olugbenga (2011), the informal sector in Lagos State covers all segments of MWM. The international labor organization report (1985) indicates that informal sector contributes 53% of new employment in Nigeria which adds values to the MWM in Lagos State. According to the managing director of LAWMA Mr. Ola Oresanya (2013,) there are 25,000 indirect jobs created through evacuating waste in Lagos state, it is safe to assume that much of these indirect jobs are through the informal sector. Therefore, there is deficient MWM policy in Nigeria which excludes the informal sector from the structural institutions of municipal waste management that impedes sustainable urban development.

4.2 Case Study of Mumbai, India

Municipal waste management system operated in Mumbai unlike Lagos State, embraces diverse stakeholders in waste management. Mumbai India, the capital of Maharashtra state is a city of 13 million people that generates 7,000 tons of waste daily which is 6.11% of daily waste generation in India and only 15% remains uncollected (Pradhan, 2007, The Indian Express, 2014). The waste composition in Mumbai is mostly organic and biodegradable as table 3 shows. The three major regions of Mumbai: Island city, Eastern suburb and Western suburb mostly generate biodegradable waste stream according to table 3, which explains why there is robust biogas initiative as a waste management strategy of implementing a sustainable urban development (Gokaldas, 2012).

The Municipal Waste Management Authority in Mumbai is the Municipal Corporation of Greater Mumbai (MCGM) which solely oversees management of municipal waste in the State. MCGM relies on 35,000 employees and a fleet of 800 waste trucks for waste collection and disposal (Mukherje, 2013). Like in Lagos State, municipal waste management in Mumbai is a partnership venture between the MCGM and the private sector which owns part of the 800-truck fleet but there is no formal recycling program in the city (Mukherje, 2013). The rag pickers in the informal sector are responsible for almost all of solid waste recycling in Mumbai. Dharavi's 13th compound, though not officially recognized, is a 15,000 single-room factory that recycles 80% of Mumbai solid waste while employing 250,000 urban poor. It is the single largest recycling center, reputed to be a recycling micro-entrepreneurship in the city of Mumbai (Carr, 2013). The overall output of the Dharavi's rag pickers cooperatives is valued at $700 million, 60% of whom are women; see photo 2, (The observer, 2007, Gokaldas, 2012). Meanwhile, a sister city of Pune in Maharashtra, allowed and incorporated the informal sector in its mainstream waste

management system. This facilitated the formation of a rag pickers trade union called the KKPKP which partnered the city to provide waste management services to about 200,000 households and has led the way in waste recycling and greatly improved the working conditions of its members (Medina 2007, Carr 2013).

Table 3. Distribution of waste characterization in Mumbai by %

Category	Island City	Eastern Suburb	Western Suburb
Biodegradable	42.29	35.72	39.52
Paper and cardboard	6.16	10.93	6.61
plastics	4.23	4.87	5.47
Metals	0.85	0.65	1.42
Glass	1.28	0.87	3.48

Source: Researcher's construct based on Mahadevia (2010).

Photo 2. Rag pickers cooperative in Dharavi 13th compound

Source: adapted from Michael Akin cited in Gokaldas, (2012).

In light of the above, the MWMS operated in Mumbai reflects a different waste management strategy from that of Lagos State where the informal sector does not enjoy a prominent place in MWMS which paints a general picture of situations in sub-Sahara Africa. In Mumbai India, there is diverse participation of stakeholders including the informal sector and NGOs in waste management with active support from the government by means of training and skill development which improved the working conditions of rag pickers (Adewole, 2012).

