

**YANGON UNIVERSITY OF ECONOMICS
DEPARTMENT OF APPLIED ECONOMICS
MASTER OF PUBLIC ADMINISTRATION PROGRAMME
(NAY PYI TAW)**

**A STUDY ON MUNICIPAL SOLID WASTE
MANAGEMENT IN NAYPYITAW UNION TERRITORY
(CASE STUDY: ZABBUTHIRI AND PYINMANA TOWNSHIPS)**

**SOE THUREIN TUN
EMPA - 32 (18th BATCH)**

MAY, 2023

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A thesis submitted as a partial fulfillment towards the requirement for the Degree of
Master of Public Administration (MPA)

Supervised by

Dr. Tin Tin Wai
Pro-Rector
Yangon University of Economics

Submitted by

Soe Thurein Tun
Roll No. 32
EMPA 18th Batch (NPT)
(2019 - 2023)

MAY, 2023

**YANGON UNIVERSITY OF ECONOMICS
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MASTER OF PUBLIC ADMINISTRATION PROGRAMME**

This is to certify that this thesis entitled “**A Study on Municipal Solid Waste Management in Naypyitaw Union Territory (Case Study: Zabbuthiri and Pyinmana Townships)**”, submitted in partial fulfilment towards the requirements for the degree of Executive Master of Public Administration (EMPA) has been accepted by the Board of Examiners.

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Associate Professor

Department of Applied Economics

Yangon University of Economics

.....

Dr. Tin Tin Wai

(Supervisor)

Pro-Rector

Yangon University of Economics

May, 2023

ABSTRACT

This paper investigates on municipal solid waste management in Nay Pyi Taw Union Territory. The objectives of the study are to assess the awareness and participation of the Nay Pyi Taw Citizens in municipal solid waste management and to examine the challenges facing the Nay Pyi Taw Development Committee in municipal solid wastes management. In this study, 200 respondents are asked to collect the data. Their responses are gathered through interviews and questionnaire surveys with a self-administered questionnaire. It is found that most respondents get the information awareness concerning with municipal solid waste management from TV/ Radio. Nearly half of respondents dispose solid waste by municipal service. It is also found that the respondents are strongly agree level on the awareness and attitude for municipal solid waste management and are agree level on the participation of municipal solid waste management. Nay Pyi Taw Development Committee has many challenges in municipal solid wastes management especially advantaged technology, skillful staffs and workers, laws and regulations, budget requirement, separation and disposal system, plans for sustainable waste management system, and creating awareness programs. Therefore, Nay Pyi Taw Development Committee should encourage the awareness and participation in the disposing and management of the municipal solid wastes and draw short term and long term plans to be effective services for public.

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TABLE OF CONTENTS

	Page
ABSTRACT	ii
ACKNOWLEDGEMENTS	iii
TABLE OF CONTENTS	iv
LIST OF TABLES	v
LIST OF FIGURE	vi
LIST OF ABBREVIATIONS	vii
CHAPTER I INTRODUCTION	1
1.1 Rationale of the Study	1
1.2 Objectives of the Study	2
1.3 Method of Study	2
1.4 Scope and Limitations of the Study	3
1.5 Organization of the Study	3
CHAPTER II LITERATURE REVIEW	4
2.1 Municipal Solid Waste	4
2.2 Types of Solid Waste	5
2.3 Municipal Solid Waste Management	8
2.4 Components of Municipal Solid Waste Management	9
2.5 Community Behavior and Awareness on Solid Waste Management	11
2.6 Reviews on Previous Studies	12

CHAPTER III OVERVIEW ON MUNICIPAL SOLID WASTE	15
MANAGEMENT IN NAY PYI TAW	
3.1 Profile of Study Area	15
3.2 The Nay Pyi Taw Development Committee (NPTDC)	16
3.3 Policy, Legal and Regulatory Framework for Solid Waste Management	17
3.4 Duties and Responsibilities of Pollution Control and Cleansing Department	18
3.5 Waste Disposal Management System	19
3.6 Situation on Solid Waste Management	21
3.7 Public Awareness and Participation Activities	22
 CHAPTER IV SURVEY ANALYSIS	 24
4.1 Survey Profile	24
4.2 Survey Design	25
4.3 Survey Results	25
 CHAPTER V CONCLUSION	 41
5.1 Findings	41
5.2 Suggestions	42
 REFERENCES	
APPENDIX	

LIST OF TABLES

Table No.	Particular	Page
4.1	Personal Information of the Respondents	26
4.2	Main Information Sources	29
4.3	Awareness on Wet Waste	30
4.4	Awareness on Dry Waste	31
4.5	Current Awareness of Waste Management	32
4.6	Frequency of Municipal Solid Waste Disposal	33
4.7	Waste Separation in Disposing	33
4.8	Ways to Dispose Solid Waste	34
4.9	Sizes of Waste Bag	34
4.10	Participation on Municipal Solid Waste Management	35

LIST OF FIGURE

Figure No.	Particular	Page
3.1	Composition of Municipal Solid Waste in Nay Pyi Taw	21

LIST OF ABBREVIATIONS

MONREC	Ministry of Natural Resources and Environmental Conservation
MSWM	Municipal Solid Waste Management
NPTDC	Nay Pyi Taw Development Committee
PCCD	Pollution Control and Cleansing Department

CHAPTER 1

INTRODUCTION

1.1 Rationale of the Study

Municipal waste designated as trash or garbage in the United States and rubbish in the United Kingdom, is a type of waste that includes everyday items thrown away by the public. "Waste" can refer specifically to food waste, as in garbage disposal. Solid waste includes municipal waste; industrial wastes; electronic waste; health care waste; hazardous waste; sewage, waste from agriculture and animal husbandry and other related activities, demolition waste and mine tailings. Waste management is vital to save the surroundings from the toxic effects of environmental and non- environmental wastes. Improper waste management leads to water pollution. It can cause soil erosion and air pollution.

The problem is more serious in developed countries than in developing countries. Their economic growth and urbanization are faster. Solid waste management at waste product, storage, collection, transfer and transportation, disposing of waste is required in the maintenance of environmentally sound public health economic engineering in accordance with the best principles of aesthetic and environmental considerations.

Therefore, management in waste management, finance law, all planning and engineering functions are included. Adequate municipal waste management is much more than a technical problem. It includes organizational, social coordinating a large workforce, including legal and financial aspects; management and stakeholders as well as public collaboration are involved. The preparation and management of a good solid waste management system requires careful consideration of multidisciplinary inputs and local conditions. The problem parts in municipal solid waste management of developing countries can be recognized. These include inadequate service coverage and operational efficiency; ineffectiveness of services; limited use of recycling activities. This can be described as inadequate disposal of landfills and inadequate management of hazardous healthcare waste. Myanmar has been facing considerable

challenges with the management of waste as a result of rising income and consumption levels, increasing urban population and lack of effective waste treatment and disposal options. Currently, the city and township development committees are the departments responsible for waste collection and disposal in Myanmar. Especially in developing countries like Myanmar, it is definitely beyond the capacity of the responsible authorities to manage waste. Therefore, the selection criteria for public or private service delivery need to be seriously considered.

Nay Pyi Taw Union Territory has an estimated population of 1.3 million and the municipality produces more than 200 tons of waste. Waste management is a very important issue for the Nay Pyi Taw Union Territory and urban area, and it can have major impacts on the environment. Having a good municipal waste management system in Nay Pyi Taw only relies on Nay Pyi Taw Development Committee (NPTDC). Moreover, there are many difficulties in waste collection, transportation, final disposing and management of the municipal solid wastes in Nay Pyi Taw Development Committee. Therefore, this study intends to explore the challenges in the disposing and management of the municipal solid wastes faced by the Nay Pyi Taw Development Committee.

1.2 Objectives of the Study

The objectives of the study are as follow:

- (1) To assess the awareness and participation of the Nay Pyi Taw Citizens in municipal solid waste management
- (2) To examine the challenges facing the Nay Pyi Taw Development Committee in municipal solid wastes management

1.3 Method of Study

In this study, descriptive and quantitative methods are used. It based on primary and secondary data. For primary data, survey questionnaires are used by random sampling method. The structured survey questionnaires are conducted 120 respondents in Zabuthiri Township and 80 respondents in Pyinmana Township who used the services of Pollution Control and Cleaning Department under Nay Pyi Taw Development Committee (NPTDC) to assess the awareness and participation concerning with municipal solid waste management. Moreover, 10 officials who serve municipal solid waste management from Nay Pyi Taw Development Committee

(NPTDC) interview to examine the challenges of municipal solid wastes management. The secondary data is collected from Nay Pyi Taw City Development Committee (NPTDC), libraries, published and unpublished reports, relevant textbooks, Articles, previous researches, internet Journal and internet websites.

1.4 Scope and Limitations of the Study

This study was focused on the municipal solid waste management in Nay Pyi Taw union territory. This study emphasizes on the disposing and management of the municipal solid wastes faced by the Nay Pyi Taw Development Committee. Zabuthiri and Pyinmana Townships are selected as the study areas. Although there are eight townships in Nay Pyi Taw, this study will choose only two townships because of the time limitation to collect data and analyze the whole region and the urban population in the other six townships are fewer than 38 %.(Statistics from the 2014 census). Data collection period was in October, 2022. This study limits to examine the challenges facing the Nay Pyi Taw Development Committee in municipal solid wastes management.

1.5 Organization of the Study

There are five chapters in this study. Chapter I introduces rationale of the study, objectives of the study, method of the study, scope and limitation of the study and organization of the study. Chapter II presents literature review on municipal solid waste and basic concepts of solid waste. Chapter III displays overview on solid waste management in Nay Pyi Taw. Chapter IV analyzes on survey analysis. Chapter V is the conclusion part, which included findings and recommendation for the municipal solid waste management.

