

YANGON UNIVERSITY OF ECONOMICS
MASTER OF PUBLIC ADMINISTRATION PROGRAMME

A STUDY ON COMMUNITY'S PERCEPTION AND PRACTICE
ON THE PLASTIC POLLUTION IN MYANMAR
(CASE STUDY: KYEE MYIN DAING TOWNSHIP)

SI THU LIN
MPA-22 (18th Batch)

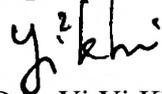
MAY, 2019

YANGON UNIVERSITY OF ECONOMICS
MASTER OF PUBLIC ADMINISTRATION PROGRAMME

A STUDY ON COMMUNITY'S PERCEPTION AND PRACTICE
ON THE PLASTIC POLLUTION IN MYANMAR
(CASE STUDY: KYEE MYIN DAING TOWNSHIP)

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

Supervised by:



Daw Yi Yi Khin

Associate Professor

Department of Applied Economics

Yangon University of Economics

Submitted by:



Si Thu Lin

Roll No. 22

MPA-18th Batch

2017 - 2019

May, 2019

ABSTRACT

Plastic is as one of the most common and convenient materials in modern society. The use of plastic is increasingly controversial, however, because of its negative impacts on the environment, biodiversity, and human health. The main purpose of the study is to examine the current status of public perception on plastic pollution and environmental conservation. It was a descriptive study based on primary data from Kyee Myin Daing Township. The survey was conducted on a total 265 respondents by using structured questionnaire. It was found that 97.4 percent of respondents concern about plastic pollution and 66.8 percent of respondent answer plastic can be treated by recycling it after using it. 54 percent of respondent answer the main reason for using plastics is easily available in the market, 81.1 percent of respondent know that the most responsible person to reduce plastic pollution is themselves. It was found that among 265 respondents, 49.4 percent are using between 4 to 6 plastic bags every day, and 87.9 percent of respondent will bring their own items instead of paying extra charge for using plastic bag, bottle, and cup, but 12.1 percent shall continue using it by paying an extra charge.

ACKNOWLEDGEMENTS

I would like to express my gratitude to Professor Dr. Tin Win (Rector of Yangon University of Economics), Professor Dr. Khin Naing Oo (Former Rector of the Yangon University of Economics), and Dr. Ni Lar Myint Htoo (Pro-Rector of the Yangon University of Economics) for allowing me to attend the post graduate course of MPA at Yangon University of Economics and giving me the opportunity to submit this thesis. Professor Dr. U Kyaw Min Htun (Retired Pro-Rector of the Yangon University of Economics) one of the great founders of MPA program was also unforgettable statues.

During academic year, all of the teachers are very enthusiastic in respective subjects, and they share their knowledge and experiences during my studies. Thus all teachers were greatly thankful people for the whole program. Among them, My special thanks are due to our Programme Director, and Head of Applied Economics Department Professor Dr. Phyu Phyu Ei was the most regardable person for her encouragement to finish my thesis in time.

Moreover, I would like to express my heartiest thanks to my supervisor, Daw Yi Yi Khin, Associate Professor, Department of Applied Economics, Yangon University of Economics, for her perspicacious guidance, consistent supervision, sharing valuable knowledge, and encouragement in preparing this paper.

I would like to thank all my friends and colleagues who helped me in conducting survey for this paper and the respondents from Kyee Myin Daing Township who participated in my study. Without their actively participation, this thesis could not be successfully completed.

Words are not enough to express my sincere thanks to those mentioned as well as to those who are not mentioned here but their contributions are highly appreciated.

Last, but not least, I would like to express my high gratitude to my parent who support me to attend the Master of Public Administration and their encouragement throughout the whole academic life.

TABLE OF CONTENTS

	Page
ABSTRACT	i
ACKNOWLEDGEMENTS	ii
TABLE OF CONTENTS	iii
LIST OF TABLES	v
LIST OF FIGURES	vii
LIST OF ABBREVIATIONS	viii
CHAPTER I INTRODUCTION	1
1.1 Rationale of the Study	1
1.2 Objective of the Study	2
1.3 Method of Study	2
1.4 Scope and Limitations of the Study	2
1.5 Organization of the Study	2
CHAPTER II LITERATURE REVIEW	4
2.1 The Evolution of Plastic	4
2.2 Impact of Plastic Pollution	8
2.3 The Concept of 3Rs	16
2.4 Plastic Pollution Control Practice in Selected Countries	20
2.5 Review on Previous Studies	23
CHAPTER III OVERVIEW OF PLASTIC POLLUTION CONTROL IN MYANMAR	25
3.1 Policy and Regulations Related to Pollution	25
3.2 Plastic Production and Waste Generation	27
3.3 Plastic Waste Management	28
3.4 3R Initiative	32
3.5 Plastic Pollution Control and Public Awareness Promoting Activities	33
3.6 Environmental Education in Myanmar	34
3.7 Perspective of Key Stakeholders	36

CHAPTER IV	SURVEY ANALYSIS	39
	4.1 Survey Profile	39
	4.2 Survey Design	40
	4.3 Survey Results	40
CHAPTER V	CONCLUSION	55
	5.1 Findings	55
	5.2 Recommendation	57
	REFERENCES	
	APPENDIXES	

LIST OF TABLES

Table No.	Title	Page
2.1	Resin Identification Code and Their Usages	6
2.2	Degradation Rates of Common Plastic Materials	11
2.3	Top 20 Countries Ranked by Mass of Mismanaged Plastic Waste, 2015	15
3.1	Composition of Plastic in Municipal Solid Waste	28
3.2	Major Landfill Sites in Yangon	29
3.3	Major Landfill Sites in Mandalay	29
3.4	Major Landfill Sites in Nay Pyi Taw	30
3.5	Recycling Plants in YCDC	32
4.1	Demographic Characteristics of Kyee Myin Daing Township	39
4.2	Characteristics of Respondents	41
4.3	Perception about Plastic Pollution by Respondents	42
4.4	Source of Knowledge about Plastic Pollution	43
4.5	Occurrence of Plastic Wastes	43
4.6	Types of Problems Caused by Plastic Pollution	44
4.7	Knowledge of the Origin of Plastic by Respondents	44
4.8	Knowledge of Health Problems Caused by Excessive Consumption of Plastic	45
4.9	Knowledge of Treatment after Used Plastics	45
4.10	Main Reason for Using Plastic Products	46
4.11	Reasons to Reduce Plastic Pollution by Respondents	47
4.12	Attitude on Main Responsible Person to Reduce Plastic Pollution by Respondents	47
4.13	Attitude on No Plastic Day in Supermarket by Respondents	48
4.14	Opinion on the Most Necessary Options to Reduce Plastic Consumption by Respondents	48
4.15	Opinion on Plastic Consumption Raising by Respondents	49
4.16	Attitude on Banning the Consumption of Plastic by Respondents	50

4.17	Attitude on An Extra Charge for Plastic Products by Respondents	50
4.18	The Items used for Shopping by respondents	51
4.19	Types of Mostly Used Plastic Products by Respondents	51
4.20	3R Practices Done by Respondents	52
4.21	The Amounts of Daily Using Plastic Bags by Respondents	52
4.22	The Practice after Used Plastics Bags by Respondents	53
4.23	The Practice on Reduction Plastic in use of Products by Respondents	53

LIST OF FIGURES

Figure No.	Title	Page
2.1	Annual Global Plastic Production from 1950 to 2015	7
2.2	Primary Plastic Production by Industrial Sector, 2015	8
2.3	Plastic Ocean Input from Top 20 Rivers, 2015	16
3.1	Structure of Plastic Recycling Market	31

LIST OF ABBREVIATIONS

3R	Reduce, Reuse, Recycle
BPA	Bisphenol A
ECD	Environmental Conservation Department
FDS	Final Disposal Site
HDPE	High-density polyethylene
LDPE	Low-density polyethylene
MCDC	Mandalay City Development Committee
MPIA	Myanmar Plastic Industries Association
MSW	Municipal Solid Waste
NCEA	National Commission for the Environmental affairs
NP	Nonylphenol
NPTDC	Nay Pyi Taw City Development Committee
NSDS	National Sustainable Development Strategy
PC	Polycarbonate
PCCD	Pollution Control and Cleansing Department
PE	Polyethylene
PET	Polyethylene terephthalate
PP	Polypropylene
PS	Polystyrene
PVC	Polyvinyl chloride
SDG	Sustainable Development Goal
SPI	Society of The Plastics Industry
SWM	Solid Waste Management
UNEP	United Nations Environment Programme
YCDC	Yangon City Development Committee

CHAPTER I

INTRODUCTION

1.1 Rationale of the Study

Plastic is one of the most common and convenient materials in modern society. The use of plastic is increasingly controversial, however, because of its negative impacts on the environment, biodiversity, and human health. Plastic does not naturally biodegrade in the environment. Instead, it breaks down into small particles (micro-plastics) that can negatively impact human health by releasing toxins into the food chain and by poisoning wildlife and marine life.

Among the plastic products, plastic bag is a serious problem all around the world for destroying environment. It creates wastages problem, harms the environment and causes health hazards if being misused. However, people are still using it due to easy availability, small storage place, weight convenience and cost effectiveness. As city being swarmed with plastic bag which causes flood, environmental and even health hazards, actions are being taken in a lot of countries to minimize the usage of plastic bag. Some countries have imposed strict law and regulation to overcome this issue. It is illegal to use plastic bag in some countries and whoever uses it will be jailed or fined.

Plastic bags can be seen all around Myanmar for grocery, retail and food stall. Take away foods or drinks packed in plastic bags are a very common occurrence. Plastic bag applications for hot edible items can be dangerous as misusing of wrong type of plastic bag may cause chemical migration from the plastic to the food. Those chemicals include Styrene, Bisphenol A and Phthalates which cause cancer, heart disease and reproduction issue. A lot of public figures in Myanmar have also urged the public to avoid using plastic bags to pack hot edible items due to health and environment issues.

Stakeholders such as government, consumer and business owner are very important for a successful plastic bag reduction implementation. This study will concentrate on one of the most important stakeholders, the consumer. Consumer plays

a very important role as their opinion affects another stakeholder which is organization or even government to react on the issue in order to maintain the good reputation in public eyes. Therefore, in order to understand the influencing factors, target study area was chosen for the Kyee Myin Daing Township, which is one of the townships from YCDC administration. It is located in western district of Yangon and Yangon River divides it into two parts. The east bank of the Yangon River is more urbanized than the west part. Therefore, the perception and practice of the consumer from different living conditions is worth to be studied for this study.

