

UNIVERSITI PUTRA MALAYSIA

MUNICIPAL SOLID WASTE MANAGEMENT AND HEALTH RISK IMPLICATION IN ZANZIBAR

BIUBWA FAKI ALLY

FPSK(m) 2015 61



MUNICIPAL SOLID WASTE MANAGEMENT AND HEALTH RISK IMPLICATION IN ZANZIBAR

BUBWA FAKI ALLY

Thesis submitted to the School of Graduate Studies, Universiti Putra Malaysia, in fulfillment of the requirements for the Degree of Master of Science

September 2015

COPYRIGHT

All material contained within the thesis, including without limitation text, logos, icons, photographs and all other artwork, is copyright material of Universiti Putra Malaysia unless otherwise stated. Use may be made of any material contained within the thesis for non-commercial purposes from the copyright holder. Commercial use of material may only be made with the express, prior, written permission of Universiti Putra Malaysia.

Copyright © Universiti Putra Malaysia



DEDICATION

This thesis work is dedicated to my sweet husband and my lovely daughters Zuwena and Yasmin for their passion and giving me opportunity to pursue the master program in Malaysia.



Abstract of the thesis presented to the Senate of the Universiti Putra Malaysia in fulfillment of the requirement for the degree of Master of Science

MUNICIPAL SOLID WASTE MANAGEMENT AND HEALTH RISK IMPLICATION IN ZANZIBAR

By

BIUBWA FAKI ALLY

September 2015

Chairperson Faculty

:

:

Sharifah Norkhadijah Syed Ismail, PhD Medicine and Health Sciences

Solid waste is a visible concern in Zanzibar. One of the fundamental problems facing Zanzibar communities is the lack of formal system for solid waste management and is more apparent in informal settlements. It is estimated that, more than 50% of the diseases that affects people of Zanzibar are related to unsanitary environments which highly associated with poor waste management practices. The study aimed at assessing the current municipal waste practices and associated health risks in the municipality. Necessary data was obtained through interview administered questionnaire on one to one basis with a total of 200 households systematically selected from their residential areas. Similarly, photograph, documentation, field and direct observation were considered to add value of information. The results revealed that, more than half of respondents (66.5%) have access to collection services in their residence and 33.5% don't have any collection services. All residents in Zone A (N = 50) receive collection services followed by Zone B (N = 41) while residents in Zone C (13%) and Zone D (8%) don't have adequate collection services. Within the household, open containers such as plastic buckets (55%) and plastic sucks (32.5%) are usually used for the storage of waste and majority of respondents don't practice waste sorting in their homes (92%). The method of disposal is mainly communal collection containers (36.5%) including metal skips and slabs, through door to door collection service (25%) and indiscriminately disposal in open piles (29%). Burning or burying is common practices in the residential areas without access to collection services. There is low level of awareness about specific health and environmental problems associated with poor collection and disposal. Analysis revealed that there is significant relationship between household practices and reported health symptoms. The prevalence of respiratory illness, skin rashes, under 5 children diarrhea and malaria observed was higher in Zone C which is nearby the dumping site compared to other zones (A, B, and D). Reported health symptoms were more noticed to children aged 5-15 years particularly respiratory symptoms than other age category. The results depicted statistically significant relationship only between reported health symptoms and practices implying that improper waste management practices



increase public health risks in terms of disease occurrence such as respiratory symptoms, diarrhea and other sanitation borne illness. Therefore, institutional capacity should be strengthened by moving it from centralized to decentralized approach. Also involvement of all stakeholders (government agencies, public, private and informal sectors; NGOs and CBOs) in system design from planning of MSWM issues to operations should be considered a synergy for effective and sustainable MSWM system in the Municipality.

Key words: municipal solid waste management, practices, health risks, Zanzibar.



Abstrak tesis yang dikemukakan kepada Senat Universiti Putra Malaysia sebagai memenuhi keperluan untuk ijazah Master Sains

AMALAN DAN CABARAN PENGURUSAN SISA PEPEJAL DAN IMPLIKASI RISIKO KESIHATAN DI MAJLIS PERBANDARAN ZANZIBAR

Oleh

BIUBWA FAKI ALLY

September 2015

Pengurusi:Sharifah Norkhadijah syed Ismail, PhDFakulti:Perubatan dan Sains Kesihatan

Sisa pepejal merupakan aspek yang diberikan perhatian yang ketara di Zanzibar. Salah satu masalah fundamental yang dihadapi oleh komuniti Zanzibar ialah kekurangansistem yang formal bagi pengurusan sisa pepejal dan yang lebih ketara di kawasan penempatan tidak formal. Dianggarkan, lebih 50% penyakit yang dihidapi rakyat Zanzibar berkaitan dengan persekitaran tidak bersih yang sangat berkaitan dengan amalan pengurusan sisa yang lemah. Kajian ini dijalankan bertujuan untuk menilai amalan sisa majlis perbandaran terkini dan risiko kesihatan berkaitan di kawasan perbandaran . Data yang diperlukan diperoleh melalui temu bual yang mengandungi soalan berdasarkan temu bual secara basis satu dengan satu dengan jumlah 200 isi rumah yang dipilih secara sistematik dari kawasanperumahan. Di samping itu, fotograf, dokumentasi, pemerhatian lapangan dan langsung diambil kira bagi menambah nilai pada maklumat.Hasil kajian menunjukkan bahawa, lebih daripada separuh responden (66.5%) mempunyai akses pada perkhidmatan pengutipan pepejal di kawasan perumahan mereka, manakala 33.5% tidak mempunyai sebarang perkhidmatan pengutipan pepejal. Semua penduduk di Zon A (N = 50) menerima perkhidmatan pengutipan, diikuti oleh Zon B (N = 41), manakala penduduk di Zon C (13%) dan Zon D (80%) tidak menerima perkhidmatan pengutipan yang mencukupi. Dalam kalangan isi rumah, bekas terbuka, seperti baldi plastik (55%) dan penyedut plastik (32.5%) biasanya digunakan bagi penyimpanan sisa dan majoriti responden tidak mengamalkan penyisihan sisa di rumah mereka (92%). Kaedah penyisihan kebanyakannya merupakan bekas pengutipan komunal (36.5%), termasuk skip besi dan slab, melalui perkhidmatan pengutipan pintu ke pintu (25%) dan tidak terkecuali pelupusan dalam bentuk timbunan terbuka (29%). Pembakaran atau penanaman merupakan amalan biasa di kawasan perumahan tanpa akses pada perkhidmatan pengutipan. Terdapat kesedaran yang rendah tentang kesihatan yang spesifik dan masalah persekitaran yang berkaitan dengan pelupusan dan pengutipan yang lemah. Analisis menunjukkan bahawa terdapat hubungan yang signifikan antara amalan isi rumah dan simptom kesihatan yang dilaporkan.