CHAPTER 2

LITERATURE REVIEW

2.1 Municipal Solid Waste

Waste refers to "something, material, or object that people consider useless at a certain time and place" (Mugambwa, 2009). Waste is an energetic concept that can be defined in various ways (Pongrácz, 2009). Waste is a product or material that is no longer suitable for its proposed use. In natural ecosystems, waste products (i.e., oxygen, carbon dioxide, and dead organic matter) are used as food or reactants. Wastes resulting from human activities are often very resistant and take a long time to decompose. In most cases, the definition of waste depends on the type or category of waste being considered. Some types of waste are municipal solid waste, Hazardous waste and electronic waste.

Waste can be categorized based on material, such as plastic, paper, glass, metal, and organic waste. Additionally, wastes that are radioactive, combustible, infectious, poisonous, or non-toxic may be divided into categories based on their potential for danger. The origin of the waste may also fall into other categories, including industrial, domestic, commercial, institutional, and building and demolition. (Rick LeBlanc, 2020)

Solid waste is not very diverse from municipal waste. This study adopts the definition of solid waste from Environment Report of Uganda, which defines solid waste as “organic waste and waste materials produced by households, commercial, institutional and industrial enterprises”. Municipal solid waste (MSW) is one of the important and White et al. (1995) report that MSW has various impacts.

One of the most significant issues that many cities throughout the world suffer is solid waste management. The problem is particularly due to urbanization, industrialization, poor urban planning and lack of adequate resources which contribute to the massive generation of solid waste. In the poorest countries, this issue has caused significant environmental, social, and economic problems. Waste is produced by human activity, and how it is handled, stored, collected, and disposed of

can have an impact on the environment and public health. Municipal Solid Waste Management (MSWM) problems and issues, particularly in the rapidly growing urban cities of the developing countries, seem to be of fundamental importance. (Chris Zurbrugg, 2002)

2.2 Types of Solid Waste

Types of solid waste are classified into municipal solid waste, construction waste, industrial waste, agricultural solid waste and commercial waste.

(A) Municipal Solid Waste (MSW)

Municipal solid waste (MSW), is a waste type consisting of everyday items that are discarded by the public. "Garbage" can also refer specifically to food waste. Municipal solid waste management generally refers to the management of solid waste from residential societies, streets, public places, commercial buildings, hospitals, and other institutions. The management of these types of waste is mainly the responsibility of municipal and other governmental authorities. EU Waste Directive 2008, defines waste management to "mean the collection, transport, recovery and disposal of waste, including the supervision of such operations and the after-care of disposal sites, and including actions taken as a dealer or broker". According to Augustino et al (2015), solid waste is made up of organic and inorganic waste materials that comes about as a result of human and animal activities and is no longer needed which needs to be discarded due to its value loss to the user. Disposing solid waste improperly causes diseases like cholera, diarrhea, among others.

MSW is waste that is frequently in contact with people and their collection, treatment and disposal are considered an important service by politicians and local government. Kaseva & Gupta (1996) designate waste is collected by municipal authorities including non-hazardous waste from institutional and industrial, hospital waste. Buah et al. (2007) describe MSW as solid waste collected for native authorities from domestic and marketable sources. White et al. (1995) defined municipal solid waste (MSW) as waste generated from domestic and marketable creations. They added that municipal waste is only a small part of the total solids. Vergara & Tchobanoglous (2012) observed that municipal solid waste generation reflects people's lifestyles and customs. MSW can harm the public and the environment if not managed properly.

White et al. (1995) MSWs are difficult to manage because of their varying components, including glass, metal, paper and other organic materials. Similarly, Berkun et al., 2011 revealed that the characteristics of MSW depend greatly on the source. However, in some countries, such as Turkey, almost more than half of all MSW is recyclables such as cardboard paper, glass and plastics make up a significant percentage of total municipal waste. Dixon & Jones (2005) reported that municipal solids include soil, garden and food waste, wood paper, textiles and rubber.

They consider that municipal solid waste is mainly collected from domestic and commercial sources. Due to the composition of MSW, waste can be easily used for energy recovery or fuel production. White et al. (1995) argued that unlike other types of waste, which have a good and homogeneous percentage of each material, the composition of municipal solid waste changes and generally varies from city to city.

(B) Construction Waste

Construction waste is one of the main waste streams in the world. Poon et al. (2001) reported that the amount of construction waste is about 29,674,013 metric tons per day. Most of the construction waste generated in the country consists of inorganic and unoccupied materials. Furthermore, Jaillon et al. (2009) pointed out that the large amount of waste generated by the construction industry is due to the country's limited land area.

A study (McDonald & Smithers, 1998) found that an average of 15% of waste in Australia is generated by construction activities each year. Faniran & Caban (1998) stated that waste generated from the construction industry in Australia increases the cost of construction projects mainly due to strict control of landfills in Australia. Faniran & Caban (2020) found that most construction waste is generated from design/detail errors, design changes, packaging waste, unused scraps and other materials.

Similarly, Barros et al. (1998) observed that a good percentage of construction waste produced in the Netherlands plastics, metal, wood and stones mainly from demolition and reconstruction activities.

(C) Industrial Waste

Ngoc & Schnitzer, (2009) described industrial waste as a result of processing raw materials to produce new products. These are factories, even in mines or

factories. Malaysia (Shafigh et al., 2014) reported that most of the total solid waste generated in Indonesia and Thailand is from palm oil extraction. In Thailand, the palm oil industry generates about 3.2 million metric tons of waste annually. Ngoc & Schnitzer (2009) reported the various wastes produced by industries. Some wastes are toxic, while others are non-toxic.

Types of industrial waste are dirt and gravel, brick and concrete, piece of metal oil, Chemicals Lumber even vegetables from restaurants. Industrial waste is solid, semi-solid or liquid form. It can be hazardous waste (some types of toxic) or non-hazardous waste. Industrial waste pollutes nearby soil or nearby water, groundwater, and ponds streams. It can pollute rivers or coastal waters. Industrial waste is often varied with municipal waste, making true assessment difficult. As of 2017, the United States estimates that annual industrial waste has risen to 7.6 billion tons. Most countries have enacted laws to deal with the problem of industrial waste, but strictness and compliance systems vary. Enforcement is always a problem.

(D) Agricultural Solid Waste

Agricultural waste is unwanted or unsalable material produced by agricultural activities directly related to growing crops or raising livestock for profit or primarily for subsistence purposes. Some agricultural wastes include vines, fruit trees, and vegetables. Agricultural waste is mainly produced by farming. However, it is not limited to production, but livestock and other activities related to the food chain. Every stage and level of the agro-food chain can generate significant agricultural solid waste. (Adejumo, 2020)

Agricultural wastes in general are large and beyond the scope of this study. However, according to Tchobanoglous et.al (1993), agricultural wastes from animal husbandry, it was noted that wastes are generated from activities such as plant seeding and milk production. Williams (2005) stated that agricultural wastes include animal waste, crop residues and silage waste. Agricultural waste can be mostly recycled in the energy and industrial sectors.

(E) Commercial Waste

Commercial waste is an important waste especially considering the large amount of solid waste produced by this sector. Environment & Heritage Service (2005) reported that commercial and industrial waste generated approximately 1.5

million tons of waste at Northern Ireland in 2005. The report said commercial enterprises generated more than half of the total waste generated for that year. The results of a survey of industry and commerce in England (DEFRA, 2009) show that commercial waste accounted for about 11% of total waste generated in 2002.

Similarly, a survey in Scotland (SEPA, 2008) found that retail, wholesale, hotels and restaurants were shown to generate the most commercial waste in Scotland in 2006. The survey shows that some countries with many businesses produce more economic waste than other regions with fewer businesses. Glasgow and Clyde in particular have a higher percentage of waste than other areas.

Commercial solid wastes include wastes from stores, restaurants, markets, offices, hotels, motels, and printing shops. It is solid or semi-solid waste generated by movements between service centers and other car repair shops (Tchobanoglous et.al, 1993).

The literature (Buah et al., 2007; Ogwueleka, 2009; White et al., 1995) indicated that commercial wastes are often discussed or grouped under municipal wastes. However, Williams (2005) notes that in most cases, information on the breakdown of domestic and commercial wastes are not readily available. McLeod et al. (2011) argued that wastes generated from commercial and domestic activities have similar components. However, in the UK, waste is not collected together for disposal.

In general, the most common waste generated by the business sector is consumer electronics, battery, tires, white goods paper, cardboard metals, plastics, food waste, wood and glasses (Tchobanoglous et.al, 1993). Sustainable solid waste management is necessary the characteristic of the area, an adequate understanding of the sources and production rates of wastes (Tchobanoglous et.al, 1993). Therefore, the participation of various sectors of commerce is important to deal with waste separately from other businesses to understand the volume and production rate.

2.3 Municipal Solid Waste Management

Solid waste management is associated with the control of storage, collecting transportation or transfer; public health conservation economy aesthetics. Engineering disciplines are defined as the discipline of processing and disposing of solid waste in an optimally remedial manner.

According to Beranek (1992), imported wastes are agricultural activities such as landscaping activities and domestic and commercial processes. Solid waste is

significantly different from wastewater and gas emissions. Solid waste is waste that is considered suitable for land disposal by ordinary people. Municipal waste management is undertaking a progress from disposal as landfill to sustainable management such as 3R (reuse, recycle, reduce) (Shekdar, 2009, Agamuthu and Fauziah, 2011, N. Li et al., 2013).

In Europe, a waste hierarchy concept with five levels was proposed which consists of prevention, preparation for reuse and recycling, recovery and disposal (Waste Framework Directive, 2008). The objective is source-reduction, disposal through dumping and burning and landfilling (McBean et al., 1995, Taylor, 2000, Neo, 2010, Achillas et al., 2011, Ahsan et al., 2012). This trend moves MSW management beyond the technical realm to product manufacturers, government organizations. It requires the involvement of all stakeholders, including private businesses and landlords. Therefore, the success of the MSW management system depends not only on technical innovation, but also on public participation, social, policy, public attitudes and behaviors. It is also significantly influenced by economic and psychological factors.