1.2 Objective of the Study

The objective of the study is to examine the existing condition of community perception on plastic pollution and environmental conservation.

1.3 Method of Study

The method of the study is mainly a descriptive method with primary and secondary data. Secondary data are obtained from the previous research paper, articles, various books and websites on plastic pollution for references. In addition, primary data are obtained from survey questionnaire based on references to find out the objective of the study. The questionnaire is divided into four sections namely Part A: General Information of Respondents, Part B: Knowledge of Respondents on Plastic Pollution, Part C: Attitude of Respondents on Plastic Pollution, and Part D: Practice of Respondents on Plastic Pollution.

1.4 Scope and Limitations of the Study

This study mainly focus on respondent living in Kyee Myin Daing Township, and seven wards out of twenty two wards are selected as sample locations with 265 respondents. The survey was conducted from February to April 2019. The main focus is to examine only on the existing condition of the plastic consumer. Due to limited resources and time the plastic producers are not studied in this study.

1.5 Organization of the Study

There are totally five chapters in this study. Chapter 1 is introduction of the study that includes rationale of the study, objectives of the study, method of the study, scope and limitation of the study and organizations of the study. Chapter 2 deals with

literature review on previous studies. The literature review deals with the history of plastic, impact of plastic pollution, 3Rs Concept, plastic pollution control, plastic pollution control practice in selected countries, and review on previous studies. Chapter 3 deals overview on case of plastic pollution in Myanmar. Chapter-3 describes plastic production and waste generation, plastic waste management, recycling plants in YCDC, 3R initiative, plastic pollution control, public awareness promoting activities, policy and regulations related to pollution at national and local level, environmental education , and perspective of key stakeholders. Chapter 4 deals with analysis of all information collected from Kyee Myin Daing Township. It includes Survey Profile and Design, Survey Findings, Knowledge on Plastic Pollution, Attitude on Plastic Pollution and Practice on Plastic Pollution by respondents. Chapter 5 is conclusion which consists of finding and recommendations

CHAPTER II

LITERATURE REVIEW

2.1 The Evolution of Plastic

Plastic is a word that generally means ‘flexible and easily shaped’. It is also chemically called polymers which are chemically bonded molecules called monomers. Before the plastic was not invented, only clays, glasses, tree gums and rubber could be molded into different shapes, but they could not return into their original nature after heated. All plastics are made of carbon came from fossil fuels, whereas biopolymers or bio-plastics use carbon derived from natural materials.

In 1869, the first synthetic polymer was created by John Wesley Hyatt as New York firm offered a reward for anyone who could supply an alternative for ivory in billiard balls which were demanded because of the growing popularity of billiards. He discovered a plastic which was called Celluloid that could be shaped into a variety of forms and similar to natural substances like tortoiseshell, horn, linen, and ivory by mixing cellulose which derived from cotton fiber with camphor. His invention helped not only people but also the environment. Leo Baekeland found the Bakelite in 1909, which is hard and resistant to heat and electricity, and unlike celluloid, so it was suitable for industrial mass production. The plastic known as nylon that could be strained into strong fibers was invented in the 1930s by Wallace Carruthers.

The production of synthetic materials preserves the need for scarce natural resources. Plastics provided those substitutes. The use of these early polymers became widespread by the outbreak of World War II, and the plastic production increased by 300%. Nylon was used during the war for parachutes, ropes, body armor, helmet liners, and more. Plexiglas provided an alternative to glass for aircraft windows. The production of plastic continues today, and it replaces in the production of steel, paper, glass and wood.

2.1.1 Types of Plastics and Their Usages

Generally, the common characteristics of plastic are as follow;

1. Electrical and thermal insulator
2. Resistant to penetration of water and gases
3. Lightweight
4. Easily molded
5. Non-biodegradable and takes hundreds of years to break down
6. Flammable

Plastics can be divided into two major categories:

1. **Thermo set or thermosetting plastics-** Once cooled and hardened, these plastics retain their shapes and cannot return to their original form. They are hard and durable. Thermo sets can be used for auto parts, aircraft parts and tires. Examples include polyurethanes, polyesters, epoxy resins and phenolic resins.
2. **Thermoplastics-** Thermoplastics can soften upon heating and return to their original form. They are easily molded and extruded into films, fibers and packaging. Examples include polyethylene (PE), polypropylene (PP) and polyvinyl chloride (PVC). (Craig Freudenrich, 2007)

Plastics can be distinguished into seven types. The numbers shown inside the triangles refer to different types of plastics used in making plastic products and containers. The numbering system is based on a voluntary plastic guide developed by the Society of The Plastics Industry (SPI). Presently, SPI is working to improve the numbering system to make it easier know what to recycle. As all types of plastic can leak harmful chemicals, no 3, 6 and 7 should be used carefully. Thus, no 1, 2, 3, 4 and 5 plastic can be used safely.

Table (2.1) Resin Identification Code and Their Usages

Resin Code	Usage
	<p>Polyethylene terephthalate (PET) is used in beverage bottles, cups, other packaging, etc. PET can be recycled into fiberfill for sleeping bags, carpet fibers, rope, pillows etc.</p>
	<p>High-density polyethylene (HDPE) is used in films, wraps, bottles, cups, milk jugs, disposable gloves, and garbage bags. HDPE can be recycled into flower pots, trash cans, traffic barrier cones, detergent bottles, etc.</p>
	<p>Polyvinyl chloride (PVC) is commonly used for pipes, siding, flooring and plumbing, etc.</p>
	<p>Low-density polyethylene (LDPE) is found in things like plastic bags, six-pack rings, tubing, etc. LDPE can be recycled into new grocery bags.</p>
	<p>Polypropylene (PP) is used in things like auto parts, luggage, industrial fibers as well as food containers, etc. PP can be recycled into plastic lumber, car battery cases, manhole steps, etc.</p>
	<p>Polystyrene (PS) is commonly utilized in plastic utensils, Styrofoam, cafeteria trays, etc. PS can be recycled into plastic lumber, cassette tape boxes, flower pots, etc.</p>
	<p>Other plastics are usually a mixture of various plastics, like squeeze ketchup bottles, “microwaveable” dishes, etc. Other (number 7) is usually not recycled because it is a mixture of different types of plastics.</p>

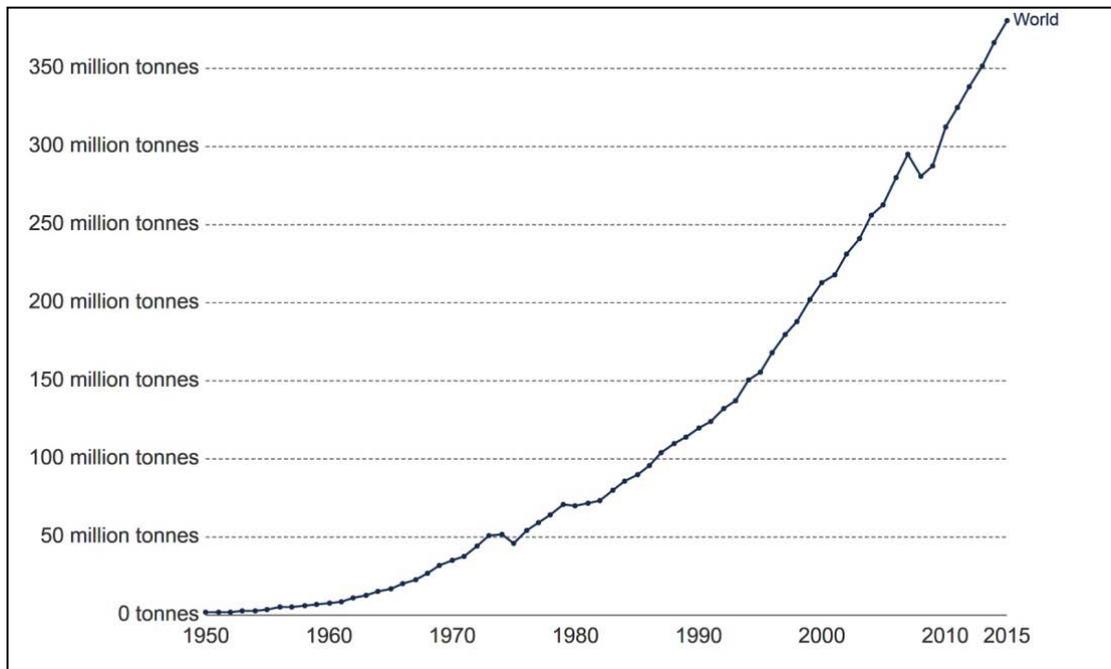
Source: the Society of the Plastics Industry

2.1.2 Global Plastic Production

The invention of the first synthetic plastic, Bakelite in 1909 initiates the beginning of the global plastic industry. In 1950, only 2 million tonnes per year of plastics were produced in the world. The production has increased annually, and it

became 381 million tonnes in 2015, which is roughly equivalent to the mass of two-thirds of the world population. There was a slight drop in annual production in 2009 and 2010 as the result of the 2008 global financial crisis.

Figure (2.1) Annual Global Plastic Production from 1950 to 2015

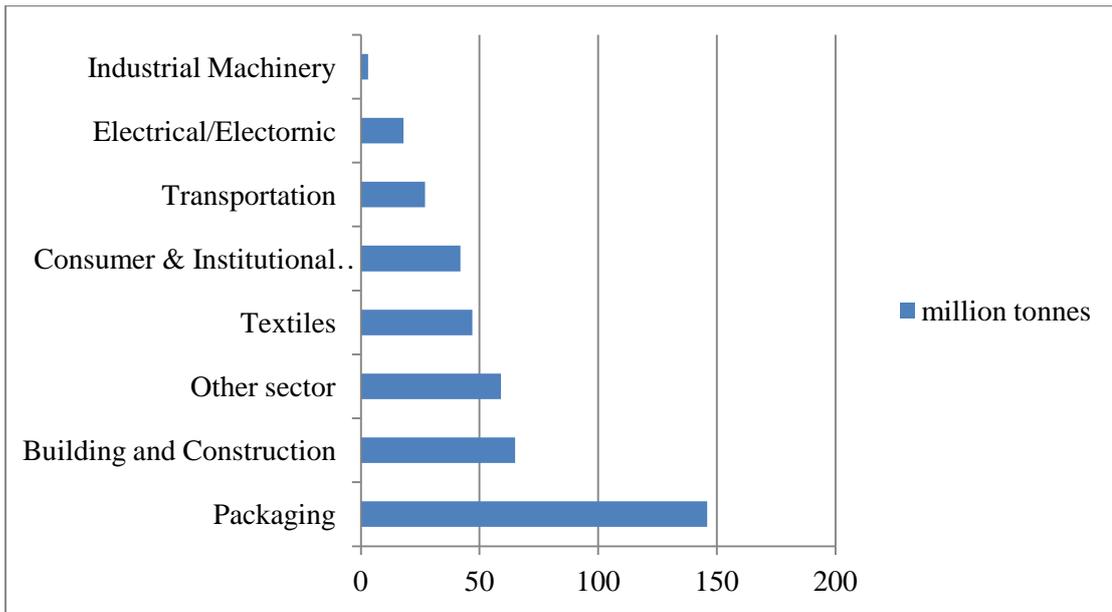


Source: Geyer et al. (2017)

More than 99% of plastics are produced from chemicals derived from oil, natural gas and coal. If current trends continue, by 2050 the plastic industry could account for 20% of the world's total oil consumption. About 50 per cent of plastic is used for single-use disposable applications (Hopewell et al., 2009). The most common single-use plastics found in the environment are cigarette butts, plastic drinking bottles, plastic bottle caps, food wrappers, plastic grocery bags, plastic lids, straws and stirrers, other types of plastic bags, and foam take-away containers.