4.3 Case Study of Rio De Janerio, Brazil

The municipal waste management system in Rio De Janerio, unlike Mumbai, is a product of the national waste management policy. Rio is the second largest city in Brazil and the third largest metropolitan area in south America (Rioonwatch, 2012). It is made of 6.3 million

populations and generates over 9,000 tons of waste daily, over 50% of which is organic waste, (see Figure 2). The national policy in MSW was consummated in 2010, and was aimed at decreasing the volume of solid waste produced nationally while increasing the sustainability of MWMS from the local to the national level (Bianctini & Fillio, 2011). This policy was based on the Reverse Logistics Program that embraces all sectors of the municipal waste management in Brazil and calls for shared responsibility among various stakeholders in MWMS. These include the public sector, the private sector comprising of producers, retailers, importers as well as wholesalers; and the waste pickers in the informal sector (Bianchini et al., 2011). According to the policy, states and municipalities are obligated to develop their own waste management plans and these must be socially inclusive, requiring the inclusion of the informal sector in the waste management system (Consconni, 2010). The waste management in Rio De Janerio, is undertaken by the Municipal Authority known as COMLURB, which depends on 22,000 employees for waste collection services (Monteiro, 2013). The COMLURB is comprised of 92 Administrative Municipalities that partner with the recycling cooperatives in the informal sector and other stakeholders for waste management services (Medina, 2008, Monteiro, 2013). As table 2 indicates, Rio de janerio a major city in RJ State of Brazil generates 9,000 tons of waste out of the 15,000 tons generated by the state. However, the total amount of waste recycled by the COMLURB is only 2% of the total waste generated, out of which the city of Rio is only responsible for only 1%. The informal sector recycles about 55% of the waste and employs over 500,000 people known as catadores whose employments are recognized as legal occupation, while 45% is recycled by the private sector (Monteiro et al., 2013). Following the introduction of the national waste management policy in Brazil, with its emphasis on social inclusiveness. The recycling business has become a lucrative industry by taking advantage of the rising cost of natural resources globally which increased the profitability of recycling activities worldwide (Wilkes, 2015).

Photo 3. A Catadore in Rio de Janeiro

Source: Institute Ecoacao, (2013)

According to Wilkes (2015), the catadores cooperative in 2015, made a profit of $45,000 from recycling and the average member of the cooperative was making an average of $300 per month. In Brazil generally, collecting, packaging and selling aluminum cans alone accounted for $600 million economic activity in municipal waste management (Wilkes et al, 2015). The boom in recycling industry could be attributed to the universalization of all-inclusive municipal waste management practices introduced by the national waste management policy in Brazil, which was a catalyst for the development of socio-environmental urban sustainability.

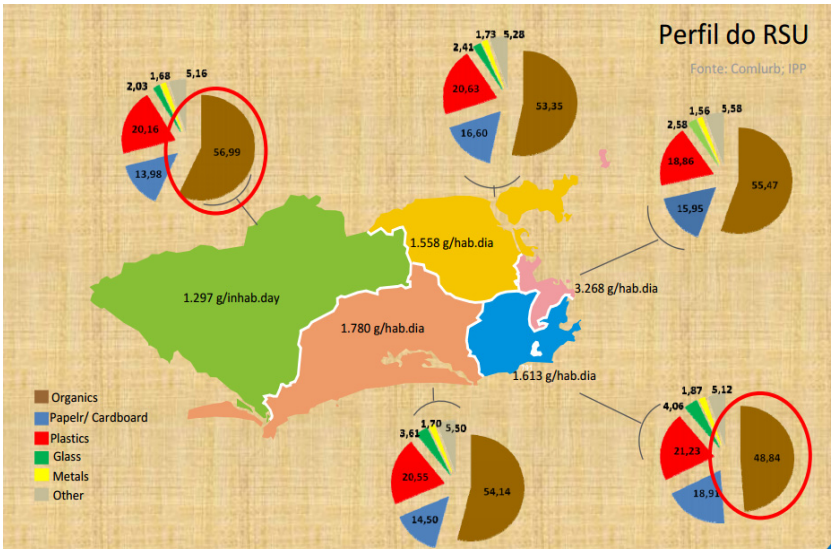

Figure 2. Waste characterization in Rio de **Janeiro**

5. Summary and Conclusion

The conceptualization of the structural institutions of the municipal waste management systems in the above cities connotes a research template for the evolvement of sustainable urban development in developing countries. The comparison of the three metropolitan cities in India, Brazil, and Nigeria analyzed the major features of different waste management practices which reflect the general urban trends in developing countries of three different continents of sub-Sahara Africa, south Asia and south America. This is necessary to underscore the economic imperativeness of the MSW in the overall municipal management that tends to either undermine or promote urban sustainability. More so because, MSWM takes the lion share of the municipal budgets in developing countries which starve other critical sectors of the economy of funds necessary for urban infrastructural development. The importance of this comparison cannot be overemphasized because the economic implication of sustainable waste management system in urban space is multi-dimensional in terms of its multiplier effects on macro-economics of the municipal city.