2.4 Components of Municipal Solid Waste Management

Municipal waste management is basically collection, transportation transfer station, and economy of waste at the final disposal site and in accordance with conservation principles and energy efficiency. It can be divided into five key components such as generation, storage, collection, transportation and disposing.

(A) Generation

Waste generation is an environmental problem of a global scale. Countries and cities are issued at different rates due to factors such as geographically location, seasonal changes, recycling, and the economic condition of the people, services, collection frequency, public opinion, legislation, and bins.

(B) Storage

Storage is the method of disposal and then storage before reaching a collection point. On-site storage is primary importance due to public health and aesthetic considerations. Better storage facilities include

- (1) Different sizes of dust

- (2) Plastic containers
- (3) Common boxes
- (4) Container location
- (5) Public health and aesthetics.

Compost garden waste and reduce the volume of waste in source management includes processes used to recover usable materials or change solid form.

(C) Collection

Waste management includes the process of waste collection. This includes the removal of waste from the source and transport to a facility for treatment or disposal at the final disposal site.

(D) Transportation

There are different types of transportation methods according to the type of waste. It will also depend on local availability and the amount of waste to be transported to the final disposal site. In general, the following methods are most commonly used in the transportation system.

- (1) Man Power System – open hand- cart, hand- cart with bins, wheelbarrow, tricycle
- (2) Motorized System – tractor, compactor, tipper-truck

(E) Final Disposing or Waste Treatment

Disposal is an essential part of solid waste management, resource recovery of accumulated waste, recycling. It can be used if there is no option to find ways to recycle or treat or reduce or reduce it and eventually throw it into the landfill.

There are four main methods of waste disposal.

- (1) Sanitary waste bin
- (2) Compost
- (3) Burning.
- (4) Recycling (Resource Recovery)

2.5 Community Behavior and Awareness on Solid Waste Management

One of the main problems related to waste management in developing countries is the lack of recognition of best practices in waste management. According to McAllister (2015), a study in Gaborone found that although citizens are aware of recycling and other sustainable waste management techniques.

When people are not interested in environmental issues, they feel uninformed and uninformed in making waste management decisions that affect their actions. When systems break down and problems grow, people look for social causes to solve the problem. This is often the case when solid waste is mismanaged in the developing world. Many researchers argue that the waste problem is caused by people's behavior and the solution is to change that behavior (Milea, 2009). Public knowledge and attitudes about waste can affect the entire SWMS (Zhu et al., 2008). Recognizing waste as a problem does not prevent other negative behaviors related to waste management (Moore, 2012). This attitude-behavior gap occurs frequently and is convenient; social norms, lack of public participation. Effective waste management practices can be affected by various factors including lack of education and awareness (Milea, 2009; O'Connell, 2011). Within this attitude/behavior gap exists a mismatch between a person's values and actions.

It refers to the gap between people's concern about environmental damage caused by household waste, in particular, and the limited action by those people to reduce their waste or engage in other environmental behaviors (O'Connell, 2011). Many researchers first noticed this disparity when conducting observational studies in communities in the developing world. A negative behavior often associated with improper waste management in developing countries is littering.

Another major constraint found throughout the developing world is the lack of education and awareness of effective waste management practices. Systematic and unbiased approaches and efforts by various government and non-government agencies should focus on the negative effects of increasing waste generation on the environment by educating the public.

2.6 Reviews on Previous Studies

Many studies of applied and theoretical research concerning municipal solid waste management have been conducted to find challenges in the disposing and management of the municipal solid wastes faced by the Nay Pyi Taw Development Committee. There are many research papers about waste management.

Mya Lwin Lwin Aung (2016) studied on public willingness pay for solid waste management in Yangon City by using descripts regression and contingent valuation method. The thesis finds that Yangon Solid Waste Management has several short coming and as a result, household have general discontent. Although Service Provider of Yangon City, YCDC-PCCD is trying to improve their service with the help of several groups, still there are gaps to progress all aspect of waste management. Majority of people are used to discharge their waste to designate nearby municipal secondary garbage station. Almost half of the survey respondent said that the service provided by YCDC become better. The study finds out that the cost of SWM in Yangon is three of four time of the waste service fee collected amount which still be shouldered by government. The dominant factor of public willingness to pay is trust. Although some household are not willingness to pay more, they spent more money to other service provider who are not legally recognized because they satisfy the service provided by those. Therefore, YCDC should improve their service. In overall, to develop the solid waste management of Yangon City, all related sector should improve.

Further, Minn Nay Han (2019) examined analysis on waste management behavior of Yangon citizens. The findings show that the awareness level of waste segregation, waste reduction is very low in awareness. The majority of respondents used plastic bag to carry take away food. Willingness to pay gradually decreased as the bid price in MMK increased. The most influencing reasons for unwillingness to pay are: taxes are paid and no extra charge, having feeling of no responsibility, more information for the future plan. The main factors influencing for this decision was the issue of mutual understanding and trust.

Navarro Ferronato (2019) studied on waste mismanagement in developing countries: a review of global issues through secondary data. In the finding, inaccurate publication of solid waste materials states that environmental pollution is a global problem. Open landfills and incineration are common waste disposal systems, mainly in low-income countries. It also reviewed informal sector activities in developing

cities and focused on the main health risks associated with waste management. The results show that environmental impacts are spread across the globe. Marine litter, atmosphere soil and water pollution and direct contact between waste collectors and hazardous waste is a major problem. Many reviews of specific wastes have been published in the scientific literature to quantify their environmental impacts. This narrative literature review assesses the global problems caused by different proportions of waste, and the diversity of sources of pollution in the environment. It showed how it affects public health and sustainable development.

Li Zhen-shan, Yang Lei, Qu Xiao-Yan, Sui Yu-mei (2009) explored the capacity of transfer stations and treatment facilities is an urgent issue as these areas are overburdened. These problems should be solved first by building more sites and converting to new treatment technologies. Legislation improvements in public education and management of waste pickers are issues that need to be addressed.

Eshetu Gelan (2021) examined municipal waste management practices for achieving green architecture concepts in Ethiopia. According to the observations, most of the waste is generated from households, followed by commercial centers, street cleaning industries/factories. It is reported that it is released from various hotels and hospitals. From 2016 to 2020, an average of 80.28% of solid waste is collected, whereas 19.72% of the waste is not collected. There are little or no efforts made to segregate solid waste at the source. The generated waste is disposed of in the Reppi open landfill. Together with Ethiopian electric power (EEP) and the City Government of Addis Ababa, waste has been converted to energy since 2019. The study suggests minimizing waste from its source by reducing generation, composting, reusing, recycling, waste-to-energy strategy, and well-designed buildings to achieve the concept of green architecture in Addis Ababa through better solid waste management.

Etea T, Girma E & Mamo K (2021) studied on risk perceptions and experiences of residents living nearby municipal solid waste case studies in Ginchi Town, Ethiopia. One of the sources of pollution in the town is a lack of MSWMS. The key observation is there are no organized collection, transfer and disposal of the generated MSW in the town. Solid waste bins, or landfills are not available in survey area. Solid waste from homes, businesses and institutions is illegally dumped in open lands, riverbanks, drains and roadsides. Food waste, plastics, festivals, plastic bottles, clothing, shoes, cleaning supplies, dead animals, broken eyeglasses, used batteries, ash and hair are the main components of waste dumped into rivers. According to the

survey results, respondents believed that open landfills could cause air, water and soil pollution. Also, living near vacant lots may be a risk factor for adverse health effects. In addition, he had health problems because he lived near a landfill. They were concerned about the direct and long-term effects of these health problems on themselves and their families, and the potential for future health problems as a result of continued illegal dumping. And they were disappointed and upset by the lack of solutions and the continued disposal of household waste. Respondents also stressed that landfills cause human disease, and respiratory-related health problems were frequently cited.

In conclusion, there are no other studies that is a study on municipal solid waste management in Nay Pyi Taw Union Territory (Case study: Zabbuthiri and Pyinmana Townships). The purpose of this academic work is to assess the awareness and participation of the Nay Pyi Taw Citizens in municipal solid waste management and to examine the challenges facing the Nay Pyi Taw Development Committee in municipal solid wastes management.

CHAPTER 3

OVERVIEW ON MUNICIPAL SOLID WASTE MANAGEMENT IN NAY PYI TAW

Municipal solid waste management in Nay Pyi Taw is presented by profile of Nay Pyi Taw, Nay Pyi Taw Development Committee (NPTDC), policy, legal and regulatory framework for solid waste management, duties and responsible of pollution control and cleansing department, basic components of solid waste management and situation on solid waste management.

3.1 Profile of Study Area

The Nay Pyi Taw Union Territory is an administrative division in central Myanmar and 70,571 km² in area. It also includes Nay Pyi Taw, the capital of Myanmar. The city is located in the heart of the Union Territory. It is unusual among large cities in Myanmar as it is a city planned entirely outside a state or region. The city, then known only as Pyinmana District, officially replaced Yangon as the administrative capital on November 6, 2005. Nay Pyi Taw union territory includes 4 districts and 8 townships. They are

(1) Ottara District

- Ottarathiri Township
- Tatkone Township

(2) Zeyarthiri District

- Zeyarthiri Township
- Pobbathiri Township

(3) Lewe District

- Dekkhinathiri Township
- Lewe Township

(4) Pyinmana District

- Pyinmana Township
- Zabuthiri Township

3.2 The Nay Pyi Taw Development Committee (NPTDC)

Nay Pyi Taw Development Committee is the administrative body of Nay Pyi Taw, the administrative capital of Myanmar. NPTDC is separate from Nay Pyi Taw Council. The NPTDC was established by the National Peace and Development Council issued on December 29, 2009. This Law gave NPTDC a ministerial status as well as a wide range of duties and responsibilities, including urban planning, urban sanitation and environment in Nay Pyi Taw. It is the principal agency responsible for planning, development, infrastructure provision and operation of municipal services in Nay Pyi Taw. Consisting of 5 to 9 members, it is led by a Chairman who acts as the Mayor, and a Vice-Chairman who acts as the Vice-Mayor.