According to the primary global plastic production by industrial sector, 2015 data, Packaging was the primary sector for plastic production with 146 million tonnes. The second largest sector utilizing plastic was the building and construction, which accounts 65 million tonnes, and the following sectors are as follow.

Figure (2.2) Primary Plastic Production by Industrial Sector, 2015



Source: Geyer et al. (2017)

2.2 Impact of Plastic Pollution

Every invention has cost and benefit, so the positive impacts of the plastic did not last because in 1950, plastic debris was observed in the ocean for the first time, raising concerns about pollution. Since awareness about environmental issues increase, observers describe that Plastic was cheap, flimsy, or fake. An anxiety about Plastic waste more increased in the 1970s and 1980s, so plastic's reputation decreased as so many plastic products are single-use, and it never disappears in the environment.

From the several form of pollution, plastic pollution deals with both cumulative pollution and global pollution. Plastic pollution is the accumulation of plastic objects (e.g. plastic bottles and much more) in the Earth's environment that adversely affects wildlife, wildlife habitat and humans. Plastics that act as pollutants are categorized into macro-(over 20mm diameter), meso-(5-20mm diameter), or micro debris (under 5mm diameter), based on size (Hammer, J; Kraak, MH; Parsons, JR, 2012). Very small microplastics are barely detectable, and for practical purposes. Plastics are inexpensive and durable, and as a result levels of plastic production by humans are high (Hester, Ronald E.; Harrison, R. M., 2011). Moreover, the chemical structure of most plastics renders them resistant to many natural processes of degradation and as a result they are slow to degrade. (GESAMP, 2015)

2.2.1 Cost of Plastic Pollution

Environmental externalities are expressed through physical linkages among polluter and pollute. There are cases of one polluter and one pollute, one polluter and multiple pollutes, multiple polluters and single pollute, and both polluters and pollutes are damaged. Since pollution is followed by negative externalities, plastic pollution also provides costs of pollution on both polluters and pollutes.

There are three possible environmental problems which caused by plastic pollution. First, oil, natural gas or coals used for plastic production are limited natural resources, so these resources must be conserved.

Second, large quantities of harmful pollutants produced from the manufacture of plastics have been proven to cause cancer, birth defects, nerve and immune disorders and blood and kidney ailments, and spoil the earth and air. (Tim Krupnik, 2001)

Third, as old and unwanted plastic wastes are not always easy to dispose, when plastics are dumped into land, rivers, streams, and sea, it contaminates the water, soil, marine life and the air. Once plastic wastes are burned, they release a poisonous chemical, dioxin into the air. Moreover, recycling of plastics is uneconomical, polluting and labour intensive. Hydrocarbons and toxic fumes which released from recycling process effect skin and respiratory problems. And recycled products are back into circulation in the market place and eventually without making any reduction.

Most of the plastic wastes discharged from household clog drains and hit urban sewage systems, providing breeding grounds for mosquitoes, and causing floods during the monsoon. Plastic wastes ended in landfills leach toxic metals such as lead and cadmium pigments into underground water. Land filling plastic wastes would mean preserving the poison forever as plastics take more than hundreds of years to degrade.

The economic damage caused by plastic waste is inevitable. In the Asia-Pacific region alone, tourism, fishing, and shipping industries cost \$1.3 billion per year for plastic litter (APEC, 2009). In Europe, it costs €30million per year for cleaning waste from coasts and beaches. Studies point out that the total economic damage to the world's marine ecosystem caused by plastic accounts for \$13 billion in every year. (UNEP, 2014)

2.2.2 Various Plastics and their Degradability

Unlike metals, not only plastics do not rust or corrode, but also they do not biodegrade. Generally, Plastics can take up to thousands of years to degrade in nature. Table-2.1 shows the degradation rates of common plastic materials. In nature, Plastics can only degrade into microplastics by means of photo-degradation, which is the process of the decomposition of the material by the action of light. (Kalliopi N. Fotopoulou and Hrissi K. Karapanagioti, 2017). This process occurs faster on land such as beaches because of high UV irradiation and abrasion by waves, whereas the degradation process is much slower in the ocean due to the cooler temperatures and reduced UV exposure. (GESAMP, 2015)

Microplastics are plastic particles smaller than 5 mm, and ranging from 333 μm to 5 mm. The microplastics are further divided into two types namely, primary and secondary microplastics. Plastic materials that are prepared in a microscopic size are called primary microplastics. They are mostly used in facial, hand- cleansers and cosmetics. Nowadays microplastics are used in the medical field as a carrier for drugs, proteins and other biomolecules. However, increasingly, the use of microplastics has replaced traditionally used natural exfoliating material (ground almonds, pumice, apricot, walnut husks and oatmeal).

Secondary microplastics are the products formed by the breakdown of large plastic materials from sea and land. Plastic materials in the land and marine environments, over a period of time lose their structural integrity, which results in their fragmentation by the effects of physical, biological and chemical processes. Ultraviolet (UV) radiation from sunlight causes oxidation of the polymer matrix that leads to bond breakage.

Plastics present in the marine environment (below the sea surface) have less chance of photo-oxidation occurring, whereas plastic materials present on beaches have a high chance of turning brittle, being cracked and degrading rapidly because of the high oxygen availability and direct exposure to sunlight. This turns the plastic yellow, results in the loss of their structural integrity and leads to fragmentation by the action of the waves, abrasion and turbulence. This process is a continuous one, and ultimately as the fragments become smaller over time they become microplastics and after some time they become nanoparticles. The existence of nanoplastics in the ocean is likely to be increasing everyday and in the coming years researchers have already started to think about the impact of these in the marine food chain. Micro plastics are

particularly difficult to monitor and they may also have more influential impacts than larger plastics.

Table (2.2) Degradation Rates of Common Plastic Materials

Material	Degradation Rate (Years)
Plastic bag made from HDPE	10 – 100
Plastic bag made from LDPE	500 – 100
Styrofoam cup	50 – 500
Plastic bottle	450 – 1000
Bottle Cap	100 – 500
Drinking Straw	100 – 500
Commercial netting	30 – 40
Foamed plastic buoy	80
Monofilament fishing line	600

Source: <https://www.alansfactoryoutlet.com/how-long-does-it-take-plastics-to-break-down>

2.2.3 Harmful Effects on Human Health

Nowadays, plastic pollution is recognized as a hazard to public health and the human body. The stabilizers and chemicals used in plastic production are highly toxic, and not only affect ground water, the environment, the air we breathe. The most dangerous toxicants which harm to human health are bisphenol A (BPA), dioxins and phthalates.

Phthalates are toxic chemicals that are known to leach out from PVC, which can cause serious health problems. Phthalates are reported to be carcinogenic, and linked to allergies and asthma. They can also cause damage to the liver, kidneys and heart as well. It can cause serious problems in children. PVC is the major contributor of dioxin release. Researchers have reported that the environmental concentration of dioxin is above the concentration threshold in some aquatic environments.

PC is a clear plastic widely used in medicine as storage containers, in water bottles, food cans and so on. BPA is a raw material used in PC, and is found to leach into foods and liquids stored in containers, a higher temperature increases the leaching of BPA. BPA is a chemical that mimics estrogen, a human hormone and BPA can

cause adverse side effects in humans. It stimulates prostate cancer cells and causes breast tissue changes.

PET is widely used in packing materials for soft drinks, juice, water, beer, mouthwash, detergents and so on. Antimony trioxide and *bis*(2-ethylhexyl) phthalate leach from PET. These are associated with asthma and allergies in children, and they have an effect on the kidneys, liver and spleen.

Polystyrene is widely used in Styrofoam containers, disposable cups, bowls, egg cartons, food containers and compact disc cases. They tend to leach styrene, which is an endocrine disruptor that mimics the hormone estrogen (female hormone). So it causes problems in reproductive developmental problems. Styrene is toxic to the brain and nervous system, mostly to workers with long-term exposure. (Doble, M., Venkatesan, R., & Kumar Nelamane Vijayakumar, R., 2014)

Another potential negative impact from plastic to human health is caused by microplastics. Studies on mussels (Browne *et al.*, 2008) indicate that microplastics are translocated from the gut to the circulatory system within 3 days and then persist in circulation for over 48 days. The study did not find any significant toxicological effects, but these may occur over a longer period of exposure (as might occur in a natural environment). Research on the final fate of microplastics after ingestion is still sparse and more knowledge is needed on the processes by which they move into the circulatory system

2.2.4 Harmful Effects on Wild Life

Another major concern about plastic waste is the impact on wildlife. Mostly, marine wildlife suffered the impact of plastic waste than other animals as most of the plastic waste from land reaches marine environment from rivers, drainage, and the sewage system or by wind, and they are collected as marine debris. In the marine environment, plastic debris is the major cause of leaching of toxins that include phthalates from PVC, nonylphenol (NP) (intermediate degradation product of the nonylphenol ethoxylate class of surfactants) from polyolefins, brominated flame retardants from urethane foam and BPA from PC and so on. NP is toxic to the mammals and aquatic species.

There are two key pathways by which plastic debris can affect wildlife: Entanglement: Birds and other larger animals often become trapped or ensnared in plastic bags, fishing line, and other debris. Ingestion: Many marine organisms cannot

distinguish common plastic items from food. Animals that eat plastic often starve because they cannot digest the plastic and it fills their stomachs, preventing them from eating real food.