Prevalen penyakit respiratori, ruam kulit, diarea kanak-kanak bawah 5 tahun dan malaria yang dikesan adalah lebih tinggi di Zon C yang berhampiran dengan tempat pembuangan sisa berbanding dengan zon-zon yang lain (A,B, dan D). Simptom kesihatan yang dilaporkan lebih ketara dalam kalangan kanak-kanak berumur 5-15 tahun, terutamanya simptom respiratori berbanding dengan kategori umur yang lain. Hasil kajian menunjukkan terdapatnya hubungan yang signifikan secara statistik hanya antara simptom kesihatan yang dilaporkan dan amalan yang memberi implikasi bahawa amalan pengurusan sisa yang tidak sempurna meningkatkan risiko kesihatan umum dari segi kekerapan penyakit, seperti simptom respiratori, diareadan penyakit bawaan sanitari yang lain. Oleh itu, kapasiti sesebuah institusi perlulah dikukuhkan dengan cara pendekatan berpusat ke tidak berpusat. Penglibatan semua pihak berwajib (agensi kerajaan, orang awam, swasta, sektor tidak formal, agensi bukan kerajaan dan organisasi berasaskan komuniti) dalam reka bentuk sistem daripada perancangan isu pengurusan sisa pepejal hinggalah ke peringkat operasi boleh dianggap sebagai sinergi kepada pengurusan sisa pepejal yang efektif dan mapan dalam perbandaran.

Kata kunci: pengurusan sisa pepejal, amalan, risiko kesihatan, Zanzibar.

ACKNOWLEDGEMENTS

First and foremost, I would like to thank Allah for giving me energy and strength to carry out this study to the end.

I would like to express my sincere gratitude and appreciation to my chairman, Dr. Sharifah Norkhadijah Syed Ismail for her precious time in supervision. I am grateful for her great support, understanding, constructive comments, suggestions, and guidance and being patient with me throughout this work. I also extend my appreciation to my co-supervisor, Dr. Irniza Rasdi for her assistance, thoughtful questions, insightful critiques and suggestions throughout.

My heartfelt thanks to the State University of Zanzibar (SUZA) for not only allowing me to pursue this master's program but also for financially supporting this study under Building Stronger Universities (BSU) Project. My thanks goes also to Mr. Rajab S. Rajab from Division of Sewerage, Drainage and Solid Waste, Zanzibar Municipal Council for his willingness to provide me with information of Municipal Solid Waste Management (MSWM) in Zanzibar municipality used in this research. Similarly, thanks to Dr. Haji Mwevura, Deputy Vice Chancellor-Academic from the State University of Zanzibar for his supervision and guidance during data collection in Zanzibar. I owe special thanks to my supporting team of University students who assisted me down in the field during data collection. I am indebted to thank Mr. Juma Omar Abdalla from Kizimbani Agricultural College for his assistance on data analysis and use of SPSS tools. In particular, I am grateful to Mr. Bakar Omar Hamad from Zanzibar Institute of Financial Administration for his support on formatting and proofreading. Once again, I acknowledge all respondents for their willingness to participate in this study and answer the questionnaire which made this research possible.

My special thanks for my lovely husband, Mr. Hamad Omar Hamad for his moral support, encouragement, patience on my absence and keep my spirit up throughout my study. I cannot justify end of my study journey without appreciating the effort of my dear mother, Khadija Hamed Nassor for her prayers to accomplish my study successfully. Thank you *mama*, you have always been the torch through which my future brightens.

 \bigcirc

I must admit that the list above is not exhaustive of all those who in one way or the other have put their effort in this work. The list is long while the space is very limited to mention them all. Nonetheless, this does not mean their support and contribution is less important. From the bottom of my heart I thank them all, and may Allah reward them the best in this world and hereafter.

This thesis was submitted to the Senate of the Universiti Putra Malaysia and has been accepted as fulfillment of the requirement for the degree of Master of Science. The members of supervisory committee were as follows:

Sharifah Norkhadijah Syed Ismail, PhD

Senior Lecturer Faculty of Medicine and Health Sciences Universiti Putra Malaysia (Chairman)

Irniza Rasdi, PhD

Senior Lecturer Faculty of Medicine and Health Sciences Universiti Putra Malaysia (Member)

> **BUJANG BIN KIM HUAT, PhD** Professor and Dean School of Graduate Studies Universiti Putra Malaysia

Date:

Declaration by Members of Supervisory Committee

This is to confirm that:

- the research conducted and the writing of this thesis was under our supervision;
- supervision responsibilities as stated in the Universiti Putra Malaysia (Graduate Studies) Rules 2003 (Revision 2012-2013) are adhered to.

Signature:	
Name of	
Chairman of	
Supervisory	
Committee:	Dr. Sharifah Norkhadijah Syed Ismail
Signature:	
Name of	
Member of	
Supervisory	
Committee:	Dr. Irniza Rasdi