The Nay Pyi Taw Development Committee is organized with (21) Departments, as followings:

- (1) Mayor Office
- (2) Administration Department
- (3) Budget and Accounts Department
- (4) Inspection Department
- (5) Co-ordination Department
- (6) Assessor Department
- (7) Revenue Department
- (8) Markets Department
- (9) Veterinary and Slaughter House Department
- (10) Pollution Control and Cleansing Department
- (11) Engineering Department (Roads and Bridges)
- (12) Engineering Department (Buildings)
- (13) Engineering Department (Water and Sanitation)
- (14) Motor Transport and Workshop Department
- (15) Central Stores Department
- (16) Playgrounds, Parks and Gardens Department
- (17) Department of Health
- (18) Security and Disciplinary Department
- (19) City Planning and Land Administration Department
- (20) Public Relations and Information Department
- (21) Production Department

In addition, there are three organizations under control and management of NPTDC, which are Zabuthiri Specialist Hospital, Cement Factory (Nay Pyi Taw) and Brick Factory (Nay Pyi Taw).

Under NPTDC, Pollution Control and Cleansing Department undertakes the responsibilities for environmental quality management within Nay Pyi Taw area including waste management according to the Nay Pyi Taw Development Law (2009). By-law regarding the environment conserving and cleansing work within the border in the Nay Pyi Taw Development Area, the rules and regulations for management control are promulgated on 21 March of 2016 with notification 44/2016.

3.3 Policy, Legal and Regulatory Framework for Solid Waste Management

Appropriate legislation and associated regulatory requirements need to be set by Ministry of Natural Resources and Environmental Conservation (MONREC) with the cooperation of relevant line ministries, regional development committees, and city and township development committees to guide the execution of the National Waste Management Strategy and Master Plan. Key priorities are listed as follows:

- (i) Setting necessary standards and tools for the management of isolated waste streams, such as municipal solid waste, industrial waste, other special waste (hazardous, medical, e-waste, mining and wastewater etc.)
- (ii) Establishing the legal basis for directing mandatory extended producer responsibility practices,
- (iii) Defining the basic parameters and infrastructural guidelines for implementing a waste management system, including separation classifications, intermediate treatment options, and final disposal,
- (iv) Issuing requirements for licensing and conditions for legal liability associated with addressing environmental concerns such as air and water issues associated with waste management facilities, landfill construction and incinerator operations,
- (v) Developing a supportive legal and regulatory framework that, among others, stipulates the amount and collection frequency of waste charges; delegates powers to concerned authorities with regard to supervising the implementation of regular waste audits; mandates the collection and submission of relevant information and data on a timely basis; and outlines specific waste management performance targets for government bodies and agencies,

- (vi) Instituting a compliance and enforcement program will be critical to the successful execution of the strategy and master plan.

Thus, there is required an independent and robust team of inspectorates or environmental regulators in both Nay Pyi Taw and its regional offices tasked with ensuring that the public behaves in accordance with the legislation and regulations. Nay Pyi Taw Development Committee adopted Laws that relate to waste management in Pollution Control, and Cleaning Department like: The Nay Pyi Taw Development Law(2009), NDC Pollution Control and Cleaning Department By- Laws.

By- law regarding the environment conserving and cleaning work within the border in Nay Pyi Taw Development Area, the rule and regulation for management control are promulgated on 21 March of 2016 with notification 44/2016.

3.4 Duties and Responsibilities of Pollution Control and Cleansing Department

The Pollution Control and Cleansing Department (PCCD) is responsible for keeping the city clean and tidy. The duties and responsible of that Department are as follows:

- (1) Sweep, collect and transport the waste from roads and streets in the townships that have to pay tax accuracy of waste within the boundary area of the Nay Pyi Taw Union Territory.
- (2) Plan and manage suitable waste collection systems for disposing waste in taxed townships and wards.
- (3) Designate disposal places, construct brick tanks and keep waste bins in order to carry out the designated collection systems regularly.
- (4) Guide to clean the waste in non-tax accuracy of government buildings, compounds and campus, and to discard the waste in designated places.
- (5) Manage to dispose the collected waste at final disposal sites.
- (6) Open the advanced public toilets with charges.
- (7) Designate and manage cemeteries for burial and cremation systematically.
- (8) Supervised and monitor necessary preventive ways for water pollution, air pollution, soil pollution and noise pollution, and directive for essential additional conducts and take action with current Laws and Regulations in order to prevent environmental pollution.

- (9) Submit to buy necessary equipment, garbage trucks and international standard dust bins, to maintain, use and record them systematically. Take action for irresponsible dumping according to Laws, By-laws and directive.
- (10) Give public information, campaign, awareness to discard waste systematically and to obey the system of discarding the waste separately such as dry waste and wet waste.
- (11) Supervise the enterprises which can make department's income.

3.5 Waste Disposal Management System

Public focus is an essential device for growing public participation in strong waste control programs. It is the important thing to a hit waste control and taken into consideration a important thing in any waste control software aside from suitable legislation, robust technical support, and ok funding. Having a right waste control can bring about the provision of treasured substances to reuse. This can store cash even as doubtlessly growing new jobs and commercial enterprise opportunities. Reducing, reusing and recycling waste are vital for the environment; however it is able to additionally be profitable.

In general, the contemporary waste series device consists of number one and secondary series. The number one waste series system (door-to-door series) is unique labor-in depth pastime utilizing bell ringing approach even as secondary series system is the gathering of waste from secondary waste series stations completed specially with tipper vehicles (dumpers), rubbish vehicles and arm-roll vehicles. There are bell ringing structures carried out via way of means of rubbish trucks in all wards and townships of Nay Pyi Taw Union Territory. PCCD branch collects the kitchen wastes each day with the aid of using bell ringing system. The families discard the kitchen wastes from their houses to the rubbish truck whilst it arrives. The coping with employees load the wastes onto the vehicle. When the truck is full, it takes to the air to the dumping site.

The wastes of families with inside the civil servants' quarters are accrued in each night workplace day and with inside the morning of holidays. These are accumulated each morning within side the other. Road sweepers are used for cleaning of fundamental roads in Nay Pyi Taw Union Territory. Hotels, supermarkets, restaurants, companies, cinemas, nongovernment businesses and places of work pay the renting expenses the vehicles constant through on name gadget at PCCD after they

want to gather the rubbish separately. NPTDC is sporting out to dispose the waste setting apart as dry waste and moist waste from Sibin Housings and Kantkaw Housings, the civil servants' housing compounds, in Nay Pyi Taw Union Territory. Wet waste manner kitchen wastes (meals waste, veggies and meat) are accumulated each day. Wet waste means kitchen wastes (food waste, vegetables and meat) are collected every day. Dry waste such glass, bottles, iron/metal boxes, variety of plastic and paper wastes are collected every Sunday, Wednesday and Friday.

Although NPTDC behavior Solid Waste Management series vehicles, citizens of body of workers housings and wards discard the rubbish on the locations of the streets for now no longer having a threat to preserve ready the gathering cars coming to acquire wastes. The resident residents are accountable to tell the department, so that during segment can be made with the aid of using accountable officials from PCCD, gathering the unlawful wastes day by day from in which the ones are disposed.

Easily-decayed wastes from markets, veggies portions are collected, one by one and generated to reuse swapping into herbal fertilizers through evidently breed system (earthworm). Market wastes are every day disposed withinside the Arm roll bins and accumulated as secondary waste series system. In Nay Pyi Taw Union Territory included Zabuthiri Township, Pobbathiri Township, Ottarathiri Township, Dekkhinathiri Township, Zeyarthiri Township, Pyinmana Township, Lewe Township and Tatkhon Township, wastes from hospitals and clinics are transported by paying fees for collection. There are (11) Public Hospitals, (12) Private Hospitals, (45) Clinics and (12) Laboratories which have been waste-collected by On Call System in Naypyitaw Union Territory. In (11) Public Hospitals, a general hospital (1000 bedded), a general hospital (200 bedded), two general hospitals (100 bedded) and others (6) hospitals include.

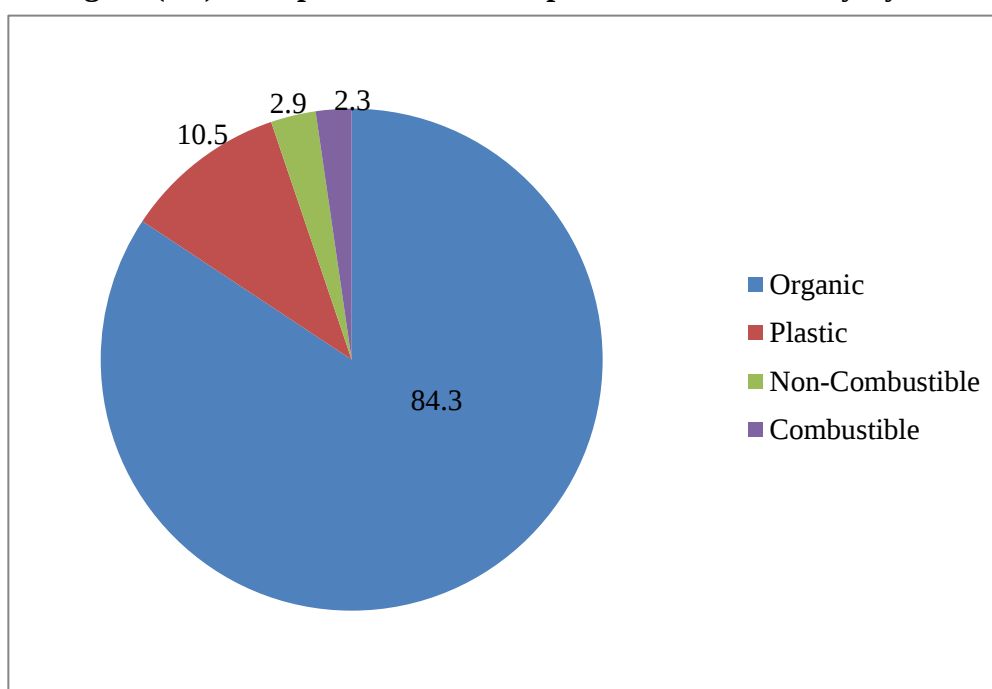
PCCD collects scientific waste from each hospital, clinic, laboratory and scientific store on everyday foundation by unique waste cars for scientific waste whilst kitchen waste from the ones are accrued day by day through everyday rubbish trucks. Sharp wastes from hospitals consisting of needles, bottles, and syringes are incinerated at very last disposal web website online in Pobbathiri Township. Remaining of these wastes like ashes is dumped in concrete waste series tanks. The popular wastes are buried (via landfill method) in very last disposal site, whilst unsafe wastes including bandages and laboratory wastes are burned in Gwaytgyi cemetery.