UNEP (2006) claims that plastic waste causes the death of up to a million seabirds, 100,000 marine mammals and countless fish through various impacts. Laist (1997) reported that at least 267 different species are known to have suffered from impacts of plastic waste. This includes 86 per cent of all sea turtle species, 44 per cent of all seabird species and 43 per cent of all marine mammal species.

2.2.4 Plastic Waste Management

The amount of plastic waste can be estimated by observing the amount of global consumption of plastic. According to the data, the global primary plastic waste generation reached 300million in 2015, of which plastic packaging waste accounted for 47% of the plastic waste generated globally. With the largest population, China produced the largest quantity of plastic, at nearly 60 million tonnes. This was followed by the United States at 38million, Germany at 14.5million and Brazil at 12 million tonnes.

At the end of its life time, plastic wastes are handled by three main methods: burying in landfill, incineration and recycling. Each has its own inherent limitations. Improper plastics waste management can lead to serious health threats, resulting in fires and the contamination of air, soil and water. Plastic components of landfill waste persist for more than 20 years and the occupied land could not be used for more productive means, such as agriculture. Plastic debris in landfill also acts as a source of environmental pollutants. Pollutants such as benzene, toluene, xylenes, ethyl benzenes and trimethyl benzenes released as gases, and contained in leachate and endocrine disrupting compounds, in particular BPA. BPA released from plastics in landfill lead to an increase in production of hydrogen sulphide and high concentrations of hydrogen sulphide are potentially lethal.

Careful control is necessary during the incineration of waste chlorine containing plastics, as they are converted into toxic compounds during certain thermal reactions; hence, the establishment of optimum operational conditions for the combustion of this plastic waste is urgently required, in order to limit the emission of volatile chlorinated organic compounds. However, volatile or low-molecular hydrocarbons and chlorinated organic compounds are currently emitted from the

incineration of this type of plastic waste.

There are two approaches in widespread use for the recycling: mechanical and chemical recycling; the most promising seems to be chemical recycling. The mechanical recycling of plastics waste, known as secondary recycling, is an important resource for reuse in manufacturing plastic products. However, mechanical recycling is limited to single-polymer plastics, thus excluding the use of more complex and contaminated plastics waste for recycling. (Muralisrinivasan Subramanian, N, 2016)

According to recent estimates, 79 percent of the plastic waste ever produced now sits in landfills, dump or in the environment, while about 12 percent has been incinerated and only 9 percent has been recycled. While the United States, Japan and many European countries generate significant amounts of plastic waste, they are also relatively good at managing it. Most of the mismanaged wastes are come from Asia such as China, Indonesia, Philippines, and Vietnam. These countries are experiencing rapid economic growth, which is reducing poverty rates and improving the quality of life for hundreds of millions of people. As these economies grow, and consumption booms, the use of plastic goods increases. Table-2.2 shows the nations generating the largest amounts of mismanaged plastic waste. Researchers estimated that if the plastic production continues in this way, 13.2 billion tons of plastic waste will enter landfills or the environment by 2050.

Table (2.3) Top 20 Countries Ranked by Mass of Mismatched Plastic Waste, 2015

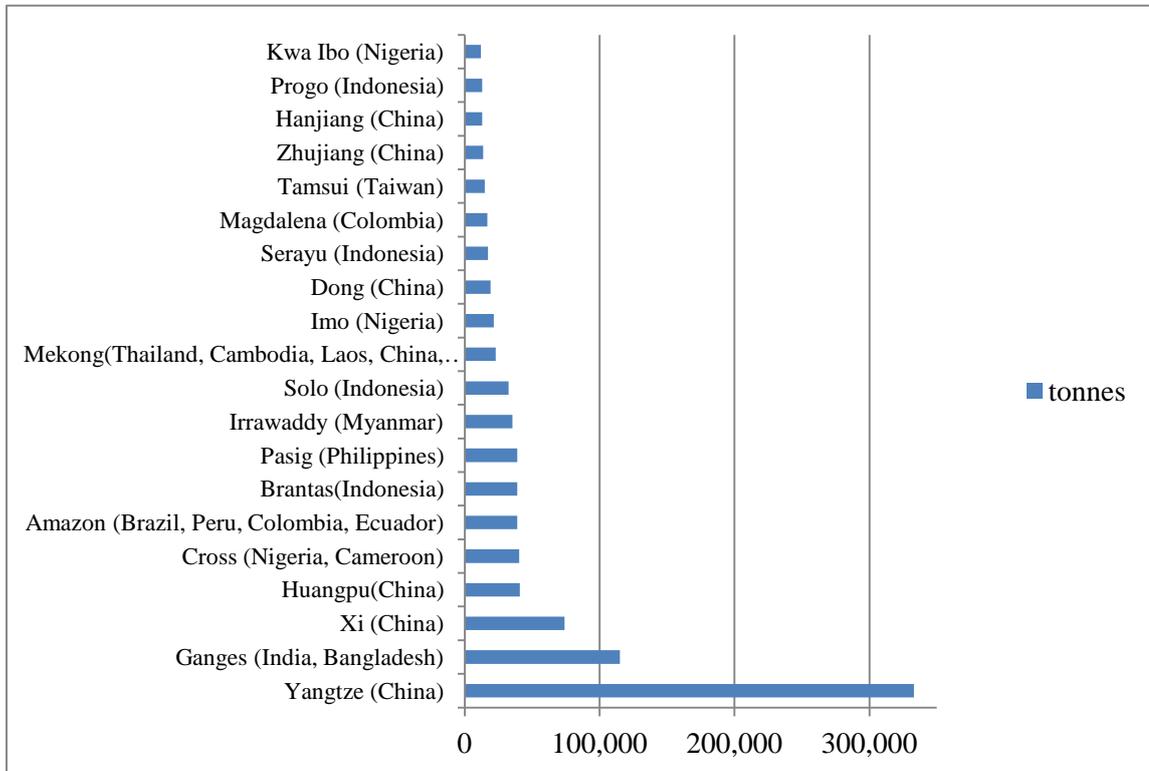
Rank	Country	Waste Generation Rate [kg/pp]	% of Waste that is plastic	% of Mismatched waste	Plastic Waste [MMT/yr]	% of Mismatched plastic Waste
1.	China	1.10	11	76	8.82	27.7
2.	Indonesia	0.52	11	83	3.22	10.1
3.	Philippines	0.5	15	83	1.88	5.9
4.	Vietnam	0.79	13	88	1.83	5.8
5.	Sri Lanka	5.1	7	84	1.59	5.0
6.	Thailand	1.2	12	75	1.03	3.2
7.	Egypt	1.37	13	69	0.97	3.0
8.	Malaysia	1.52	13	57	0.94	2.9
9.	Nigeria	0.79	13	83	0.85	2.7
10.	Bangladesh	0.43	8	89	0.79	2.5
11.	South Africa	2.0	12	56	0.63	2.0
12.	India	0.34	3	87	0.60	1.9
13.	Algeria	1.2	12	60	0.52	1.6
14.	Turkey	1.77	12	18	0.49	1.5
15.	Pakistan	0.79	13	88	0.48	1.5
16.	Brazil	1.03	16	11	0.47	1.5
17.	Myanmar	0.44	17	89	0.46	1.4
18.	Morocco	1.46	5	68	0.31	1.0
19.	North Korea	0.6	9	90	0.30	1.0
20.	United States	2.58	13	2	0.28	0.9

Source: Jambeck, J.R., et al. (2015)

Most of the mismatched plastic wastes are accumulated on land and flows into the ocean from rivers and streams, and accumulates as gyres, which are large rotating currents, which have lower sea levels near their centers. There are five major gyres in the world: the North Pacific, the South Pacific, the Indian Ocean, the North Atlantic and the South Atlantic. About half of all of the plastic waste that ends up in

the oceans comes from just five countries: China, Indonesia, the Philippines, Thailand and Viet Nam. River Yangtze was the top pollution river, and carried input of approximately 333,000 tonnes in 2015.

Figure (2.3) Plastic Ocean Input from Top 20 Rivers, 2015



Source: Lebreton et al. (2017)

2.3 The Concept of 3Rs

The concept of 3Rs has become a significant policy approach for sustainable consumption and production by the World Summit on Sustainable Development (Srinivas, 2015). Most of the wastes goes into the land fill are non-biodegradable, and many years later the occupied lands are not be able to use for more than 20 years. Therefore, 3Rs concept becomes the solution to reduce the total amount of waste that will accumulate into the land fill. Firstly, it is important to reduce the amount of waste generated, then reuse existing materials and finally recycle materials. This "3R"-reduce, reuse and recycle is a fundamental concept for waste management (Iges, 2005). 3Rs practices comprise different measures and skilful techniques to minimize the volume of discarded waste materials that was generated to dispose out. (Jibril JDA, et al., 2012)

2.3.1 Reduction

The first option in waste hierarchy is strict prevention of waste generation by implementing source reduction strategies in all production activities. This is the prevention principal “avoidance of waste”. Waste prevention is closely linked to improving manufacturing methods change of manufacturing designs such as reducing packaging and influencing consumers so that they demand greater products and less packaging. Many countries are running awareness raising campaigns to educate the public and encourage consumers to demand goods that produce less waste and drive the creation of a more resource-efficient market. (Bouanini S, 2013)

This can only be achieved by effective waste prevention at source which includes adoption of suitable practices, adjustments in the usage of raw materials, as well as in technology and production processes. At the domestic level, source reduction can be done not necessarily by adopting a high technology but only by making suitable decisions in the management of the household (Williams PT, 2005) such as change of consumption pattern and lifestyle by running awareness- raising campaigns to educate the public and encourage consumers to demand goods that produce less packaging and drive the creation of a more resource efficient market and compact garbage by producers such as reducing the amount of packaging by individual practice include of use of plastic bags, reducing the use of plastic and paper plates, cups and plastic utensils, and consume more reusable items or use of more recyclable materials. Earlier studies indicate that nearly 20 per cent reduction in waste generation is possible through simple housekeeping measure that requires no or marginal investment. Proper design and packaging of products with minimum volume of material and longer useful life can reduce the waste considerably. (Ramachandra TV, 2011).

2.3.2 Reuse

The next best option for SWM is re-use and this encompasses the utilization of an item after its primary use either for a purpose similar to that which it was planned or for a completely new one. Reusing items can be by repairing, selling or donating these items to charity and community groups, and therefore this can reduce waste. Reuse is preferable to recycling since the item doesn't need to be reprocessed.

In addition to environmental consideration, sensitive reuse schemes can have important social and cultural benefits (UNEP, 2003). This is exemplified in the reuse

of bottles (of beverages) or shopping plastic bags from stores (Williams PT, 2005). Reusing materials multiple times or for another purpose can also save on solid wastes. Some examples of this include, refilling a water bottle rather than buying a new one; reusing newsprint as a paper towel to clean items and soak up liquids; using reusable cloth napkins instead of paper napkins; reusable cups instead of paper cups; and reusing grocery bags for garbage collection.