TABLE OF CONTENTS

			Page
ABST	RACT		i
ABST	RAK		iii
ACK	NOWL	EDGEMENTS	v
APPR	ROVAL		vi
DECI	LARAT	ION	viii
LIST	OF TA	BLES	xiii
LIST	OF FIG	GURES	xiv
LIST	OF AB	BREVIATIONS	XV
CILAI			
CHAI	PTER		
1	INTR	ODUCTION	1
1	1 1	Introduction	1
	1.2	Background of the study	1
	1.3	Problem Statement	3
	1.4	Objectives of the study	5
	1.5	Research questions	5
	1.6	Scope of the study	5
	1.7	Significance of Findings	6
	1.8	Thesis organization	7
2	LITE	RATURE REVIEW	8
	2.1	Introduction	8
	2.2	Municipal Solid Waste	8
	2.3	Municipal Solid Waste Management (MSWM)	8
		2.3.1 MSWM generation and composition	9
		2.3.2 Waste handling, separation, storage, and processing at	
		the source	11
		2.3.3 Collection and transportation	12
	2.4	2.3.4 Treatment and Disposal	15
	2.4	Environmental Impacts of MSWM Practices	18
		2.4.1 Water pollution	18
		2.4.2 Atmospheric pollution	18
		2.4.3 Land pollution	19
	2.5	2.4.4 Odor	19
	2.5	Health risks related to municipal waste management	20
		2.5.1 Health risks to the Communities	21
		2.5.2 Health risks to Informal Wasta Diakara	22
	26	2.5.5 Health HSKS to Information Waster Fickels	23
	2.0	2.6.1 MSWM policies and regulations in Zanzibar	24 25
	27	2.0.1 IVIN WIVI PULICIES ALL LEGULATIONS III ZAIIZIDAT Municipal Solid Waste Management Problems and	23
	∠.1	Challenges	77
		Chancinges 2.7.1 Financial	∠ / 28
			20

	2.7.2 Technical	28
	2.7.3 Weak institutional arrangements	29
	2.7.4 Economic constraint and limited utilization of	
	resources	30
	2.7.5 Social	31
2.8	Municipal Solid Waste Management Strategies	32
	2.8.1 Developing integrated planning on waste management	
	system	32
	2.8.2 Stakeholders' involvement and institutional set-up	33
	2.8.3 Developing public private-partnerships with private	
	sectors and community based organizations and	
	informal workers	34
3 MET	CHODOLOGY	36
3.1	Introduction	36
3.2	Description of the study area	36
3.3	Research design and research design framework, Conceptual	
	framework	37
3.4	Study samples and sampling technique	39
3.5	Sample Size Calculation	40
3.6	Data collection	40
	3.6.1 Primary data	40
	3.6.2 Secondary data	40
3.7	Data collection techniques and Instruments	41
	3.7.1 Instrumentation	41
3.8	Observation	42
3.9	Data processing and Analysis	43
4 RES	ULTS AND DISCUSSION	44
4.1	Introduction	44
4.2	Respondents background	44
4.3	The households' practices, knowledge, awareness and	
	concerns on MSWM in Zanzibar Municipality	46
	4.3.1 Waste handling, separation, collection services and	
	disposal practices	46
	4.3.2 Knowledge and awareness on MSWM issues	54
	4.3.3 Concern on Municipal Solid Waste Management	58
4.4	Health symptoms reported in the selected residential shehias.	62
	4.4.1 Relationship between reported health symptoms and	
	socio demographic factors	68
	4.4.2 Relationship between reported health symptoms and	
	existing practices	69
	4.4.3 Relationship between reported health symptoms with	
	knowledge and awareness on MSWM issues.	71
4.5	Municipal Solid Waste Management Problems and	
	Challenges	73

5	CONC	CLUSION	76
	5.1	Introduction	76
	5.2	Key findings	76
		5.2.1 Household practices, knowledge, awareness and	
		concerns on MSWM	76
		5.2.2 Waste handling, collection services, separation and	
		disposal practices	76
		5.2.3 Knowledge and awareness on MSWM issues	78
		5.2.4 Concern about environmental and public health risks	78
	5.3	Health symptoms reported in relation to MSWM	79
	5.4	Relationship between reported health symptoms and other	
		variables in the study	79
	5.5	Municipal Solid Waste Management Problems and	
		Challenges	80
	5.6	Limitations of the study	80
	5.7	Conclusion	81
	5.8	Recommendations for future researches	82
	5.9	Recommendation from the study	82
		5.9.1 Public education and awareness	83
		5.9.2 MSWM privatization	83
		5.9.3 Strengthening financial mechanisms	84
		5.9.4 Development of policy, legal framework and	
		enforcement of regulations and by-Laws	84
		5.9.5 Community and stakeholders' involvement in	
		integrated MSWM plan	84
		5.9.6 Training and motivation of human resources	85
		5.9.7 More researches on municipal solid waste in Zanzibar	85
REFE	RENCI	ES	86
APPE	NDICE	S	93
BIOD	BIODATA OF STUDENT		
LIST	OF PU	BLICATIONS	103

5

C

xii

LIST OF TABLES

Table		Page
4.1	Respondents Profile (socio-economic characteristics of respondents) ($N = 200$)	45
4.2	Household waste separation	48
4.3	Collection service and frequency of collection	49
4.4	Households disposal practices in Municipal Solid Waste Management Zones (N = 200)	51
4.5	Indiscriminate disposal practices within neighborhoods	52
4.6	Knowledge on MSWM issues	54
4.7a	Awareness on MSWM issues	55
4.7b	Multiple responses on awareness about environmental and health problems	57
4.8	Willingness to participate in MSWM issues	61
4.9	Household suggestions on MSWM system improvement	62
4.10	The common health symptoms reported in the selected shehias and by zones	63
4.11	Odds ratios (OR) of health symptoms by zones	64
4.12	Distribution of health symptoms by age category and sex between zones	66
4.13	Association between reported health symptoms and social demographic characteristics as measured by ORs (95%CI)	69
4.14	Association between reported health symptoms and practices as measured by ORs (95%CI)	70
4.15	Relationship between reported health symptoms with knowledge and awareness as measured by ORs (95%CI)	72

LIST OF FIGURES

Figure		Page
2.1	Equipment used waste for collection	14
2.2	The location of the dumping site in Zanzibar	17
2.3	Indiscriminate dumping in residential areas	17
3.1	The location of the study area (Zanzibar Municipality	37
3.2	Conceptual Framework	38
3.3	Research design framework	39
4.1	Type of storage containers used for household waste	47
4.2	Agent who provide collection services in the residential areas	53
4.3	Reasons for not satisfied with the collection services	53
4.4	Concerns about public health and environmental risks	59

 \bigcirc

LIST OF ABBREVIATIONS

CBOs	Community –Based Organizations
CI	Confidence Interval
EGSSAA	Environmental Guidelines for Small-Scale Activities in Africa
GDP	Gross Domestic Product
HIJRA	Humanitarian Initiative Just Relief Aid
IGES	Institute for Global Environmental Strategies
ISWM	Integrated Solid Waste Management
MSWM	Municipal Solid Waste Management
NGOs	Non-Government Organizations
OR	Odds Ratios
SEZM	State of Environment of Zanzibar Municipality
SMOLE	Sustainable Management of Land and Environment in Zanzibar
SPSS	Statistical Package for Social Sciences
ТРНС	Tanzania Population and Housing Census
UNEP	United Nations Environment Program
UNESCO	United Nations Educational, Scientific and Cultural Organization
UN-HABITAT	United Nations Human Settlements Program
WHO	World Health Organization
ZEP	Zanzibar Environment Policy
ZHDR	Zanzibar Human Development Report
ZMC	Zanzibar Municipal Council
ZSDP	Zanzibar Sanitation and Drainage Program
ZUSP	Zanzibar Urban Services Project

 (\mathbf{G})

CHAPTER 1

INTRODUCTION

1.1 Introduction

This chapter provides an overview of the subject researched the background of the research, problem statement, justification of doing the research, research objectives, research questions, significance of the study and scope of the study.