3.6 Situation on Solid Waste Management

In Nay Pyi Taw Union Territory included Zabuthiri Township, Pobbathiri Township, Ottarathiri Township, Dekkhinathiri Township, Zeyarthiri Township, Pyinmana Township, Lewe Township and Tatkhon Township, wastes from hospitals and clinics are transported by paying fees for collection. PCCD collects medical waste from every hospital, clinic, laboratory and medical shop on a daily basis by two unique waste motors for scientific waste at the same time as kitchen waste from the ones are gathered each day through everyday rubbish trucks. The waste production in Nay Pyi Taw Union Territory is 282 tons per day. The 520 cleansing workers are servicing with 125 garbage trucks and annual incomes are 243,058,550 kyats. There are 247 part-time employees and 112 permanent employees for waste collection and disposal in Nay Pyi Taw. 32 trucks are used to collect waste, 2 of these are used for hazardous waste and hospital waste. The rate of household waste production is 2.585 kg.

Solid Waste of Nay Pyi Taw is produced from households, markets, commercial producers, hotels, gardens and other institutions. MSW also contains mainly organic materials (84.3%), plastic (10.5%), non-combustible (2.9%), and combustible (2.3%) each. See in figure (3.1).

Figure (3.1) Composition of Municipal Solid Waste in Nay Pyi Taw



Source: NPTDC, (2021)

Pobbathiri Final Disposal Site-1: Pobbathiri Final Disposal Site-1 is located in Pobbathiri Township within Phoe Zaung Hill Forest reserve, beside the No.(2) Nay Pyi Taw - Takkone Road, and the area is about (100) Acres. Pobbathiri Final Disposal Site has enough coverage for refuses generated from Zabbuthiri Township, Pobbathiri Township, Oattarathiri Township, Dekkhinathiri Township, Zeyarthiri Township, Pyinmana Township and (22) markets in Naypyitaw Union Territory about (220)tons daily.

Sankalay Final Disposal Site-2: Sankalay Final Disposal Site-2 is located (7.4) mile west from Lewe Township, near Sankalay Cemetery and the area is about (2.96) acres. Sankalay Final Disposal Site has enough coverage for refuses generated from Dekkhinathiri Market, (6) markets within Lewe Township Area and solid waste collected by Lewe Township Development Committee about (37) tons daily.

Takkone Final Disposal Site-3: Takkone Final Disposal Site-3 is located (0.5) mile west from Takkone Township, beside Yangon-Mandalay Highway and the area is about (6.43) acres. Takkone Final Disposal Site has enough coverage for refuses generated from (3) markets within Takkone Township Area and solid waste collected by Takkone Township Development Committee about (25) tons daily.

3.7 Public Awareness and Participation Activities

Relating the Environmental Impact Assessment, PCCD has conducted environmental impact undertaking in Nay Pyi Taw areas, factory environmental effects, public complaints about environmental impact, awareness activities, cooperation with NGOs and CSOs; cooperation with the Department of Environmental Conservation, and local /international seminars, conferences, training.

Relating the awareness activities, the disposal of garbage separate, store and management by PCCD, save five minutes video file in LED. Boards at Myoma Market, Thapyaygone Market and near Pyinmana Mingalar Lake are being displayed for the public commencing since 17.8.2018 every day from 16:00 to 20:00.

PCCD made solid waste awareness campaign from 2018-2019 Fiscal Year regarding with the disposal waste system and types of the waste, to discuss systematic disposal of waste, to reduce the use of plastic, elimination of the waste in Thikechaung, disadvantage of waste, prohibition and action on the disciplined disposal of the waste. Total number of 333 people from Pyinmana Township

participated for 7 times and total people 524 numbers in Zabuthiri Township for 15 times.

During the 2018-2019 Fiscal Year, garbage collection activities conducted seven times in collaboration with NGOs and CSOs. Those activities collected in collaboration with NGOs and CSOs. Public participation activities collect the garbage in Yezin University area, along the main roads in Nay Pyi Taw, Shwe Kyar Pin Quarter, Old Yangon-Nay Pyi Taw Road, near the Uppatasanti Pagoda, corner of Shwe Nantthar Quarter and Shwe Pyi Taw Street.

CHAPTER 4

SURVEY ANALYSIS

This chapter presents an analysis and discussion of the study. There are three sections in this chapter. They are survey profile, survey design, and survey analysis.

4.1 Survey Profile

Zabuthiri Township is located in south of Mandalay Region. The official name of the city was announced on 27th March 2006. It is 9.5 miles long from east to west and 4.4 miles long from south to north. According to Nay Pyi Taw Council report (2019), 8851 houses, 26332 households, 12 wards are in urban area. 1339 houses, 1338 households, 2 village groups and 4 villages are in rural area. Totally, there are 10190 houses, 27670 households, 12 wards, 2 village groups and 4 villages in it. The majority of the people in the Township live in urban areas with (94.7%). The population density is 1,659 persons per square kilometer. There are 3.5 persons living in each household in it.

Pyinmana Township is composed of 5 wards, 30 village tracts and 144 villages in 2008. It is reorganized into 7 wards, 29 village tracts and 140 villages in 2013 and up to now. There are 73983 urban populations and 106212 rural populations in Pyinmana Township. The total population is 180195 numbers with total household of 38276 living in 36650 houses. Urban population comprises 41.06% and rural population 58.94%. Most of People are lived in rural area. In Pyinmana Township, there are more females than males with 94 males per 100 females. The majority of the people in the Township live in rural areas with only (38.4%) living in urban areas. The population density of Pyinmana Township is 170 persons per square kilometre. There are 4.5 persons living in each household in Pyinmana Township.

4.2 Survey Design

A survey was carried out mainly in two Townships (Zabuthiri Township and Pyinmana Township) in Nay Pyi Taw. The survey size is 200 respondents who used the services of Pollution Control and Cleaning Department under Nay Pyi Taw Development Committee (NPTDC). The survey period is October, 2022. This study mainly used a descriptive method using structured questionnaires. The survey questionnaire had multiple choice questions, yes or no and also used five point 'Likert Scale' (1 = strongly disagree, 2 = disagree, 3 = neutral, 4 = agree, and 5 = strongly agree) for awareness and participation of waste management. Collected data were organized, analyzed and interpreted in the light of objective of the study by applying descriptive methods.

This questionnaire consists of three parts. The first part is personal information and the second part is awareness and attitude on municipal solid waste management. Finally, the third part is participation on municipal solid waste management. Moreover, 10 officials from NPTDC are asked by interview method to examine the challenges facing the Nay Pyi Taw Development Committee in municipal solid wastes management.

4.3 Survey Results

Survey results are presented by personal information, awareness on municipal solid waste management, participation on municipal solid waste management and challenges of the municipal solid wastes faced by NPTDC.

4.3.1 Personal Information

Personal information is shown with gender, age group, education, marital status, occupation, township, average monthly income, family members and types of resident. Table (4.1) shows personal information of the respondents.

Table (4.1) Personal Information of the Respondents

Particular	Number	Percentage
Gender		
Male	67	33.5
Female	133	66.5
Total	200	100.0
Age (Years)		
Under 30	83	41.5
Between 30 and 40	49	24.5
Between 41 and 50	47	23.5
Above 50	21	10.5
Total	200	100.0
Education		
Illiterate	57	28.5
College	35	17.5
Graduate	88	44.0
Post-graduate	20	10.0
Total	200	100.0
Malarial Status		
Married	73	36.5
Single	101	50.5
Widowed/ divorced	26	13.0
Total	200	100.0
Occupation		
Student	16	8.0
Government Employees	125	62.5
Private Employees	30	15.0
Dependent	29	14.5
Total	200	100.0

Table (4.1) Personal Information of the Respondents (Continued)

Particular	Number	Percentage
Township		
Zabuthiri Township	104	52.0
Pyinmana Township	96	48.0
Total	200	100.0
Average monthly income		
Less than and 200000 MMK	72	36.0
Between 200001 MMK and 500000 MMK	102	51.0
Between 500001 MMK and 800000 MMK	14	7.0
Between 800001 MMK and 1000000 MMK	3	1.5
Above 1000000 MMK	9	4.5
Total	200	100.0
Family members		
None	26	13.0
Less than and 2	61	30.5
Between 3 and 5	94	47.0
Over 5	19	9.5
Total	200	100.0
Types of Resident		
Wood	20	10.0
Brick	28	14.0
Apartment	152	76.0
Total	200	100.0

Source: Survey Data, (2022)

Table (4.1) summarizes the profile of the respondents in Zabuthiri and Pyinmana Townships selected for this study. The survey respondents were categorized into two groups for gender: male and female. 67(33.5%) of respondents are male and 133(66.5%) of respondents are female. The respondents were categorized into four age groups: under 30, between 30-40 years old, between 41 to 50 years old and 50 years old and older. The largest number of respondents from both

townships came under 30 years old. The second largest number of age group is between 30 to 40 years old.