2.3.3 Recycling

Recycling is another waste management strategy in developed countries. The recycling process includes collection, segregation and processing of waste with productive value as such inorganic fractions of MSW (paper, metal, plastic, and glass materials) may be recycled (Williams PT, 2005).

2.3.4 3Rs Performance around the World

Solid waste management practices in developed countries progressed from 'no-system' to an increasingly centralized 'municipal system'. According to this approach, the municipal authorities are the main actors in the field. Most developed countries are implementing solid waste management strategies based on 'waste hierarchy' by emphasizing reuse and improving the quality of products that can be recycled. The hierarchy of SWM is said to be an internationally accepted and practical concept in many countries throughout the world especially in developed countries. This policy shift away from land filling has significantly increased the use of medium priority waste handling methods, which were historically more prominent due to resource scarcity but dropped to single digit percentages in Europe during the first half of the 20th century (Marshall RE, Farahbakhsh K, 2013).

Many similarities exist between the historical SWM development trajectories of industrialized countries and the current trajectories of developing countries. Many cities in lower income nations are experiencing similar conditions to those of the last century in high income countries such as, increasing urbanization and socioeconomic disparities, inadequate provision of sanitary and environmental amenities, social exclusion and inequalities related to existing SWM systems, and high levels of morbidity and mortality linked to inadequate sanitation, waste disposal, and water supply provision were common then as they are today, particularly in poorer urban neighborhoods in lower income countries (Konteh FH, 2009)

Common concerns regarding mainstreaming 3R policies among developing countries are urbanization, inequality, and economic growth; cultural and socio-economic aspects; policy, governance, and institutional issues; and international influences, and lack of expertise and budget have complicated SWM in developing countries (Marshall RE, Farahbakhsh K, 2013). Recycling in Europe has rebounded to 25% or higher and in Austria and the Netherlands this rate reaching as high as 60% (Kollikkathara NH, Feng ES, 2009). In Australia, for instance the recycling rate is high and is increasing, with 99% of households reporting that they had recycled or reused some of their waste within the year 2002, up from 85% in 1992 (Mwiinga F, 2014). Recycling rate in Germany and Austria for example, go beyond 25%, with and Brazil having material recovery rates as high as approximately 41% (Troschinetz AM, Mihelcic JR, 2009). For most of such advanced countries, recycling is typified by kerbside programs through which collection and segregation of recyclables are carried out. the European Union has targeted to reach recycling rates of at least 50% in all over Europe by 2020, while the front-runner countries are around 65% and the EU average is 39% as of 2013 (EEA, 2007).

Developed countries in Asia like Japan, South Korea, Taiwan, and Singapore ultimately aim for the elimination of landfills from their systems. In these countries, SWM systems have become stable through a variety of legal measures supported by central government financial support. Likewise, in these high income Asian countries, their citizens are highly aware of their responsibilities and making SWM a common practice in their daily life. Recycling rate in Republic of Korea reported Very High (>90%), and in Singapore High (>70%) as the pioneer developed countries in East Asia Region.

Regarding reuse, this could be exemplified in the reuse of bottles (of beverages) or shopping plastic bags (Williams PT, 2005). The rates of reuse in developed countries are very high, in some developed countries such as Japan, Sweden, Belgium and Denmark, and Finland, the index of reuse of solid waste is over 90% (Samiha B, 2013). For example, in Finland, 95% of the soft drink, beer, wine and spirit containers are refillable, and in Germany, 73% are refillable (Mwiinga F, 2014). Moreover, reusing start to play a conventional practice in developing countries. In China for example, in order to avoid using plastic bags, the Chinese government has created a policy since 2008, to pay for the plastic bags, and encourage using

reusable bags. So, all supermarkets in China sell the plastic bags which pushed people to reduce using it, and provide reusable bags to use instead the plastic bags.

Another example in developing countries, refillable glass bottles are still widely used, and families routinely take the empty bottles to grocery stores when they purchase beverages. If someone doesn't bring an empty bottle when purchasing a beverage in a refillable bottle, must pay a deposit equivalent to the cost of the bottle. This encourages the return of reusable bottles, which is in parallel encouraging the reuse principle. A very successful example of waste reduction is community waste organizations initiatives in the United Kingdom. Some schemes have reduced average waste disposal from 800 kg to 250 kg per household per year and recycling rates between 47% and 52% have been achieved. (Marshall RE, Farahbakhsh K, 2013).

2.4 Plastic Pollution Control Practice in Selected Countries

Environmental pollution results from one or all of these factors:

- (1) property rights in the environment being polluted are neither nonexistent nor enforced,
- (2) much of the environment's services are shared by the entire population, and
- (3) people lack the moral and ethical strength to refrain from the type of behavior that causes environmental degradation.

The role of "incentives" to address these three causes of environmental degradation is an important element in designing appropriate environmental policies. The incentives lead people to make decisions in one direction rather than another. There are two incentives to control environmental pollution. First, an economic incentive is something in the economic world that leads people to channel their efforts at economic production and consumption in certain directions. Second, nonmaterial incentive leads people to modify their economic behavior; for example, self-esteem, the desire to preserve a beautiful visual environment, or the desire to set a good example for others. (Barry C.Field et al., 2003)

Pollution is a result of profit motive, so the only way to reduce environmental pollution is to weaken the strength of the profit motive. If the incentives within the system are not structured to reduce profit motive, destructive environmental impacts will produce in the system. More than 60 countries have introduced policies to curb plastic pollution. The most widely used an economic instruments are taxes or levy,

bans, fees or charges, tradable permits, deposit-refund schemes, environmentally motivated subsidies. And nonmaterial instruments are voluntary approaches, private-public agreements, and public education.

2.4.1 China

In 1999, the Chinese government banned the production and use of all single-use plastic tableware, but the ban was never effectively enforced and it was officially lifted in 2013. Plastic litter in China has become known as “white pollution”. Prior to 2008 about 3 billion plastic bags were used in China every day, creating more than 3 million tons of garbage each year. To curb the production and consumption of plastic bags, in 2008 the Government of China introduced a ban on bags thinner than 25 microns and a levy on thicker ones, promoting the use of durable cloth bags and shopping baskets.

Exemptions were allowed for bags used in the handling of fresh food such as raw meat and noodles for hygiene reasons. One year after the introduction of the legislation, the distribution of plastic bags in supermarkets fell on average by 70%, avoiding the use of 40 billion bags. Within seven years, the number of plastic bags used by supermarkets and shopping malls shrank by two-thirds, with 1.4 million tons of bags avoided. However, plastic bags do remain common, especially in rural areas and farmers’ markets, due to weak enforcement.

2.4.2 Bangladesh

In the early 1990s, environmental NGOs and the Ministry of the Environment of Bangladesh started supporting campaigns against single-use plastic bags. Initially limited to Dhaka, the capital city, the initiatives rapidly spread throughout the country due to the large positive response received from the public. Environmental groups estimated that in 2002, more than nine million plastic bags were wasted daily in the capital city of Dhaka. Of this, about 10% reached landfills and dumpsites, while the remaining was improperly discarded in the environment.

In 2002, after plastic bags were found responsible for exacerbating the deadly flooding of 1989 and blocking drainage systems in 1998, the government introduced a ban on all shopping bags made of polyethylene (PE). After the implementation of the ban, the government promoted a campaign informing citizens that offenders could face fines of up to \$71 and six months in jail. Despite public support, the ban was not

strictly enforced and plastic bags are still widely used in Bangladesh, especially in food markets. Activists found that the lack of cheap alternatives largely contributed to the failure of the policy.

2.4.3 Austria

In 2016 the Federal Ministry of Agriculture, Forestry, Environment and Water Management of Austria signed an agreement with large retailers and environmental protection organizations to reduce the usage of carrier bags. The agreement sets a target more ambitious than the one in the EU Directive, aiming to reduce the consumption of plastic bags to a maximum of 25 bags per person per year, including also any single-use carrier bags made from other materials such as paper.

As of January 2017, most of Austria's large supermarket chains have voluntarily stopped providing customers with free carrier bags (made from any kind of material). Some supermarkets have gone a step further and if customers don't bring their own shopping bags, they can only purchase reusable ones at the checkout counters.

The government will support the promotion of awareness raising campaigns and environmental projects. A first campaign targeting customers via radio, print and social media was implemented from February to April 2017. To monitor and communicate the progress of the policy, a report will be published annually with an analysis of data provided by the signing retailers.

2.4.4 Rwanda

In 2004, the Rwandan Ministry of Environment, concerned by the improper disposal of plastic bags, as they were often burned or clogged drainage systems, commissioned a baseline study which revealed that plastic bag litter was threatening agricultural production, contaminating water sources, killing fish and creating visual pollution.

In 2008 the Rwandan government banned the manufacturing, use, sale and importation of all plastic bags. Paper bags replaced plastic ones, and citizens also started using reusable bags made of cotton. Along with the new ban, tax incentives were provided to companies willing to invest in plastic recycling equipment or in the manufacturing of environmentally friendly bags.

Critics claim that stakeholders were insufficiently consulted during the policy

design and that the poorest fractions of the population were not considered. Despite the good intentions, after the entry into force of the ban, investments in recycling technologies were lacking, as were good and cheap alternatives.

As a result, people started smuggling plastic bags from neighboring countries and a lucrative black market emerged. With time, enforcement of the law became stricter, and if caught, offenders would face high fines and even jail. In the long run, citizens became used to the new regulation and, Kigali, the capital of Rwanda, was nominated by UN Habitat in 2008 as the cleanest city in Africa.

2.5 Reviews on Previous Studies

Legesse Adane and Diriba Muleta (2011) studied that Plastic bag wastes pose serious environmental pollutions and health problems in humans and animals. The situation is worsened in economically disadvantaged countries like Ethiopia. The trend of utilization of plastic bags is increasing from time to time in spite of a good deal of awareness of the residents about the adverse effects of these products. In order to reduce the problems associated with plastic bag wastes, it is recommended to educate the public (1) not to use plastic bags, and (2) to use eco-friendly alternative materials (bags) made from clothes, natural fibers and paper. City level legislation is also highly recommended against indiscriminate use and disposal of plastic bag wastes as well as to end free distribution of plastic bags by retailers.