1.2 Background of the study

The production of municipal solid waste is an inevitable consequence of human activity, and its management directly impacts the health of the people and environment surrounding it (Vergara & Tchobanoglous, 2012). The process of Municipal Solid Waste Management (MSWM) encompasses all the function of direct waste generation, storage, collection, source separation, processing, transport, treatment, recovery and disposal (Ramachandra & Bachamanda, 2006; Agamuthu, 2011). These processes have to be carried out within existing legal, social, economic efficient and environmental guidelines which are very important for the protection of public health and aesthetic and environmental reasons (Jafari, Hatam & Saed 2010; Pattnaik & Reddy, 2010; Guerrero, Maas & Hogland, 2013).

To achieve these goals, effective and sustainable municipal solid waste management systems must be embraced by local authorities with appropriate organizational capacity and cooperation between numerous stakeholders in the public and private sectors actors (Schubeler, 1996; Henry, R, Zhao. Y., Dong. J, 2006). However, management of MSW is most challenging compared with other types of wastes such as agriculture, mining and industrial wastes particularly in the developing world (Wang, 2011). The management in most cities of developing countries is highly unsatisfactory (Schubeler, 1996).

 \bigcirc

Municipal solid waste management is a continually growing problem at global, regional and local levels although the problem appears to be different in different countries (Ramachandra & Bachamanda, 2006). With rising urbanization, population expansion, economic growth and change in lifestyle and food habits, the amount of municipal solid waste has been rapidly increasing in developing countries and its composition is also changing (Dokhikah, 2012; Vergara & Tchobanoglous 2012; Jafari, Hatam & Saed, 2010). Giusti (2009) and Agamuthu (2011) indicate the daily global MSW generation is estimated to be more than $2x10^9$ tons.

However, due to inadequate resource and inefficient infrastructures, not all of the waste generated get collected and transported to the final dumpsites (Prakiti, 2006). Most municipalities lack the efficient collection techniques which are evidenced by increasing dumpsites and abandoned waste and deposit in the city streets and open places in the residential areas (United Nations Environment Program (UNEP), 2005; Sandra Contreau, 2006; Ohaka, A., Ozor, P & Ohaka, C, 2013). The piling up of uncollected waste then becomes a breeding ground for pathogens leading to communicable diseases such as cholera, diarrhoea and malaria (Ifeoma*et al*, 2011; Vuai, 2010). Achankeng (2003) revealed that the prevalence of such disease can be related to the polluted condition caused by the waste being left around.

In addition, unhealthy disposal of solid waste remains the prevalent method used by many communities in the developing countries where waste is disposed of randomly at uncontrolled open dumps, water bodies, wetlands and surface drains (Mangizvo, 2010; Odufuwa, 2012; Ogunrinola, 2012; Agwu, 2012; Ohaka*et al*, 2013).

Proper management of municipal solid waste can reduce or eliminate adverse human health and environmental impacts, while supporting economic development and improved quality of life. Despite this fact, many challenges militated against sound urban effective waste management system. The major issues and challenges that contribute to inefficient waste management system in developing countries includes lack of organization and planning in waste management and financial restrictions (Al-Khatib I., Arafat H., Basheer T., Shawahneh H., Salahat A., Eid J., Ali W, 2007; Ogwueleka, 2009; Zaini Sakawi, 2011; Jafari, Hatam &Saed, 2010; OkotOkumu, 2012; Dhokhikah & Trihadiningrum, 2012). Waste management is poorly financed because it is not a prioritized activity in all urban councils whose funds for the operation of the urban councils are mainly from external sources (over 50 %) like the central government and donors in the form of grants (Okot-Okum, 2012; Wang, 2011).

Other important aspects compounding the problem are inadequate policy, lack of legislations and control systems (Maseva, 2005; Fauziah, 2013; Khatib, 2011; Ogawa, 2005); inadequate technology (Odufuwa et al, 2012); low recycling rate (Agamuthu, 2011); weak institutional structure (Banga, 2011; Reagassa, 2011); low public awareness and poor attitude towards waste management (Pokhrel, 2005; Premakumara, 2011; Agwu, 2012; Ohaka*et al*, 2013; Fauziah, 2013).

 \bigcirc

Poor waste handling practices and inadequate provision of facilities in cities of countries in developing results indiscriminate disposal and unsanitary environments that and pose threat to the human health the а environment(Achankeng, 2003; Pokhrel, 2005; Ifeoma 2011; Uwakwe, 2013). This unhygienic condition creates health problems by attracting disease vectors like flies, mosquitoes and rodents which in turn spread the infectious diseases such as malaria, respiratory tract infection, diarrhea, typhoid, dysentery, and cholera (Boadi, 2005; Abul, 2011; Vuai, 2010, Odufuwa, 2012; Ogunrinola, 2012; Ohaka

et al, 2013) and also reduce the aesthetic quality of the city. Improper solid waste management leads to economic loss (Abduli, M., Hossein.T., Ariandokht. A, 2013; Jafari, Hatam & Saed, 2010; Ogunrinola, 2012) and is one of the main cause of environmental pollution including ground water (Ahmed & Quader, 2011; Sankoh, F., Xiangbin.Y & Quangyen. T, 2013) and green-house gases (GHG) emission which is a critical climate change problem (Ohakwe, 2011, Khatib.I, 2011; Vergara, 2012) and becomes the topic of major environmental concern today.