The MSWM systems in Rio de Janeiro and Mumbai present a contrasting parallel to that of

Lagos State. The top-down national waste management policy in Brazil that seeks to decrease waste stream from the national to the local level and increase MSWM sustainability from bottom-up; by coopting all stakeholders in its fold is a sustainable waste management strategy similar to the waste management practice in Mumbai. The Mumbai waste management model relies on grass-root initiatives and self-organized informal sector cooperatives to drive urban sustainability while retaining the central role of the state in municipal waste management. In contrast, there is no national waste management policy in Nigeria and the waste management practice in Lagos is a product of the Lagos State Environmental Pollution Control Law which monitors and controls the disposal of waste in the State (Makinde and Adeyoke, 2007). But unlike the MWMS in Rio, the Lagos State waste management system features a public-private partnership model that relies heavy on the private sector for almost all of its waste management initiatives while leaving other critical stakeholders like the reverse logistic program in Rio. This is a deficient waste management structure that undermines socio-economic development and stall urban growth in terms of leveraging on extreme poverty reduction and creating social inclusiveness in the urban space.

The above analysis intends to reinforce the inclusive waste management structural model as a planning mechanism for building a cohesive, economically stable, environmentally friendly and socially inclusive urban society. This can be done in Nigeria and other sub-Sahara African countries because it has been successfully practiced in other developing countries. These are countries with similar deficient waste management infrastructures and weak institutions but had managed to turn this around by optimizing the resource contents of the municipal waste management. This was done through the integration and participation of the informal sector and other stakeholders by means of instrumentality of public policy.

References

Adewole T. (2012) *Communal/Informal sector participation in the waste management industry.* Retrieved August 30, 2016 from http://www.uncrd.org.jp/document/381presentation-informal sector participation in waste management-recycling.pdf

Agbesola, Y. (2013). Sustainability of municipal solid waste management in Nigeria: A case study of Lagos. *Master thesis, water and environment, university of Linkoping*, SA

Aluko, O. (2008). *Introductory Course in Environmental Sciences.* University press, Ibadan

Aluko, E. (2012). Environmental Degradation and the lingering Threat of Refuse and Pollution in Lagos State. *Journal of Management and Sustainability*, *2*(1).

Allen, R. (1982). Capitalist development and educational Role Nigerian Apprenticeship. *Comparative Education, 18*(2), 123-137.

Ajayi, N. (2013). *Nigeria 50billion underground economy fueled by complexities, unemployment, Business Day*. Retrieved April 5, 2013, from http://www.niigeriaworld.com/businessday/underground economy.htm

Awosusi, I., Olusegun, O., & Owoeye. (2012). Waste Management and Enterprises

development in slum communities in Ado-Ekiti, Nigeria. *Mediterranean Journal of Social sciences, 3*(11).

Ahmed & Alli, B. (2004). Partnership for solid waste in developing countries: Linking theories to realities. *Habitat International, 28*(3), 467-478.

Adewole, O., & Taiwo, A. (2009). Waste Management towards Sustainable Development in Nigeria: A case of Lagos State. *International NGO Journal, 4,* 173-179.

Adewole, F. (2012). The Challenge of Improving Informal Sector Activities in Lagos Island, Nigeria. *Journal of Art and Social Science*, *6*(2).