Dipankar Das and Bijan Sarkar (2015) studied that Environment as also civilization is threatened by environmental pollution. There are different types of pollution in the world and one of them is plastic pollution. Plastic pollution increases in geometric rate and now it is a big challenge for civilization. Plastic is cheap, easily applicable, every where available, easy to use, easy to expel, so it is popular. But plastic pollution is very harmful to the environment. In this situation awareness towards plastic pollution is an important issue. If we have some awareness then the part of the problem may be reduced. If we do not aware in right time then in future the plastic totally engulf the human civilization and then we have no way to escape from the problem. If future generations are aware about plastic pollution then the problem somehow will reduce in future.

Gooi Bee Sung (2010) studied that the usage of plastic bag has causes both convenience and inconvenience in our daily lives. It causes environmental hazards as most plastic bags are not bio-degradable. Hygiene and wastage issue are also being

alarmed as plastic bag can be seen littered all across the town. Usage of plastic bag for hot edible items not only causes such inconveniences but it may also cause health hazards of the consumer. Plastic bag is commonly used to pack hot edible items in hawker stall, food court and coffee shop in Penang. The danger arises when wrong type of plastic is being used as chemical migration between plastic and food can be maximized by temperature and content as there is direct contact between the hot edible items and the plastic itself. According to green marketing concept, stakeholders such as the consumer play a pivotal role in the environmental and health consciousness. Business owner will have to align with consumer's opinion on green issue so that their business will not be affected.

CHAPTER III

OVERVIEW OF PLASTIC POLLUTION CONTROL IN MYANMAR

3.1 Policy and Regulations Related to Pollution

There are some national and local policies, laws and regulations associated with waste management. Myanmar's National Environmental Policy of 1994 instituted environmental regulations concerning the utilization, conservation, and prevention of environmental degradation including water, land, forest, mineral, marine resources, and other natural resources. In addition, Myanmar's Agenda 21 commitment (1997) on implementing the integrated management of natural resources provides a blueprint for achieving specific targets on environmentally sustainable development into the daily activities and decisions of individuals, households, communities, corporations and the government.

In 2009, the country's National Sustainable Development Strategy (NSDS) was prepared, marking an important step for Myanmar as this guiding document aims to ensure development remains in harmony with the three main pillars of sustainability: environment, economy and society. The National Environmental Conservation Law and the Environmental Conservation Department (ECD) were also established in 2012 as mechanisms to enforce environmental conservation and protection.

After two years later in 2014, Environmental Conservation Rules was issued for the implementation of the law. In 2015, The Environmental Quality (Emission) Guidelines and the Procedures for Environmental Impact Assessment were also established at the national level with a view to prevent potentially adverse environmental and social impacts resulting from development projects. With an objective to develop and implement the holistic and integrated waste management strategy based on principles of inclusiveness, zero waste, zero emission and circular economy achieve a greener, cleaner and healthier environment in Myanmar, National Waste Management Strategy and Action Plan (2017-2030) is being provisioning.

Myanmar Sustainable Development Plan (2018 – 2030) also adopted guidance concerned with environment and sustainable development. At the national level, environmental conservation law (2012) is the supreme law for environmental related affairs. In environmental conservation law, pollution is defined as any direct or indirect alteration, effect of the physical, thermal, chemical or biological properties of any part of the environment including land, water and atmosphere by discharging, emitting or depositing environmental hazardous substances, pollutants or wastes so as to affect beneficial use of environment, or to affect public health, safety or welfare, or animals and plants or to contravene any condition, limitation or prohibition contained in the prior permission issued under this Law.

There are some prohibitions and penalties causing environmental pollution. According to environmental conservation law 2012 section 14, a person causing a point source of pollution shall treat, emit, discharge and deposit the substances which cause pollution in the environment in accord with stipulated environmental quality standards shall be imprisoned for a term not exceeding one year or with fine, or with both.

In section 15, the owner or occupier of any business, material or place which causes a point source of pollution shall install or use an on-site facility or controlling equipment in order to monitor, control, manage, reduce or eliminate environmental pollution. If it is impractical, it shall be arranged to dispose the wastes in accord with environmentally sound methods. The penalty for this section is imprisonment for a term not exceeding one year or with fine, or with both.

Moreover, YCDC and MCDC law also set some prohibitions for pollution control and cleansing, but people do not even know what rules and regulations are there to follow. Therefore, it is conspicuous that the relevant ministry and department are weak in enforcing their laws and regulations. In YCDC Law 2018, section 322, sub section (y), any person must not commit the following offences: Putting, dropping and throwing away dust, dirt, pieces of papers, plastic boxes, cups, bags and refuse and so on, and dead animals, dust bins, bags, packets of refuse or other things that smell bad in public spaces. Feeding animals is also prohibited. The penalty for this offence is the first offender must be fined from 50,000 MMK to 100,000 MMK or must be sentenced 3-months imprisonment or both. In MCDC Law 2014, section 105, sub section (c) Sweeping, dropping, emptying or throwing away litter or disgusting things in the flower garden, in the park and in the play grounds, on the empty land, into ditches, on the public roads and into the black lanes are prohibited. First offence: from

a fine of 10,000 Kyats to 50,000 Kyats. For repeated offence: from a fine of 30,000 Kyats to 100,000 Kyats or 3 months imprisonment.

3.2 Plastic Production and Waste Generation

Currently, there are a total of 146 plastic industries in Yangon. The organization called Myanmar Plastic Industries Association (MPIA) is the leading organization of plastic industry to represent 1,000 units of processed plastic in Myanmar and support the growth of the industry. In Myanmar, up to 250,000 metric tons of plastic are produced per year, and the production is expected to grow by 15 to 20 percent or more. Moreover, MPIA plans to double its output to 500,000 metric tons per year within five years. Due to the changing lifestyles of people and excessive consumption habits are expected to drive the demand for plastic packaging industry. Since more than 20 years ago, plastic bags have been produced in Myanmar. Most of the packaging containers are made of polymers, with high-density polyethylene (HDPE), low-density polyethylene (LDPE), polyethylene terephthalate (PET), polypropylene (PP) and (PVC) polyvinyl chloride. However, since 2009, manufacturers are required to stamp “Reduce, Reuse, and Recycle” on all plastic bags.(MPIA,2017)

Solid waste generated in Myanmar was 5,616 tons per day with per capita waste generation of 0.44 kilograms per capita per day. By 2025, the report forecasts that number to reach about 21,012 tons per day with 0.85 kilograms per capita due to an increase in consumption and urban population growth, and a lack of effective waste treatment (World Bank Report, 2012). Approximately, 55 per cent is generated by three major cities out of total waste generation in the country, including Mandalay (955 tons/day), Yangon (1,981 tons/day), and Nay Pyi Taw (160 tons/day). According to these three cities municipal data, plastic waste is composed of 19.7 percent in YCDC, 15 percent in MCDC and 10 percent in NPTDC. Moreover, 80 million plastic bags are used every day in Myanmar, and waste management expert Friedor Jeske estimates four plastic bags are used per person daily, and the amount of plastic waste has tripled over the last five years and more than 200 tons of wastes enter Myanmar’s waterways every day. Plastic wastes can be easily seen in beaches, mountains and cities than its reliable statistics. (IGES, 2017)

Table (3.1) Composition of Plastic in Municipal Solid Waste

Types of Waste	YCDC	MCDC	NPTDC
Organic	44.33%	65%	84.205%
Plastic	19.7%	15%	10.431%
Non-Combustible	20%	10%	2.834%
Combustible	15.95%	10%	2.53%
Total	100%	100%	100%

Source: YCDC, MCDC, NPTDC, 2016

3.3 Plastic Waste Management

In Myanmar, municipal solid wastes are managed by local municipal authorities and private sector involvement presently. In the three major cities, Nay Pyi Taw, Yangon and Mandalay, their autonomous City Development Committees and their Pollution Control and Cleansing Departments handle the generated wastes within their municipal areas. In others parts of the country, Township Development Committees under the Local Government manage waste collection and disposal. Currently, Plastic wastes are managed by four methods: landfill, incineration, energy recovery and recycling. Landfill is most widely used method in Myanmar, in large cities 80 to 90 percent is dumped through a semi-controlled method, and in towns, around 60 to 70 percent of wastes are collected and open dumping is widespread, while 40 percent of waste is disposed in water channels directly in rural areas.

All wastes are being discharged without applying sorting system and also included recyclable materials. Their capacities to accept waste is to a certain extent, and it has an adverse effect to the environment. As there is no sorting system and disposing for long time and heat resulting in high temperature, landfill fires generates dense smoke and noxious fumes. In addition to awful odors, uncontrolled dumps pose a number of health hazards as well as air, land and water pollution. The recent fire at Htein Bin landfill in Hlaing Thar Yar Township in which 26 people were hospitalized and smoke from the burning garbage especially plastics have affected several townships in Western Yangon was a clear reminder that relationship between plastic and human beings has become toxic. (IGES, 2017)

Table (3.2) Major Landfill Sites in Yangon

No	Location	Capacity (t/d)	Condition	Remarks
1	Htein Bin	1,080	Open Dumping	Operating
2	Dawai Chaung	843	Open Dumping	Operating
3	Shwe Pyi Thar	61	Open Dumping	Operating
4	Mingalardon	43	Open Dumping	Operating
5	Dala	33	Open Dumping	Operating
6	Seikiyi Khanaungto	4	Open Dumping	Operating

Source: YCDC, 2016

There are totally six final disposal sites in Yangon, and they can accept 2,064 tons of waste per day. In Yangon, households and industry generate 1,981 tonnes of waste per day and most of the wastes are dumped in the landfill sites without any treatment. The greenhouse gas such as carbon dioxide and methane gas are also released from those landfill sites into the atmosphere. Only 60 tonnes of rubbish everyday are converted into 1,000 megawatts in Myanmar's first waste-powered power plant near Hlawga Lake in Shwepyitha Township built in 2017.

Table (3.3) Major Landfill Sites in Mandalay

No	Location	Capacity (t/d)	Condition	Remarks
1	Kyar Ni Kan (North)	500	Open Dumping	Operating
2	Thaung Inn Myount Inn (South)	400	Open Dumping	Operating
3	New Braway factory	142	Open Dumping	Closed in 2009
4	New Kandawgyi pond	80	Open Dumping	Closed in 2009
5	New Zannkalow pond	28	Open Dumping	Closed in 2007
6	Corner of N/E Mandalay	450	Open Dumping	Closed in 2013

Source: MCDC, 2016

Mandalay city has six disposal sites in the past, but nowadays, only two disposal sites can be used. Their total capacity to accept waste per day is 900 tons, and according to MCDC report, household and industry generate 955 tons of wastes per day. Therefore, the waste generation rate and acceptable capacity is not in balance

condition. Although MCDC installed an incinerator which can handle municipal waste (30 tons/day) in Thaug Inn Myount Inn (South) landfill, this is not operational.