In addition, inefficient management options results in the loss of considerable amounts of materials and substances that can be beneficially reused, recycled or recovered. Therefore, planning for and implementing a comprehensive program for waste collection, transport and disposal along with activities to prevent or recycle waste can eliminate the aforementioned problems.

As part of the developing countries and East Africa in particular, Zanzibar experiences difficulties in waste management. According to the 2012 Tanzania Population and Housing Census, the Zanzibar population is 1,303,569 at the annual growth rate of 2.8%. With population growth due to rural- urban migration and being economic centre, the generation of wastes in the Zanzibar Municipality has increased (Gauff, 2005; State of Environment of Zanzibar Municipality (SEZM), 2005). Currently, the production of the municipal waste is estimated to be approximately 300 tons/day (Zanzibar Municipal Council (ZMC), 2013).

However, due to resource crunch, the municipal has capacity to collect and dispose of only 60 tons/day (SEZM, 2005; ZMC, 2013). Zanzibar Municipal Council (ZMC) is a local government established in 1995. This authority under Drainage, Sewerage, and Solid Waste division is the sole responsible body for waste management in Zanzibar and urban municipality in particular but faces many challenges in terms of human and material resources to effectively manage waste problem.

1.3 Problem Statement

Solid Waste is a visible concern in Zanzibar. One of the fundamental problems facing Zanzibar communities is the lack of formal system for solid waste management and is more apparent in informal settlements (SEZM, 2005; Zanzibar Urban Service Project (ZUSP), 2010). Although the Zanzibar Municipal Council (ZMC) engages in collection of municipal solid waste, this service is still inadequate; a significant proportion of the population does not have access to collection services (Zanzibar Sanitation and Drainage Program (ZSDP), 2005; Sustainable Management of Land and Environment (SMOLE), 2011). Thus, residents opt to dump waste on available spaces throughout the suburbs - resulting unsightly piles of waste and wind-blown litter everywhere. These piles of waste are scattered around residential areas and present health risks, causes bad odors and surface water channels and drains to be blocked (ZUSP, 2010).



The municipal solid waste collected is transported to central dumping site without any form of treatment prior final disposal. The current municipal solid waste management system under the local authority in the municipality does not facilitate any treatment strategy at least to reduce the waste quantity or related health and environmental problems.

Besides, there are numerous informal dumping sites throughout the country side and urban areas which are potential for considerable health hazards to the nearby residents. Health problems associated with mosquitoes, flies, rodents, bad odor and generally nuisance along with waste scavengers can be further aggravated from this indiscriminate dumping.

A broader body of literature has deemed indicated the significant relationship between improper solid waste management practices and public health risks as well as the impact to the natural environment. It is estimated that, more than 50% of the diseases that affect residents in Zanzibar are related to water and sanitation where the unsanitary environments is highly associated with poor waste management practices (Zanzibar Environment Policy, 2013). If the condition is left unchecked, it will impose social and economic costs to the government.

Moreover, waste utilization that would raise economic benefit is not priority of the sector and hence large amount of resource materials are constantly lost. In light of this, MSWM remains a challenge to the municipal authority due to its public health and environmental concerns and aesthetically consideration. Therefore there is immense pressure to improve the municipal solid waste management practices in Zanzibar Municipality. This could be attained by providing a general view of the existing system to understand the situation, the potential health risks and suggesting the possible measures for the future development in a sustainable way.

At present, there are very limited studies focusing on municipal solid waste management practices in Zanzibar with particular emphasis on environmental impact rather than its detrimental effects to human health. In addition, there is lack of basic epidemiologic data on the health impact of prevailing waste management practices. Therefore, there is a need to address the municipal solid waste management issues and associated problems which may pose health risks to the Zanzibar communities.

1.4 Objectives of the study

The main objective of the study is to assess the current municipal solid waste management practices and associated health risks in Zanzibar Municipality.

The research aimed at achieving the following specific objectives;

To determine the existing households practices, knowledge, awareness, and concerns on MSWM in Zanzibar municipality.

- 1. To examine health symptoms reported in Zanzibar municipality
- 2. To investigate the relationship between reported health symptoms and other studied variables such as knowledge and disposal practices.
- 3. To identify the problems and challenges on MSWM which the Zanzibar municipality is facing.

1.5 Research questions

From the above objectives, the following are research questions developed:

- 1. What are the existing MSWM practices of the households' and to what extent the households knowledgeable, aware and concern of the MSW in the municipality?
- 2. What are the common health symptoms reported in Zanzibar municipality?
- 3. Is there relationship between reported health symptoms and other studied variables such as knowledge and disposal practices?
- 4. What are the main problems and challenges faced by the municipal solid waste management system?

1.6 Scope of the study

The study focused on the municipal solid waste which generation trend is constantly increases with the population in the municipality and therefore put bearable pressure to the local government for its management. It also presents a valuable resource if the appropriate management options are applied and hence mount economic benefit. Geographically, the study is confined to Zanzibar municipality only which is the nation capital and economic center where many people resides and increase waste production which adds the waste management problem as faced by many other growing cities in other countries and Africa in particular. The scope of the study focus on collection and disposal practices with health implication in residential areas. This is because due to population increase in these areas, production of domestic waste also increases which forms the main constituent of MSW accounting for 74% of the total MSW stream. The study focused on these important elements for better understanding of the situation and evaluates the existing capacity of the management system on their operation.

In addition collection and proper disposal are very important steps to maintain public health and therefore their improvement can effect a significant development of overall waste management system. This would form the basis for changes in policy and motivating government to raise their interest in waste management sector.

1.7 Significance of Findings

For efficient delivery of the management system, municipal authority should strengthen control and monitoring processes, improve services and practices, and gear social dimension while compounded with support by stakeholder's participation. Therefore the outcome of this study is a comprehensive report that presents the vital findings on MSWM in Zanzibar municipality which is the capital city of Zanzibar. These data can be used as baseline assessment to motivate and drive the responsible authority to adopt safe management options to protect public health risks and reduce burden on national budget. Findings will enlighten Ministry of Health on the extent that the public health issues might be contributed to waste management problems.

The study also contributes to the literature gaps about MSWM in Zanzibar and health. Findings would be very helpful to the decision makers on MSWM in the development of efficient policy approaches and measure to be taken towards improvement of existing MSWM and promote sustainable system in the country.