As for educational attainment, the largest group in the study areas was composed of university graduates, while the second largest group was Illiterate level. Only a few people completed Post-graduate. In marital status, most of respondents in Zabuthiri and Pyinmana Townships are single and the rest of respondents are married. In terms of occupation, 125 of the respondents were government employees, after that Private Employees, Dependent, Students follow respectively. The largest group was government employees and the second largest group was private employees.

Most of respondents live in Zabuthiri Township and rest of them live in Pyinmana Township. In terms of average monthly income, the largest group earned between 200001 MMKs and 500000 MMKs. The second largest group earned less than 200000 MMKs. The third largest group earned between 500001 MMKs and 800000 MMKs. The average household size was four people with two income-earning adults. The largest group which has between 3 and 5 family members represents 47%. The second largest group which has less than 2 family members represents 30.5%. Most of the respondents live in apartment, which is about 76% and followed by wooden house 10 % and brick house 14% respectively.

4.3.2 Questionnaire Design

A questionnaire supports collecting quantitative primary data systematically, so that collected data is internally coherent and consistent for analysis. Questionnaires should also be developed to relate to the objectives of the research and formulated with a clear purpose of how the findings will be used (Roopa & Rani, 2012). According to Best (1977), the mean values of five-point Likert scale items are interpreted as follows:

The score among 1.00 – 1.80 means strongly disagree.

The score among 1.81 – 2.60 means disagree.

The score among 2.61 – 3.40 means neutral.

The score among 3.41 – 4.20 means agree.

The score among 4.21 – 5.00 means strongly agree.

Standard deviation (S.D.) is a measure that is used to quantify the amount of variation or dispersion of a set of data values. A low standard deviation indicates that

the data points tend to be close to the mean of the set, while a high standard deviation indicates that the data points are spread out over a wide range of values (Bland & Altman, 1996). The standard deviation is commonly used to measure confidence in statistical conclusions.

4.3.3 Awareness on Municipal Solid Waste Management

Awareness and attitude on municipal solid waste management are stated by main information sources, awareness on wet waste, awareness on dry waste, and current awareness and attitude of waste management.

A. Main Information Sources

Main information sources are classified into five groups such as local newspaper, TV, radio, social media, peer to peer and other group. These categories are shown in Table (4.2).

Table (4.2) Main Information Sources

Sr. No.	Types of Information Source	No. of respondents	Percentage
1	Local Newspaper	27	13.5
2	TV/ Radio	76	38.0
3	Social Media (eg: Facebook)	12	6.0
4	Peer to Peer	58	29.0
5	Others	27	13.5
	Total	200	100.0

Source: Survey Data, (2022)

According to the Table (4.2), it is found that majority of the respondents get the awareness for Municipal Solid Waste Management from TV/ Radio, representing 38.0%. The second majority of the respondents receive from peer to peer, representing 29.0%. The least group get the information from Social Media, representing 6% because most of people do not interest to look for the awareness of Municipal Solid Waste Management. It can be concluded that nearly half of the respondents receive information for awareness concerning with municipal solid waste management from TV/ Radio.

B. Awareness on Wet Waste (Organic Waste)

Awareness on wet waste (organic waste) is classified into seven groups such as newspaper, vegetable, biscuits, water bottle, flower, food waste and tin. These categories are shown in Table (4.3).

Table (4.3) Awareness on Wet Waste

Sr. No.	Types of Wet Waste	No. of respondents	Percentage
1	Newspaper	11	5.5
2	Vegetable	119	59.5
3	Biscuits	14	7.0
4	Water bottle	14	7.0
5	Flower	4	2.0
6	Food waste	33	16.5
7	Tin	5	2.5
	Total	200	100.0

Source: Survey Data, (2022)

Regarding wet waste segregation test, 119 respondents (59.5 % of total respondents) choose vegetable, 33 respondents (16.5 % of total respondents) indicate Food waste, 14 respondents (7.0 % of total respondents) indicate biscuits and water bottle, 11 respondents (5.5 % of total respondents) choose Newspaper, 5 respondents (2.5 % of total respondents) choose tin, 4 respondents (2.0 % of total respondents) select flower. The results show that over the half of all respondents answered that vegetable are wet waste.

C. Awareness on Dry Waste

Awareness on dry waste are classified into seven groups such as newspaper, vegetable, biscuits, water bottle, flowers, food waste and tin. These categories are shown in Table (4.4).

Table (4.4) Awareness for Dry Waste

Sr. No.	Types of Dry Waste	No. of respondents	Percentage
1	Newspaper	65	32.5
2	Vegetable	14	7.0
3	Biscuits	10	5.0
4	Water bottle	41	20.5
5	Flower	2	1.0
6	Food waste	30	15.0
7	Tin	38	19.0
	Total	200	100.0

Source: Survey Data, (2022)

Out of total participants, 65 respondents (32.5 % of total respondents) choose Newspaper, 41 respondents (20.5 % of total respondents) select water bottle, 38 respondents (19.0 % of total respondents) indicate tin, 30 respondents (15.5 % of total respondents) choose food waste, 14 respondents (7.0 % of total respondents) indicate vegetable, 10 respondents (5.0 % of total respondents) choose biscuits. 2 respondents (1.0 % of total respondents) indicate Flower. It is found that most of respondents answered that newspaper are dry waste.

D. Current Awareness of Waste Management

Current awareness of waste management is one of important issues for all respondents in Zabuthiri and Pyinmana Township. To assess the awareness and attitude of the Nay Pyi Taw Citizens in municipal solid waste management, nine structural questions are constructed and data collected from 200 respondents.

Table (4.5) Current Awareness of Waste Management

Sr. No.	Statement	Mean	Standard Deviation
1	Municipal solid waste is stored systematically.	4.46	.519
2	Municipal solid waste is disposed separately.	4.29	.536
3	Municipal solid waste is disposed daily.	4.26	.560
4	Solid wastes that can be recyclable are resold.	3.45	.512
5	Usage of food by the plastic bags is not good for health.	4.21	.517
6	Poor health can be caused by municipal solid waste.	3.75	.586
7	Foul odor is caused by municipal solid waste.	3.70	.591
8	Waste is stored in a separate and systematic way.	4.00	.553
9	Poor waste management is related big problem environment.	4.17	.532
	Overall mean	4.03	0.545

Source: Survey Data (2022)

The awareness for municipal solid waste management in Zabuthiri and Pyinmana Township is described in Table (4.5). According to the results, the largest mean score is 4.46, that statement is "Municipal solid waste is stored systematically." It means that most of the respondents know to store the waste systematically. The second largest mean score is 4.29, that statement is "Municipal solid waste is disposed separately." This shows that most of the respondents know they have to dispose the municipal solid waste separately.

The lowest mean value of 3.45, that statement is "Solid wastes that can be recyclable should be resold". This result shows that most of the respondents have less awareness in recyclable materials. The overall mean score is 4.03, which means that respondents are agree level on awareness for municipal solid waste management. Moreover, they want to make participation to the awareness campaigns and programs concerning with municipal solid waste management.

4.3.4 Participation on Municipal Solid Waste Management

Participation on municipal solid waste management are presented by frequency of municipal solid waste disposal, conditions on waste disposal, ways to dispose solid waste, sizes of waste bag and current practice of waste management.

A. Frequency of Municipal Solid Waste Dispose

Frequency of Municipal solid waste dispose is classified into three groups. They are shown in Table (4.6).

Table (4.6) Frequency of Municipal Solid Waste Disposal

Sr. No.	Disposal Frequency (Per Week)	No. of Respondents	Percentage
1	1 to 2 times	117	58.5
2	3 to 4 times	66	33.0
3	5 to 6 times	17	8.5
	Total	200	100.0

Source: Survey Data, (2022)

According to Table (4.5), 117 respondents (57.8% of all respondents) dispose solid waste 1 to 2 times per week representing 66 respondents (33.0% of all respondents) dispose solid waste 3 to 4 times per week and 17 respondents (8.5% of all respondents) disposal solid waste 5 to 6 times per week. The results show that most of people in Zabuthiri and Pyinmana Township dispose the solid waste 1 to 2 times per week.

B. Waste Separation in Disposing

Waste separation in disposing is shown in Table (4.7).

Table (4.7) Waste Separation in Disposing

Sr. No.	Waste Separation in Disposing	No. of Respondents	Percentage
1	Yes	135	67.5
2	No	65	32.5
	Total	200	100.0

Source: Survey Data, (2022)

As shown in Table (4.7), it is evident that 135 respondents (67.5 % of all respondents) answered that they separately dispose municipal solid waste and 65 respondents (32.5 % of all respondents) answered that they do not separately dispose municipal solid waste. There can be assumed that most of respondents have awareness to separate municipal solid waste in this study.

C. Ways to Dispose Solid Waste

Ways to dispose solid waste are stated into four groups. These categories are shown in Table (4.8).

Table (4.8) Ways to Dispose Solid Waste

Sr. No.	Items	No. of Respondents	Percentage
1	Throw on an open space or somewhere	12	6.0
2	Throw into nearly stream of drain	25	12.5
3	Using Municipal service	95	47.5
4	Dispose to final disposal site by own schedule	68	34.0
	Total	200	100.0

Source: Survey Data, (2022)

According to Table (4.8), it is found that 95 respondents (47.5 % of all respondents) answered that they dispose solid waste using municipal service and it is a largest group. Then, 68 respondents (34.0 % of all respondents) answered that they dispose to final disposal site by their own schedule, 25 respondents (12.5.0 % of all respondents) answered that they throw into nearly stream of drain, and 12 respondents (6.0 % of all respondents) living in Zabuthiri and Pyinmana Township answered that they throw on an open space or somewhere. It can be assumed that nearly half of respondents dispose solid waste by municipal service.