Bianchiani, & Fillo. (2011). *The potentials for waste management in Brazil to minimize GHC emissions and maximize Re-use materials*. Utrecht University, Brazil

Bianchinni, A. (2012). *Globalization and Waste Management: Concepts and facts.* Retrieved June 2014 from http//www.epmml/download/globalization and waste managemt.htm

Brundtl and Commission Report. (1987). *Our common future*: *The report of the Brundtland commission, 1987*. Oxford University Press

Carr, C. (2012). *Are Mumbai's recyclers leading the city's green movement?* Retrieved June 20, 2014 from http//www.urbim/inclusivecities/Mumbai/india.htm

Consonni, S. (2013). *Brazil's Incoming E-Waste Recycling Regulations Explained*. Retrieved September 19, 2013 from http://www.waste-management-world.com/art.htm

Contreau, S., & Levine. (1996). Private Sector Participation in Municipal Solid Waste Services in Developing Countries. *Urban Management and Environment, 13*(1).

Daniel, & Bhahat-Tata. (2001). *World Bank Study on waste management.* Retrieved August 30, 2016 from http:/www. Worldbank.org/wastestudy.htm

Economic Cooperation and Development. (2008). *OCED fact-book 2008: Economics, environmental and social statistics.* Retrieved August 25, 2016 from http://hdl.voced.edu.au/10707/18682

Gokaldas, V. (2012). *Waste pickers Run Biogas Plants as a Decentralized Solution*. Retrived August 25, 2016 from http//www-no-burn.org

GTZ. (2009). *Role of the Informal Sector in Solid Waste Management and the Enabling Conditions*. Center for Regional and Urban studies, United Nation, NY

Halbach, T. (2013). *International trend in solid waste handling.* Minnesota: University Press.

International Labor Organization. (1985). *The Informal Sector in Nigeria: four decades of reflections research.* Center for Urban Management, Washington DC NY.

Lagos State Waste Management Authority. (2013). *Waste Management Report*. Retrieved September 19, from www://www.Lawma.ng/charaterisation/landfill.htm

Fehr, M. (2009). Measuring the Environmental Impact of Waste Management in Brazilian

Apartment Buildings. *Environmental Development Sustain*, *11*, 319-329.

Jacobi, R., & Besen, B. (2011). *Solid Waste Management in Sao Paulo: the challenges of sustainability.* Retrieved August 25 from http//dx.do.org/solid waste.htm

Medina, M. (2000). *Scavenger Co-operatives in Asia and Latin America: Resources, Conservation and Recycling.* New York: United Nation Population Division, Department of Economics and Social Affairs.

Medina, M. (2008). *The Informal Recycling Sector in Developing Countries: Organizing waste pickers to enhance their impacts.* Public-Private Infrastructure Advisory Facility, World Bank, Washington DC.

Medina, M. (2004). Scavenger Cooperative in Asia and Latin American Resources. *Conservation and Recycling*, *31*, 51-69.

Ogishi, A. (2001). The economic impact of waste disposal and diversion in California. California: University Press.

Olugbenga, A. (2006). The Role of Informal Private Sector in Integrated Solid Waste Management in Lagos, Nigeria. *Proceedings of 21st conference on solid waste management and technology*, 343-348.

The Indian Express. (2014). *Mumbai accounts for six percent waste generation in India.* Retrieved August 25 from http://indianexpress.org-Mumbai account for waste generation/

United Nation Environmental Program. (2010). *Global partnership on waste management.* Retrieved August 30, 2016 from http://www.unep.org/globalpartnershiponwaste management/

United Nations. (2006). *World Urbanization Prospect-the 2005 Revision*. New York: United Nation Population Division, Department of Economics and Social Affairs.

U.S. EPA. (2011). *Waste-Non-Hazardous Waste-Municipal Solid Waste.* Retrieved Jul, 6, 2013 from http://www/epa.gov/epawaste/monthly/municipal/index.htm

Wilkes, C. (2015). *Recycling in Rio De Janerio: An overview*. Retrieved August 25, 2016 from http//www.rioonwatch.org.htm

World Bank Data by Country. (2006). Retrieved June 11 2013 from http://www.worldbank..org/data/counrydata.htm

World Bank. (2003). Thailand Environmental Monitor 2003. *A Joint Publication of the Pollution control Department Royal Thai Growth, the World Bank, US Asia Environmental Partnership.*

World Bank. (2003). Thailand Environmental Monitor 2003. A Joint Publication of the Pollution contro, Department Royal Thai Growth, the World Bank, US Asia Environmental Partnership.