Study also enhance further researches regarding MSW to be conducted in Zanzibar such as studies on waste characteristics; behavioral perspective and comparative analysis studies on landfill effects which always form the basis of future development plans. For instance, study on disposal sites will add knowledge to the understanding of the effects of uncontrolled sites and therefore sparks the improvement of landfill sites in order to prevent public health and environmental deterioration.

Since there is no overall policy regarding waste management and there are very few laws and regulations, this study will provide a base for a policy formulation and its directives. People were very positive with 3Rs initiative and therefore the study will guide in deciding alternatives management programs and plans on waste management hierarchy.



1.8 Thesis organization

Thesis has been organized into 5 chapters. Chapter 1 contains general introduction about the study portraying the background of the study, problem statement, justification, objectives, research questions, hypothesis, its scope and the whole work organization. Chapter 2 is a literature review comprising of relevant topics to waste management subject matter such as elements of MSWM, public health and environment impacts from municipal waste, aspects of MSWM such as political, social and technical. Chapter 3 provides detailed methodological approaches used to undertake the study. Chapter 4 presents the findings obtained from the field data and their discussion. Chapter 5 summarizes the key findings, give the general conclusion and recommendations of the study.



REFERENCES

- Abduli, M.A., Hossein. T., Ariandokht. A. (2013). Alternatives for Solid Waste Management in Isfahan, Iran: a case study. *Waste Management & Research*, 31(5): 532 - 537.
- Abul. S. (2010). Environmental and Health Impact of Solid Waste Disposal at Mangwaneni Dumpsite in Manzini: Swaziland. Journal of Sustainable Development in Africa, 12(7): 64 - 78.
- Achankeng, E (2003). Globalization, Urbanization and Municipal Solid Waste Management in Africa. *African Studies Association of Australia and thePacific*. Conference Proceedings-African on a Global Stage.
- Agamuthu P (2011). Municipal Waste Management. Institute of Biological Science, Faculty of Science, University of Malaya, Kuala Lumpur Malaysia. Waste Doi 10.1016/B978-0-12-381.
- Agwu, M. O. (2012). Issues and Challenges of Solid Waste Management Practices in Port-Harcourt City, Nigeria – a behavioral perspective. *American Journal* of Social and Management Sciences. Doi:10.5251/ajsms.2012.3.2.83.92.
- Ahmed. A & Quader. M (2011). Environmental Aspects of Solid Waste Management: A Case Study of Narayanganj City. ASA University Review, 5(1): 133-143.
- Aida. H.Z , Firuza B. M , Fauziah S.H (2011). Socio-Economic Studies of Scavengers in Malaysian Landfills. International Conference on Population Dynamism of Asia. University of Malaya, Kuala Lumpur, Malaysia.
- Al-Khatib IA, Arafat HA, Basheer T, Shawahneh H, Salahat A, Eid J, Ali W. (2007). Trends and problems of solid waste management in developing countries: A case study in seven Palestinian districts. Waste Management 27(12): 1910-1919.
- Arivukkarasu, D &Lakashmi, T.S. (2014). An Exploratory Study on Municipal Solid Waste Management System and Energy Recovery in Tiruvallur, India. International Journal of Innovative Research in Science, Engineering and Technology, 3, Special Issue 1.
- Badgie. D., Mohd.A., Latifah. A.M., Azizi . B. M. (2012). Assessment of Municipal Solid Waste Composition in Malaysia: Management, Practices and Challenges. *Pol.J. Environ.Stud*, 21 (3): 539-547.
- Banga. M. (2013). Household Knowledge, Attitudes and Practices in Solid Waste Segregation and Recycling: The Case of Urban Kampala. Zambia Social Science Journal, 2 (1): 27-39.
- Binion, E & Gutberlet, J. (2012). The effect of handling solid waste on the wellbeing of informal and organized recyclers: a review of the literature. *International Journal of Occupational and Environmental Health*, 18(1): 43-52.
- Boadi, K &Kuitunen, M. (2005). Environmental and Health Impact of Household Solid Waste Handling and Disposal Practices in Third World Cities: The

case of the Accra Metropolitan Area, Ghana. *Journal of Environmental Health*, 68(4): 32-36.

- Chua, K., Endang.J., Leong, Y. (2011). Sustainable Municipal Solid Waste Management and GHG Abatement in Malaysia. ST-4: Green & Energy Management, 1-8.
- Charles. K. (2013). Environmental Exposure and Public Health Concerns of MSW Disposal in Dar es salaam, Tanzania. Journal of Sustainable Development in Africa, 15 (3): 198-208.
- Daniel.W. (2005). Biostatistics. A foundation for analysis in the health.1348-53
- Daniel .B., Abera. K., Worku.T. (2014). Assessment of occupational injuries among Addis Ababa City municipal solid waste collectors: a cross-sectional study. Bogale et al. *BMC Public Health*, 14:169. DOI: 10.1186/1471-2458-14-169
- Davoli. E., Fattore. E., Paiano. V., Colombo.A., Palmiotto.M. (2010). Waste management health risks assessment: A case study of a landfill in South Italy. *Waste Management*, 30 (8-9): 1608-1613.
- Dhokhikah. Y & Trihadiningrum.Y. (2012). Solid Waste Management in Asian Developing Countries: Challenges and Opportunities. *J.Appl.Environ.Biol.Sci*, 2(7): 329-335.
- Daniela Porta., Simona. M., Lazzarino, A.I., Perucci. C.A., Francesco.F. (2009). Systematic review of epidemiological studies on health effects associated with management of solid waste. *Environmental Health*, 8:60
- Ekram. A., Eassa .S.M., Lotfi.S.E., El Masry .SA., Shatat. H. Z. (2014). Adverse Health Problems among Municipality Workers in Alexandria (Egypt). *Int J Prev Med*, 5 (5): 545-556.
- El-Hamouz. A. (2008). Logistical management and private sector involvement in reducing the cost of municipal solid waste collection service in the Tubas are of the West Bank. *Waste Management*, 28: 260-271.
- Fauziah. S & Agamuthu P. (2013). Policy and Strategies towards Sustainable Waste Management in Malaysia. Institute of Biological Science, University of Malaya, Kuala Lumpur, Malaysia. Proceedings of the International Conference on Solid Waste 2013-Innovation in Technology and Management, Hong kong SAR, P.R.China.
- Gauff. H (2005). Zanzibar Sanitation and Drainage Program Phase II (ZSDP II); *Feasibility Study on Solid Waste Volume*. Zanzibar Municipal Council.
- Giusti. L. (2009). A review of waste management practices and their impact on human health. *Waste Management*, 29:2227-2239.
- Gouveia. N (2010). Health risks in areas close to urban sold waste landfill sites. Rev Saúde Pública . 44(5).
- Guerrero, L.A, Maas, G., & Hogland, W. (2013). Solid waste management challenges for cities in developing countries. *Waste Management*, 33(1): 220-32.