Table (3.4) Major Landfill Sites in Nay Pyi Taw

No	Location	Capacity (t/d)	Condition	Remarks
1	Disposal Site No. 1	80 tons	Open Dumping	Operating
2	Disposal Site No. 2	4 tons	Open Dumping	Operating
3	Disposal Site No. 3	8 tons	Open Dumping	Operating
4	Disposal Site No. 4	32 tons	Open Dumping	Operating
5	Disposal Site No. 5	17 tons	Open Dumping	Operating
6	Disposal Site No. 6	19 tons	Open Dumping	Operating

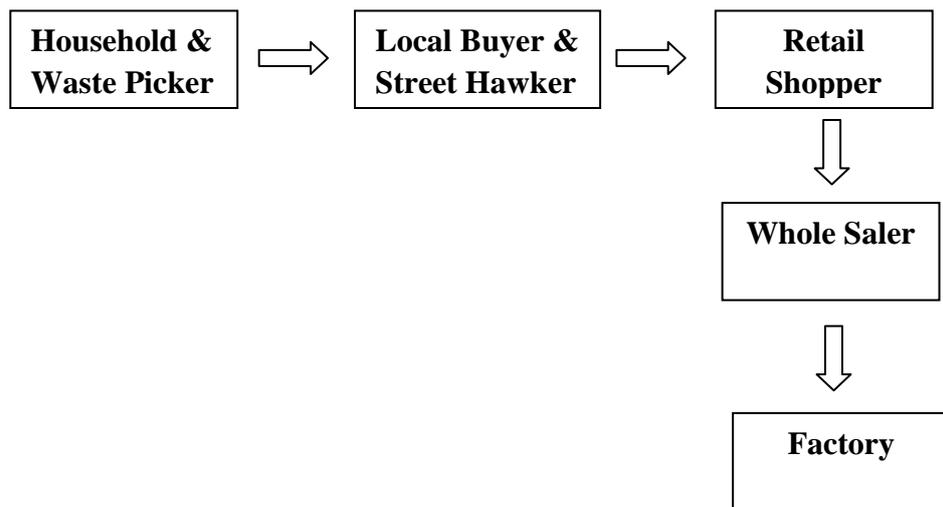
Source: NPTDC, 2016

With the acceptable capacity of 160 tons of waste per day, there are totally 160tons of generated wastes from household and industry, and wastes are dumped in six disposal sites without any treatment.

Recycling of plastic waste is conducted in Myanmar mostly by the informal waste sector such as waste pickers, waste collectors, and waste dealers. They collect recyclable plastic materials from households, communal depots, streets, commercial areas and final disposal sites, and sell these items to waste dealers who clean, sort, and store and sell them in bulk to the recycling industry both locally and for export.

Currently, there is no reliable data on recycling volumes, ratios, and the numbers of recycling factories present in Myanmar cities. It is estimated that roughly 400 small and medium-size recycling enterprises are operated in Mandalay. In Yangon, there are over 500 small scale recycling shops are operating in Yangon, and 86 tonnes of recyclable materials from the landfills are directed to the waste dealers per day, and out of this total 7 per cent is plastic.

Figure (3.1) Structure of Plastic Recycling Market



Source: YCDC

3.3.1 Recycling Plants in YCDC

Under the supervision of PCCD, YCDC is operating PVC recycling plant, plastic bag factory, plastic bin factory and high density recycle pipe factory. In 2000, YCDC started to run recycling plastic factory located in Ahlone Township, and started operating in 2001. PVC pipe recycling factory was founded in 2006 in order to eliminate the plastic bags which are collected as waste within Yangon City. The used broken PVCs pieces are used as raw materials, and then the PVC pipes (6m x 4"Φ x 4.5 mm) for the water pipe are produced. In this plant 100 viss of raw materials are used every day, and the unit cost of production is about 10000 Ks. The market price for each PVC pipe is 40000 Ks. This plant is very cost-effective as all the damaged raw materials during process can be recovered for next production, but PVC pipes are not suitable to be used for drinking purpose because Phthalates which can cause damage to the liver, kidneys and heart leaches out from PVC.

Since 2001, the plastic bag factory was founded, and normally, 300lbs of the second class recycled pellets are used as the raw material for the production every day. Three kinds of plastic bags based on color are produced, but only the black color plastic bags are produced at this moment. The production rate is about 3000 bags per day, and these bags are sold for 50 Ks per bag in all four districts. The plastic bin factory uses the discarded plastic bags as raw materials which are purchased from municipal workers with the price of 50 Ks per viss. Currently, three types of dust bin,

12”Φ, 22” height dust bin, 16”Φ, 22” height dust bin, and 24”Φ, 34” height dust bin are produced. The production rate is 20 unit of dust bin by using 125 lbs of plastic bags. In January 2009, high density recycled pipe factory was initiated, and discarded plastic bags are used as raw material. Waste to finished product ratio is 4:1, and the production rate is 20 units by using 125 lbs of plastic bags. The produced pipes are delivered to Playgrounds, Parks and Garden Department of YCDC.

Table (3.5) Recycling Plants in YCDC

Established Year	Types of Factory	Types of Product	Generation rate	Market Price
2000	Recycling plastic factory	-	-	-
2001	Plastic bin factory	Three types of dust bin	20 unit/day	-
2001	Plastic bag factory	Three kinds of plastic bags	3000 bags/day	50 Ks/ bag
2006	PVC pipe recycling factory	PVC pipes	-	40000 Ks/pipe
2009	High density recycled pipe factory	Plastic pipes	20 units	-

Source: YCDC

3.4 3R Initiative

Although Myanmar has agreed action plan at G8 Summit to promote 3R activities since 2004, however, the specific 3R activities practicing related policies as well as Laws, Rules of Law have not been framed. According to national economic trend, 3R concerned principles have to be included, so the Environmental Conservation Department under the Ministry of Natural Resources and Environmental Conservation has been formulating the National Waste Management Strategy and Action Plan (2017-2030). The national-level policy covers three strategic areas- clean environment and health, functioning ecosystems, sustainable development and mainstreaming environmental protection and management. In this strategic plan all

kinds of solid and liquid wastes, hazardous waste, electronic waste, plastic waste, industrial waste, etc are planned to handle with the following six strategic goals;

- Goal A :** Extending sound waste collection service to all citizens and eliminate uncontrolled disposal and open burning
- Goal B :** Extending sustainable and environmentally sound management of industrial and other hazardous wastes
- Goal C :** Substantively reduce waste through 3Rs (reduce, reuse, and recycle) and thereby establish a resource circular society
- Goal D :** Ensure sustainable financing mechanisms
- Goal E :** Awareness Raising, Advocacy and Capacity Building
- Goal F :** Compliance, Monitoring, Enforcement, and Recognition

Some key targets and propose activities to be implemented are specified in this National Waste Management Strategy and Action Plan for Myanmar. People who are involving the formulation and implementation work are making strong effort to achieve the above mentioned outputs.

3.5 Plastic Pollution Control and Public Awareness Promoting Activities

On October 2009, the Yangon City Development Committee (YCDC), Myanmar officially announced to ban businesses from manufacturing, importing, trading or distributing high-density polyethylene (HDPE) plastic bags for environmental reasons. Two years after Mandalay city's achievement to prohibit polyethylene bags, the authorities in Yangon also attempted not to allow the production, storage and sales of non-biodegradable waste such as polyethylene bags and ropes in April 22, 2011. Authorities have subsequently declared the north-western areas of Myitgyina and Sagaing plastic-bag free zones. In November 2009, authorities extended plastic bag producers a grace period of four months in which to cease production in Yangon. Due to the government's weak enforcement for sustainable banning, the plastic culture still remains and returns popularity nationwide.

In order to raise awareness of people on plastic pollution and environmental conservation and to get people more practices, government, associations and companies also try to take measure for protecting the environment. Since 2017, The Yangon Region Government, YCDC and volunteers initiated a community awareness campaign called Clean Yangon in order to conduct waste management practices in cooperation with international organizations and stakeholders. In 2018, with the aim

to reduce single use plastic pollution in Myanmar, Thant Myanmar is formed as the first initiatives that raise awareness of plastic pollution and mobilize action through communication campaigns and social network to reduce plastic waste and littering in Myanmar. Their vision is to see less plastic used, more items reused and recycled by 2025 through strong commitment and engagement among individuals, companies, civil society and government in Myanmar. RecyGlo is a first registered recycling service company whose business began since 2017 in Myanmar. It provides different services such as waste segregation, waste awareness training, waste collection service and logistic service to recycling centers and general waste to dump site. Coca-Cola Myanmar also has launched a nationwide recycling awareness campaign called “Tan Bo Shi Tal” which literally means “it has value” in Myanmar language. The goal is to highlight the importance of bottle and can segregation at all steps. With the objective of encouraging responsible business conduct throughout Myanmar, The Myanmar Centre for Responsible Business (MCRB) was established in 2013, and issued some guidelines as well as ideas for other organization, and for the venues MCRB uses to reduce plastic and waste at meetings. The environmentalists say that plastic pollution awareness is at nascent stage in Myanmar, and plastic pollution at the policy level is needed to address, and put in place instruments that will make it more expensive to use single use plastic and cheaper to use more sustainable materials.

3.6 Environmental Education in Myanmar

Environmental Education is important as it provides the necessary knowledge, values and skills needed by the public and decision-makers to understand the complexities of the environment. According to Chapter 36 in Global Agenda 21, The National Commission for the Environmental affairs (NCEA) is the main responsible agency for promoting public awareness on environmental matters, and it seeks to establish Environmental Education courses at both the basic and higher education level. Environmental Education in Myanmar is aimed at creating a wider knowledge of the environment among the people. It is also aimed at achieving ethical awareness in promoting sustainable use of natural resources. At the basic level, special unit on environment such as protection and wise use of natural environment and cultural heritage, pollution, waste disposal, good sanitation and green environment are taught at the primary and secondary level. In order to raise younger generation’s awareness towards environmental conservation, tree plantings have been regularly taking place

every year in July in every school within the country. In Myanmar, studies of environmental course was not separately provided at the University level, but conservation, protection of natural resources and ecology were taught in the respective sections of Geography, Geology, Botany, Zoology, Agriculture, Forestry and Marine Science courses. But in order to promote research within this area, a post graduate course in Environmental Planning and Management is offered at the Yangon Institute of Technology in 1998, and nowadays, Master and Ph.D courses in Environmental Studies are also offered at not only in Technological Universities also in Art and Science University.