D. Sizes of Waste Bag

Sizes of waste bag are classified into three groups like small, medium and big. These categories are shown in Table (4.9).

Table (4.9) Sizes of Waste Bag

Sr. No.	Sizes of Waste Bag	No. of Respondents	Percentage
1	Small	48	24.0
2	Medium	109	54.5
3	Big	43	21.5
	Total	200	100.0

Source: Survey Data, (2022)

Among all the respondents, 48 (24.0%) respondents discharge small size of waste bag to garbage truck, 109 (54.5%) respondents discharge medium size and 43 (21.5%) respondents discharge big size of waste bag to garbage truck. The data reveal that most of the respondents living in Zabuthiri and Pyinmana Township discharge medium size of waste bag to garbage truck in this study.

E. Current Practice of Waste Management

Current practice of waste management is measured with nine statements. The mean values of each statement are described in the Table (4.10).

Table (4.10) Participation on Municipal Solid Waste Management

Sr. No.	Statement	Mean	Standard Deviation
1	People try to reduce waste by using recyclable materials.	4.12	.793
2	Reusing the recycle products is encouraged.	4.28	.569
3	Public involve the campaigns regarding with municipal solid waste.	4.22	.584
4	People regularly pay waste collection fee.	4.16	.571
5	Disposing waste into a trash can in public compound are made systematically more than usual.	4.18	.630
6	Packaging the waste to be small size can be easily in disposing.	4.06	.643
7	People follow the disciplines for waste management.	3.91	.597
8	Open dumping system is harmful to our health and environment.	4.01	.622
9	Waste is stored in a separate and systematic way.	4.08	.638
	Overall mean	4.11	0.627

Source: Survey Data (2022)

As shown in Table (4.10), it is found that the statement of “Reusing the recycle products is encouraged.” is the highest mean value is 4.28. It means that respondents have strongly agreed level on reusing recycle products. The statement of

“Public involve the campaigns regarding with municipal solid waste.” is the second highest mean value 4.22. It shows that respondents have a strongly agree of participation on campaigns with municipal solid waste.

The statements “People follow the disciplines for waste management.” have the lowest mean score of 3.91. This implies that most respondents follow the disciplines and participate in solid waste management. The overall mean value is 4.11, which mean that respondents are agree on the participation of municipal solid waste management. As a consequence, they are willing to participate in municipal solid waste management.

4.3.5 Challenges of the Municipal Solid Wastes Faced by NPTDC

To examine the challenges facing the Nay Pyi Taw Development Committee in municipal solid wastes management, seven opened questions are constructed and data collected from 10 officials from NPTDC. There are many challenges in NPTDC.

A. Advanced Technology

NPTDC is required advanced technology in municipal waste management because advanced technology can be used in a variety of sectors to manage municipal waste in more efficient and effective ways. Some examples of sectors where advanced technology can be applied for municipal waste management include:

Waste collection: Advanced technology can be used to optimize routes and schedules for waste collection, reducing fuel consumption and improving efficiency. This can be done through the use of GPS tracking systems, real-time data analysis, and machine learning algorithms.

Sorting and separation: Advanced technology can be used to sort and separate waste into different categories, such as recyclable materials, organic waste, and hazardous waste. This can be done through the use of automated sorting systems, sensors, and artificial intelligence.

Recycling: Advanced technology can be used to process and recycle materials in a more efficient and cost-effective way. For example, advanced recycling technologies such as pyrolysis, gasification, and chemical recycling can convert waste into valuable products, such as fuel and chemicals.

Energy recovery: Advanced technology can be used to convert waste into energy, such as electricity or heat. This can be done through the use of technologies such as waste-to-energy incineration, anaerobic digestion, and gasification.

Monitoring and reporting: Advanced technology can be used to monitor and report on waste management practices, such as waste generation rates, collection and disposal practices, and recycling rates. This can be done through the use of sensors, data analytics, and visualization tools. There are many sectors where advanced technology can be used to improve municipal waste management practices and reduce the environmental impact of waste.

B. Skillful Staffs and Workers

The respondents answered that NPTDC requires skillful staffs and workers in serving municipal solid waste management. Effective waste management requires a team of trained and experienced personnel who can efficiently manage and dispose of waste in a safe and environmentally responsible manner. Some of the key roles that skilled staff and workers that need to play in waste management include:

Collection: Skilled workers are needed to collect waste from residential, commercial, and industrial areas. These workers must be knowledgeable about different types of waste, recycling techniques, and the use of appropriate equipment and tools.

Sorting and Segregation: In many waste management systems, waste is sorted and segregated before it is disposed of. Skilled workers are required to sort and segregate waste based on its type, recyclability, and hazardous properties.

Transportation: Skilled drivers and operators are required to transport waste from collection points to disposal facilities. These workers must be familiar with safety regulations, traffic rules, and the use of specialized vehicles.

Treatment and Disposal: Skilled workers are needed to treat and dispose of waste in an environmentally sound manner. This includes the operation of treatment facilities such as incinerators, landfills, and recycling plants.

Monitoring and Compliance: Skilled staff are required to monitor waste management processes and ensure compliance with local, state, and federal regulations. These workers must be familiar with environmental laws, safety standards, and reporting requirements. The success of waste management programs depends on the availability of skilled staff and workers who can perform these critical tasks efficiently and effectively.

C. Laws and Regulations

They answered that people are poor in following Laws and regulations of NPTDC concerning with Municipal solid waste. Especially, there are poor in policy at both national and local levels. Besides, they are weak enforcement of existing laws and regulations, weak of policy to promote 3R. They are poor in planning, know-how and capacity at national and local levels, coordination within and among different administrative layers.

D. Budget Requirement

NPTDC have budget requirement to manage municipal solid waste. Managing municipal solid waste (MSW) requires a significant budget, as it involves several processes such as collection, transportation, treatment, and disposal of waste. The exact budget required to manage MSW can vary depending on several factors such as the size of the townships, the population density, the amount of waste generated, and the chosen method of waste management. In general, the budget required for managing municipal solid waste includes the following costs:

Collection and Transportation: This involves the cost of hiring personnel, purchasing and maintaining vehicles, and fuel costs.

Treatment and Disposal: This involves the cost of building and maintaining treatment facilities such as landfills, incinerators, or composting facilities.

Recycling and Composting: This involves the cost of setting up and maintaining recycling and composting programs.

Public Education and Awareness: This involves the cost of developing and implementing public education and awareness programs to encourage waste reduction and proper waste disposal practices.

Regulatory Compliance: This involves the cost of complying with local, state, and federal regulations related to waste management.

E. Separation and Disposal System

The staffs from NPTDC answered that waste separation and disposal system is well-functioned by NPTDC. Waste segregation is the process of separating different types of waste materials according to their properties and characteristics, such as their composition, size, and potential to cause harm to the environment or human health. Proper waste segregation is important because it helps to minimize the amount of

waste that ends up in landfills or incinerators, and it makes it easier to recycle or reuse materials. A good waste segregation system typically involves the use of color-coded bins or bags to separate different types of waste, such as organic waste, recyclable materials (such as paper, plastic, and metal), and hazardous waste (such as batteries, electronic waste, and chemicals).

The segregation system can be implemented in households, workplaces, schools, and public spaces. Once waste is segregated, it can be properly disposed of according to its type. Organic waste can be composted, recycled materials can be collected and sent to recycling facilities, and hazardous waste should be handled and disposed of by specialized companies that follow strict safety protocols. It is important to note that waste segregation and disposal systems vary depending on local regulations, infrastructure, and resources. Governments, communities, and individuals all play a role in implementing and maintaining effective waste management practices.

F. Plans for Sustainable Waste Management System

NPTDC have some difficulties concerning with plans for sustainable waste management system to get better condition. Some of them are

Reduce waste generation: The first step towards sustainable waste management is to reduce the amount of waste generated in the first place. This can be achieved by implementing practices such as composting, recycling, and reusing.

Implement source separation: The segregation of waste at the source can make it easier to manage and recycle. This can be done by providing separate bins for different types of waste such as organic, paper, plastic, and metal.

Encourage recycling: Recycling is one of the most effective ways to manage waste sustainably. Municipalities can establish recycling centers, and offer incentives to individuals and businesses that recycle.

Invest in waste-to-energy technologies: Waste-to-energy technologies can be used to generate electricity from waste materials. This can reduce the amount of waste sent to landfills and provide a source of renewable energy.

Implement a circular economy: A circular economy is an economic system where waste is minimized, and resources are kept in use for as long as possible. This can be achieved by implementing practices such as product design for reuse and recycling, and encouraging closed-loop supply chains.

Educate the public: Public awareness campaigns can be used to educate individuals and businesses on the importance of sustainable waste management. This can help to change attitudes and behavior towards waste disposal and reduce the amount of waste generated.

G. Creating Awareness Programs

There are some challenges in creating awareness programs about municipal solid waste for public in Nay Pyi Taw. But, there are many awareness programs about Municipal solid waste (MSW) for the public, some of which include:

"Reduce, Reuse, and Recycle": This is a common slogan used to encourage individuals to reduce the amount of waste they produce, reuse items when possible, and recycle materials that can be recycled.

"Clean up your community": This program encourages individuals and groups to participate in litter clean-up campaigns in their communities.

"Waste segregation at source": This program promotes the practice of separating waste into different categories such as organic, recyclable, and hazardous waste, at the point of origin.

"E-waste management": This program educates individuals on the proper disposal of electronic waste and the importance of recycling electronic devices.

"Awareness campaigns": Many municipalities conduct awareness campaigns through various mediums such as billboards, flyers, and social media to educate the public about MSW management practices.

These are awareness programs that exist to educate the public about MSW management by NPTDC.