- Henry, R., Zhao. Y., Dong. J. (2005). Municipal Solid Waste Management Challenges in Developing Countries-Kenyan case study. *Waste Management*, 26: 92-100.
- Ogawa. H (2005). Sustainable Solid Waste Management in Developing Countries. WHO Western Pacific Regional Environmental Health Centre (EHC), Kuala Lumpur, Malaysia. Available at <u>www.gdrc.org/uem/waste/swm-</u>fogawa1.htm.
- Hua Wang (2011). Municipal Solid Waste Management in Small Towns. An Economic Analysis conducted in Yunnan, China. The World Bank, Development Research Group.Environment and Energy Team, August. Policy research Working paper 5767.
- Ifeoma .A ., Onyeonoro. U., Ezeama, N., Ogbuagu, N., Agam, E. (2011). Public Health Implication of Household Solid Waste Management in Awka South East Nigeria. *The internet Journal of Public health*, 1 (1): 1-6.
- Ijasan, K.C., Oloke, O.C., Adeyemo, O.A., Gbadamosi, A.F. (2012). Depressionary Effect of Proximity of Residential Properties to Waste Disposal Sites in Nigeria. (A case study of Solous Landfill Site). *Ethiopian Journal of Environmental Studies and Management EJESM*, 5 (4): 574-582.
- Ittiravivongs, A. (2012). Household waste recycling behavior in Thailand: *The role* of responsibility. International Conference on future Environment and Energy IPCBEE, 28. IACSIT press, Singapore.
- Jafari. A., Hatam G., Saed H. (2010). Municipal Solid Waste Management in Khoram Abad City and experiences. World Academy of Science, Engineering and Technlogy, 38: 198-203.
- Juma, Mzee and Fariborz. K (2011). Business Plan 2010-2011, Zanzibar Municipal Council.
- Kaseva .M. E & Mbuligwe. S.E. (2005). Appraisal of solid waste collection following private sector involvement in Dar es Salaam city, Tanzania. *Habitat International*, 29: 353–366.
- Khatib. I. (2011). Municipal Solid Waste Management in Developing Countries: Future Challenges and Possible Opportunities. *Integrated Waste Management*, 2:35-48. Available at <u>www.intechopen.com</u>.
- Kalin. K & Skoog .J. (2012). Assessment of the waste management system on Zanzibar- a Case study on Jumbi landfill, Mwanakwerekwe dumpsite and Tunguu Dumping area. Master thesis. Lund Institute of Technology.
- K. Schrapp & N. Al-Mutairi (2010). Associated Health Effects among Residences Near Jeleeb Al-Shuyoukh Landfill. American Journal of Environmental Sciences 6 (2): 184-190.
- Klundert, A &Lardinois, I (1995). Community and Private (formal and informal) Sector Involvement in Municipal Solid Waste Management in Developing Countries. The Netherlands.

- Kumar. M. & Nandini. N (2013). Community attitude, perception and willingness towards solid waste management in Bangalore city, Karnataka, *India*. *International journal of Environmental Sciences*, 4(1):87-95.
- Mangizvo. V. (2010). An Overview of the Waste Management Practices at Solid Waste Disposal Sites in African Cities and towns. *Journal of Sustainable Development in Africa*, 12 (7): 233-239.
- Maseva (2005). A Review of the Legislative and Policy Framework for Waste Management in Zimbabwe with Special Reference to Harare, Chitungwiza Municipality and Epworth Local Board. Prepared for Practical Action Southern Africa.
- Mwaura, P., Owillah, E., Mohammed. D. (2012). Report of KAP survey on Solid Waste Management in Mogadishu, Somalia. Humanitarian Initiative Just relief Aid (HIJRA).UN-HABITAT.
- Metro Manila Solid Waste Management Project (TA 3848- PHI): Public Awareness Survey, Final Report, Report NO 2.September, 2003.
- Mattiello, A., Chiodini P., Bianco, E., Flammial.I, Gallo.C., Pizzuti. R., Panico.S.(2013). Health effects associated with the disposal of solid waste in landfills and incinerators in populations living in surrounding areas: a systematic review. *Int J Public Health*, 58: 725-735.
- Maziku.J.D. (2014). Improving Solid Waste Management in the Dar es salaam Coastal Belt, Tanzania. Master Thesis. Novia University of Applied Sciences.
- Odufuwa. B. (2012). Household Participation in Waste Disposal and Management in Ijebu-Ode, *Nigeria. J Hum ECOL.* 40 (3): 247-254.
- Oberlin. A. (2013). Resource Recovery Potential: a case study of household waste I Kinondoni Municipality, Dar es salaam, Tanzania. Tanzania Journal of Natural and Applied Sciences, 4 (1): 563-574.
- Ogunrinola, I & Omosalewa, A. (2012). Health and Economic Implications of Waste Dumpsites in Cities: The Case of Lagos, Nigeria. *International Journal of Economics and Finance*. 4 (4) : 239-251.
- Ogwueleka.T. (2009). Municipal Solid Waste Characteristics and Management in Nigeria. *Iran.J.Environ.Health.Sci.Engi*, 6 (3): 173-180.
- Ohaka, A.R., Ozor, P.E & Ohaka, C.C. (2013). Household Waste Disposal Preatices in Owerri Municipal Council of Imo State. *Nigerian Journal of Agriculture, Food and Environment*, 9 (2): 32-36.
- Ohakwe, J., Nnorom. M., Nwosu. C. (2011). Statistical modeling of residents' concerns towards solid waste management facility: A case study of three towns in southeastern Nigeria. *Continental J. Environmental Design and Management* 1(1): 9-21.
- Okot-Okumu. J (2012). Solid Waste Management in Africans Cities-East Africa. College of Agriculture and Environmental Sciences. Makerere University, Kampala Uganda. DOI.org/10.5772/50241.