CHAPTER 5

CONCLUSION

5.1 Findings

The first objective of this study is to assess the awareness and participation of the Nay Pyi Taw Citizens in municipal solid waste management. The second objective is to examine the challenges facing the Nay Pyi Taw Development Committee in municipal solid wastes management. Municipal solid waste management in Zabbuthiri and Pyinmana Townships are analyzed 200 respondents. The target respondents are people living in Zabbuthiri and Pyinmana Townships. In order to carry out the objectives, both secondary and primary data were used in this study. This study limits to examine the challenges facing the Nay Pyi Taw Development Committee in municipal solid wastes management.

It is found that 66.5% of respondents are female. Mostly, the age group less than 30years old answered for this study. Over a half of all respondents are single. Most of respondents are graduated. The largest group is Government Employees. They mostly live in Zabuthiri Township. The respondents mostly earn between 200,001 Kyats and 500,000 as average monthly income. The majority of the respondents have between 3 and 5 family members. Most of the respondents live in apartment.

This study revealed that nearly half of the respondents receive information for awareness concerning with municipal solid waste management from TV/ Radio. Over the half of all respondents answered that vegetable are wet waste. Most of respondents answered that newspaper are dry waste. The statement that "Municipal solid waste is stored systematically." is the largest mean score. The statement that "Solid wastes that can be recyclable are resold" is the lowest mean value. The overall mean score is 4.03 in current awareness of waste management. This mean that most of respondents are agree on the awareness for municipal solid waste management. Moreover, they want to get knowledge from the awareness campaigns and programs concerning with municipal solid waste management.

Most of people in Zabuthiri and Pyinmana Township dispose the solid waste 1 to 2 times per week. Most of respondents have awareness to separate municipal solid waste in this study. It is found that most of people are awareness in solid waste management but they do not practice in real. Most of the respondents living in Zabuthiri and Pyinmana Township discharge medium size of waste bag to garbage truck in this study. The statement that "Reusing the recycle products is encouraged." is the largest mean score. The statement that "People follow the disciplines for waste management" is the lowest mean value. The overall mean value is 4.11, and respondents are agreed level on the participation of municipal solid waste management.

It is found that there are many challenges of the municipal solid wastes faced by NPTDC. It is required advanced technology and skillful staffs and workers in serving municipal solid waste management. People are poor in following Laws and regulations of NPTDC concerning with municipal solid waste. NPTDC have budget requirement to manage municipal solid waste. Managing municipal solid waste (MSW) requires a significant budget, as it involves several processes such as collection, transportation, treatment, and disposal of waste. Waste separation and disposal system is well-functioned by NPTDC. NPTDC have some difficulties concerning with plans for sustainable waste management system to get better condition. There are some challenges in creating awareness programs about municipal solid waste for public in Nay Pyi Taw.

5.2 Suggestions

Based on the findings from the previous sections, some relevant suggestions and recommendations are provided to encourage of the awareness and participation in municipal solid waste management.

According to the analysis of awareness on municipal solid waste management, most of the respondents receive information for awareness concerning with municipal solid waste management from TV/ Radio. Therefore, the information and knowledge of municipal solid waste management should give many ways such as Posting on Facebook, Twitter, Instagram, YouTube etc. Moreover, there should make consumer awareness campaigns and programs in Nay Pyi Taw. Reselling the recyclable solid wastes is the lowest mean value. Thus, NPTDC should give awareness to distinguish recycle materials among materials and should educate their importance. Current

awareness of waste management is agreed level with respondents. Hence, people should be created to know about municipal solid waste management than before.

Consequently the findings on the participation of municipal solid waste management, most of people in Zabuthiri and Pyinmana Township dispose the solid waste 1 to 2 times per week. Thus, garbage truck should collect daily in respective Townships. Although most of people are awareness in solid waste management, they do not practice in real. Therefore, NPTDC should make sure law and regulation regarding with municipal solid waste management and should enforce to follow them. Following the disciplines for waste management is the lowest mean value. Thus, NPTDC and respective people should encourage and persuade to the public, besides, should create more awareness programs for solid waste management. The participation of municipal solid waste management is agreed level with the respondents. So, billboard, vigny and movies should be placed in public areas to participate in creating clean and healthy surrounding.

Finally, NPTDC is required budget, advanced technology and skillful staffs and workers in serving municipal solid waste management. Therefore, NPTDC should practice Public-Private Partnership (PPP) system for municipal solid waste management to be better services for public.

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APPENDIX
MASTER OF PUBLIC ADMINISTRATION PROGRAMME
A STUDY ON MUNICIPAL SOLID WASTE MANAGEMENT
IN NAYPYITAW UNION TERRITORY

Survey Questionnaire Form

Thank you for taking part in this survey. All data and information collected from this survey will follow the highest standards of confidentiality. Your responses will contribute valuable information. Participation in the survey is entirely anonymous and the information you provide will remain strictly confidential and will not be shared with anyone. All information will be collected and number of respondents will be identified in the results of this questionnaire.

Section (A). Personal Information

Please tick (✓) one appropriate answer for each of the following questions. Each question should only have ONE answer.

1. Gender

- ☐ Male
- ☐ Female

2. Age (Years)

- ☐ Under 30
- ☐ Between 30 to 40
- ☐ Between 41 to 50
- ☐ Above 50

3. Educational status

- ☐ Illiterate
- ☐ College
- ☐ Graduation
- ☐ Post-graduate

4. Marital Status
 - ☐ Married
 - ☐ Single
 - ☐ Widowed/ divorced
5. Occupation
 - ☐ Student
 - ☐ Government Employees
 - ☐ Private Employees
 - ☐ Dependent
6. Township
 - ☐ Pobbathiri Township
 - ☐ Pyinmana Township
7. Average monthly income
 - ☐ Less than and 200000
 - ☐ Between 200001 and 500000
 - ☐ Between 500001 and 800000
 - ☐ Between 800001 and 1000000
 - ☐ Above 1000000
8. Family members
 - ☐ None
 - ☐ Less than and 2
 - ☐ Between 3 and 5
 - ☐ Over 5
9. Resident Type of Respondents
 - ☐ Wood
 - ☐ Brick
 - ☐ Apartment

Section (B) Awareness on Municipal Solid Waste Management

1. Please choice main information sources of acquiring waste related information

- ☐ Local Newspaper
- ☐ TV/ Radio
- ☐ Social Media (eg: Facebook)
- ☐ Peer to Peer
- ☐ Others

2. Please select the wet waste (organic waste)

- ☐ Newspaper
- ☐ Vegetable
- ☐ Biscuits
- ☐ Water bottle
- ☐ Flower
- ☐ Food waste
- ☐ Tin

3. Please select the dry waste (non-organic waste)

- ☐ Newspaper
- ☐ Vegetable
- ☐ Biscuits
- ☐ Water bottle
- ☐ Flower
- ☐ Food waste
- ☐ Tin

4. Please choose only one for each statement that you think the most appropriate one among the columns 1 to 5 by making a tick (✓).

1 = strongly disagree 2 = disagree 3 = neither agree nor disagree
4 = agree 5 = strongly agree

Current Awareness of Waste Management

Sr. No.	Statement	1	2	3	4	5
1	Municipal solid waste is stored systematically.					
2	Municipal solid waste is disposed separately.					
3	Municipal solid waste is disposed daily.					
4	Solid wastes that can be recyclable are resold.					
5	Usage of food by the plastic bags is not good for health.					
6	Poor health can be caused by municipal solid waste.					
7	Foul odor is caused by municipal solid waste.					
8	Waste is stored in a separate and systematic way.					
9	Poor waste management is related big problem environment.					

Section (C) Participation on Municipal Solid Waste Management

1. What times do you dispose Municipal solid waste per week?

- ☐ 1 to 2 times
☐ 3 to 4 times
☐ 5 to 6 times

2. Do you dispose waste separately?

- ☐ Yes
☐ No

3. How do you usually dispose your solid waste?

- ☐ Throw on an open space or somewhere
☐ Throw into nearly stream of drain
☐ Using Municipal service
☐ Dispose to final disposal site by own schedule

4. How about the size of waste bag do you used to discharge?

☐ Small

☐ Medium

☐ Big

5. Please choose only one for each statement that you think the most appropriate one among the columns 1 to 5 by making a tick (✓).

1 = strongly disagree

2 = disagree

3 = neither agree nor disagree

4 = agree

5 = strongly agree

Current Practice of Waste Management

Sr. No.	Statement	1	2	3	4	5
1	People try to reduce waste by using recyclable materials.					
2	Reusing the recycle products is encouraged.					
3	Public involve the campaigns regarding with municipal solid waste.					
4	People regularly pay waste collection fee.					
5	Disposing waste into a trash can in public compound are made systematically more than usual.					
6	Packaging the waste to be small size can be easily in disposing.					
7	People follow the disciplines for waste management.					
8	Open dumping system is harmful to our health and environment.					
9	Waste is stored in a separate and systematic way.					

Challenges of the Municipal Solid Wastes Faced by NPTDC

1. Do you think that NPTDC needs advanced technology in Municipal waste management?

☐ Yes

☐ No

If yes, which sectors do advanced technology need to use for Municipal waste?

2. Does NPTDC require skillful staffs and workers in serving Municipal solid waste management?

☐ Yes

☐ No

If yes, why is it required skillful staffs and workers in waste management?

3. Do People follow Laws and regulations of NPTDC concerning with Municipal solid waste?

☐ Yes

☐ No

If no, which parts of Laws and regulations do weak points involve?

4. Does NPTDC have budget requirement to manage Municipal solid waste?

☐ Yes

☐ No

If yes, for what does it require?

5. Is the waste separation and disposal system well-functioned by NPTDC?

☐ Yes

☐ No

If no, why does NPTDC not implement waste segregation and disposal system?

6. Does NPTDC have any plan for sustainable waste management system to get better condition?

☐ Yes

☐ No

If yes, what are the plans for sustainable waste management system?

7. Are there any awareness program about Municipal solid waste for public in Nay Pyi Taw?

☐ Yes

☐ No

If yes, state the name of awareness program.

(Thanks for your answers)