- Pattnaik.S & Reddy.V. (2010). Assessment of Municipal Solid Waste Management in Puducherry (Pondicherry). *India. Resource, Conservation and Recycling*, 54: 512-520.
- Pokhrel. D. (2005). Municipal Solid Waste Management in Nepal: practices and challenges. *Waste Management*, 25:555-562.
- Population and Housing Census: Population Distribution by Administrative Areas. (TPHC,2012). The United Republic of Tanzania; National Bureau of StatisticsMinistry of Finance Dares Salaam and Office of Chief Government Statistician President's Office, Finance, Economy and Development Planning Zanzibar. March, 2013.
- Prakiti (2006). Solid Waste Management: *Principles and Terminologies*. Center for Management Studies, DibrugarhUniversity. Available at <u>http://cmsdu.org</u>.
- Premakumara, D.J (2011). Survey of Household Solid Waste Generation and Public Awareness on Waste Separation and Composting Practices in Cebu City: Community-Based Solid Waste Management System development Project in Cebu city. Institute for Global Environmental Strategies, Japan.
- Rachiotis, G., Papagiannis D., Markas D., Thanasias E., Dounias G., Hadjichristodoulou C. (2012). Hepatitis B Virus Infection and Waste Collection: Prevalence, Risk factors and Infection Pathway; American Journal of Industrial Medicine 55 (7):650-655.
- Ramachandra, T. & Bachamanda, S. (2006). Environmental audit of Municipal Solid Waste Management. International Journal of Environmental Technology and Management, 7(3/4), 369. DOI:10.1504/IJETM.2007.015152
- Regassa. N., Sundaraa. R.D & Seboka, B.B. (2011) .Challenges and Opportunities in Municipal Solid Waste Management: The case of Addis Ababa City, Central Ethiopia.*J Hum Ecol*, 33(3): 179-190.
- Sandra Contreau (2006). Occupational and Environmental Health Issues of Solid Waste Management: *Special Emphasis on Middle and Lower- Income Countries.* The International Bank for Reconstruction and Development/ The World Bank. Washington, DC.
- Sankoh, F., Xiangbin.Y., Quangyen.T. (2013). Environmental and Health Impact of Solid Waste Disposal in Developing Cities: A case study of Granville Brook Dumpsite, Freetown, Sierra Leone. *Journal of Environmental Protection*, 4, 665-670.
- Schubeler. P (1996). Conceptual Framework for Municipal Solid Waste Management in Low –Income Countries. Urban Management and Infrastructure. UNDP/UNCHS (Habitat)/World Bank/SDC Collaborative Programme on Municipal Solid Waste management in Low-Income Countries.
- State of the Environment of Zanzibar Municipality (SEZM, 2005): A summary of the Environmental Profile.

- Sustainable Management of Land and Environment in Zanzibar (SMOLE II, 2011). Revolutionary Goverment of Zanzibar. Discussion Material for Solid Waste Management in Zanzibar.
- Sheikh, M.A. (2015). Municipal Solid Waste Management in tourist island ecosystems, Zanzibar: status, characteristics, challenges and prospects. *Waste Management*, 41: I-III.
- Tchobanoglous, G., Theisen, H. Vigil, S. (1993). "Integrated solid waste management: Engineering principles and management issues", McGraw Hill, New York, 45-52.
- United Nations Environment Program (UNEP, 2005). Solid Waste management (Volume 1).ISBN:92-807-2676-5.
- United Nations Human Settlements Program (UN-HABITAT, 2009). Solid Waste Management in the World's Cities: Pre-publication presentation. Printed by UNON Print Shop, Nairobi, Kenya.
- United Nations Human Settlements Program (UN-HABITAT, 2010). Solid Waste Management in the World Cities. Earthscan Ltd, Dunstan House, 14a Cross Street, London EC IN 8XA, UK. ISBN: 978-1-84971-169-2.
- United Nations Human Settlements Programme (UN-HABITAT, 2011). Collection of Municipal Solid Waste: Key issues for Decision -makers in Developing Countries. ISBN: 978-92-1-132385-6.
- Uwadiegwu.B&Chukwu.K (2013). Strategies for Effective Urban Solid Waste Management in Nigeria. *European Scientific Journal* .Vol.9,No.8 ISSN:1857-7881 (Print) e- ISSN 1857-7431.
- Uwakwe. F. (2013). Solid Waste Management in Owerri Municipality and its Immediate Environs. *Academic Journal of Interdisciplinary Studies*, 2(5).
- Vergara. S &Tchobanoglous (2012). Municipal Solid Waste and Environment: Aglobal Perspective. Annu. Rev. Environ. Resour, 37:277–309.
- Vuai. S (2010). Characterization of MSW and related waste-derived compost in Zanzibar municipality. *Waste Management & Research*, 28:177-184.
- Wang. H & Wang. C (2013). Municipal Solid Waste Management in Beijing: characteristics and challenges. *Waste management & Research* 31(1) 67-72.
- World Bank (2012). A Global Review of Solid Waste Management. Urban Development Series. Available at <u>www.worldbank.org/urban</u>.
- World Health Organization (WHO). Effect of Air Pollution on Children's Health and Development; Special Program on Health and Environment. European Centre for Environment and Health. Europe, 2005.
- Zaini Sakawi. (2011). Municipal Solid Waste Management in Malaysia: Solution for Sustainable Waste management. *Journal of Applied Sciences in Environmental Sanitation*, 6(1): 29-38.
- Zanzibar Environmental Policy (ZEP). The Revolutionary Government of Zanzibar. The first Vice Presiden'ts Office, Department of Environment Zanzibar, February, 2013.

Zanzibar Human Development Report (ZHDR). 2009: Towards Pro Poor Growth.

- Zanzibar Urban Services Project -Environmental and Social Impact Assessment-(ZUSP-ESIA) (2010). Report Number. 12574-9746-10.
- Zhang.D., Tan. S.K., Gersberg, R.M. (2010). Municipal solid waste management in China: Status, problems and challenges. *Journal of Environmental Management*, 91: 1623-1633.
- Zurbrugg, C (2003). Urban Solid Waste Management in Low –income countries of Asia: *How to cope with the garbage crisis*. Scientific committee on problems of the environment (SCOPE). Urban Solid waste Management Review session, Durban, South Africa, Nov, 2002.