In the formal education sector, environmental education and awareness is promoted by teaching the younger generations towards information and issues on environment and development. Since 1996, according to “Education for All” program, an Environmental Education program was begun in some thirty townships by the United Nations agencies, Non-governmental agencies, and the Department of Basic Education. The program covers such environmental topics such as population control, energy problems, and consumptions of natural resources, soil conservation, health care and home economy as a way to help people to solve the environmental problems faced in daily life. Another important program, “Improving Access of Children, Women and Men of the Poorest Communities to Primary Education for All” began in eleven townships in 1996. The aims of this project are (1) to promote respect and appreciation for the environment; (2) to teach environmental principles, such as the need to conserve natural resources and biodiversity; (3) to teach about environmental issues, such as deforestation and pollution; and (4) to provide the knowledge and skills necessary to tackle environmental problems. At the national level, since 1994, under the provision of the NCEA, nation-wide World Environment Day celebrations have been held, aiming at promoting public environmental awareness and involving local communities in environmental conservation programmes. On February 2018, with the theme of the WED “Beat Plastic Pollution”, the world come together to combat single-use plastic pollution. It urges governments, industry, communities and individuals to explore sustainable alternatives and to urgently reduce the production and excessive use of single-use plastic polluting oceans, damaging marine life and threatening health. These actions will particularly support progress not only on the Sustainable Development Goal target SDG 14.1 and also SDG 12.1. SDG 14.1 aims to prevent and significantly reduce marine pollution of

all kinds, including marine debris and nutrient pollution through land-based activities. SDG 12.4 targets focused on reducing waste generation and encouraging sustainable practices.

In Myanmar, the first step such public awareness was actually taken about twenty years ago. The effectiveness of environmental programs depends on the level of public participation. No environmental program can succeed if the public is unaware of the importance of environmental conservation, and does not actively participate in it. In developing countries like Myanmar, environmental education is being linked to the elimination of hunger, poverty, illiteracy, and repression as well as the enhancement of equality and harmony among nations. When compared to the situation in more developed countries, the people of Myanmar may find it more urgent to provide for the basic needs than to solve environmental problems. (Hla Hla Win, 2001)

3.7 Perspective of Key Stakeholders

The political will of the authoritative person are very important for a successful policy implementation, and their opinion affects another stakeholder. A lot of public figures in Myanmar have also urged the public to avoid using plastics due to health and environment issues. The perspectives of the following key stakeholders such as government officials, ambassador, and waste management specialist are presented.

U Phyo Min Thein, Yangon Region Chief Minister

According to the Yangon Region Chief Minister, the plastic waste management services for recycle, recovery and reuse are being implemented in Yangon City. He also mentioned the huge negative impact of plastic waste on the environment and important needs of substitute things for the people, and it has a little difficulty as substitute things cannot be provided. Finally, He pointed out the sense of taking responsibilities of all citizens to keep the environment clean and green.(www.7daydaily.com/story/128250)

Dr. Zaw Myint Maung, Mandalay Region Chief Minister

He said according to the Mandalay City Waste Management Strategic Plan, community based waste management system is being established, and on every Sunday MCDC collects waste by categorizing as either reusable or recyclable waste. He asserted that in waste generation and plastic consumption reduction activities, public participation is crucially important, especially housewives who are operating the kitchen. (www.7daydaily.com/story/128250)

Kristian Schmidt, EU ambassador to Myanmar

His Excellency Kristian Schmidt said that plastic has been evolved last over 100 years, food are being packed in different types in Myanmar, even if plastics is eliminated from our society, society would not be collapsed as there are many alternative ways before the invention of plastic. He again stated that plastic pollution is global problem, and 13 million of plastic wastes are discharged into ocean annually, so plastic pollution damages the domestic economy especially, fishermen as well as tourism industry. He mentioned that the cost of environmental destruction due to plastic pollution is about 8 billion USD in every year. (www.myanmar.mmtimes.com/news/111244.html)

Dr. Aung Myint Maw, Deputy Head of Pollution Control Department, Yangon City Development Committee

In Yangon, commercial city, 10 per cent of total waste generation is plastic related wastes, according to 2014 survey based on Yangon population. People are using plastics because it can get easily. Therefore, public must reduce their plastic consumption to some extent. For example- if one person reduces one plastic bag for one day, 7 million of plastic bags would be reduced as there are 7 million of people in Yangon. Reduction of using plastic is the right way to combat plastic pollution. (www.shwemom.com/plastic-pollution-in-the-ocean-set-to-triple-by-2025-Is)

Mr Friedor Jeske, Waste Management Specialist, and Member of Thant Myanmar

He estimated that the amount plastic waste has tripled over the last five years ago in Myanmar and about 200 tons of plastic wastes enter into Myanmar's waterways every day. He suggested that to reduce plastic consumption, taxation to plastic

consumption should be applied, and as most of the places in Myanmar are filled with plastic wastes, plastic waste management should be established properly, and taxation to users is the one of the alternatives. He also asserted that the problem with waste management in Myanmar is the lack of subsidize fund, not the lack of knowledge. (www.myanmar.mmtimes.com/news/111244.html)

CHAPTER IV

SURVEY ANALYSIS

4.1 Survey Profile

To fulfill the objective of exploring current status of community's perceptions on plastic pollution and environmental conservation, one of the townships from YCDC administration, Kyee Myin Daing Township was selected as study area. It is located in the western part of Yangon, and its neighbor townships are Kamayut Township, Twante Township, Sanchaung Township and Ahlone Township. With total area 12.5 Km², there are 22 wards, and Yangon River divides Kyee Myin Daing into East and West parts. The following table shows the demographic characteristics of Kyee Myin Daing Township.

Table (4.1) Demographic Characteristics of Kyee Myin Daing Township

Total population	101,287
Males	47,274
Females	54,013
Percentage of urban population	100.0%
Area (Km ²)	12.5
Population density (persons per Km ²)	8,955.4 persons
Mean household size	4.6 persons
Number of wards	22

Source: Kyee Myin Daing Township General Administration Department (2017)

The number of female is higher than the number of male in Kyee Myin Daing Township. The entire population in the Township lives in urban areas. The population density of Kyee Myin Daing Township is 8,955 persons per square kilometre. There are 4.6 persons living in each household in Kyee Myin Daing Township.

4.2 Survey Design

The structured questionnaire was designed to consist of four main parts. The first section consists of questions relating to the characteristics of the respondents. In second section, the questions are related to the knowledge on Plastic Pollution by respondents. In third section, the questions are referred to the attitude of Respondents on Plastic Pollution. In fourth section, the questions are concerned with practice of Respondents on Plastic Pollution. Simple random sampling method is used for this study. There are 22 wards in Kyee Myin Daing Township and 7 wards (30%) were selected from the total wards. The required sample size is determined by using the formula in appendix (B). Total number of respondents is 265. Afterward, collected data are entered and analyzed by using statistical software SPSS.

4.3 Survey Results

The survey findings are presented with the following tables in each part of the conducted survey. There are four parts in survey findings: Characteristics of the respondents, Knowledge of Respondents on Plastic Pollution, Attitude of Respondents on Plastic Pollution and Practice of Respondents on Plastic Pollution.

4.2.1 Characteristics of the Respondents

The following Tables show the characteristics of the respondents which include gender, age, education, and occupation are shown in Table (4.2).

Table (4.2) Characteristics of Respondents

No	Variable	Characteristics	Number of Respondents	Percentage
1	Gender	Male	116	43.8
		Female	149	56.2
		Total	265	100%
2	Age	13-19	41	15.5
		20-29	141	53.2
		30-39	42	15.8
		40-49	16	6.0
		50-59	22	8.3
		60~	3	1.1
		Total	265	100%
4	Education	Uneducated	4	1.5
		High School	14	5.3
		Graduated	125	47.2
		Master Degree	112	42.3
		Doctorate	10	3.8
		Total	265	100%
5	Occupation	Own Business	47	17.7
		Dependent	24	9.1
		Student	77	29.1
		Civil Servant	44	16.6
		Company Staff	71	26.8
		Artist	2	0.8
		Total	265	100%

Source: Survey Data, 2019

The above table (4.2) shows characteristics of respondents in study area, in which 43.8 percent are male and 56.2 percent are female. Therefore, the numbers of female respondents are higher than male respondents in this survey. Among 265 respondents,

the youngest age of respondent is 13 year old and above 60 is the oldest one. About 53.2 percent, half of the population is 20 to 29 years old. Age distribution of population is said to be concentrated at 20 to 29 year.

As shown in table (4.2), among 265 respondents, 47.2 percent are graduated, 42.3 percent are master degree, 3.8 percent are doctorate, 5.3 percent are high school and 1.5 percent is uneducated respectively. Most of the respondents are those who already graduate and have got master degree. Therefore, the study population is covered with well educated person and their cooperation is very satisfying. The finding of present study is mainly focused on level of individual respondent's knowledge, attitude and practice regarding plastic pollution.

In this study, 29.1 percent of respondents are student, 26.8 percent are private employee, 17.7 percent are doing their own business, 16.6 percent are civil servant and the remaining of 9.1 percent are dependents. Therefore, most of the respondents are still student who are currently unemployed.

4.3.2 Knowledge of Plastic Pollution by Respondents

In this section, respondents are asked about their knowledge on plastic pollution, and how they know about plastic pollution from which sources.

Table (4.3) Perception about Plastic Pollution by Respondents

Concern about Plastic Pollution	No of Respondents	Percent
Yes	258	97.4
No	5	1.9
Haven't thought about it	2	0.8
Total	265	100.0

Source: Survey Data, 2019

Table (4.3) shows that 258 respondents out of 265 respondents concern about plastic pollution, only 2 respondents answer haven't thought about it to the question and 5 respondents do not concern about it. Since most of the respondents are graduated and student, respondents notice that plastic are polluted in the environment.

Plastic wastes can be seen everywhere, and most of the public spaces are filled with plastic wastes.

Table (4.4) Source of Knowledge about Plastic Pollution

Source	No of Respondents	Percent
Documentary Film	25	9.4
Flyer	18	6.8
Television	45	17.0
Book	58	21.9
Social Media	62	23.4
School Lesson	10	3.8
Campaigns	24	9.1
Other	23	8.7
Total	265	100.0

Source: Survey Data, 2019

According to table (4.4), 23.4 percent of respondents obtain their knowledge about plastic pollution from social media, and 21.9 percent of respondents obtain it by reading books. Television is the third source from which respondent obtain knowledge. The other sources are documentary film, flyer, school lesson, campaigns. Therefore, social media is the best way to communicate and mobilize the people. There are non-government organization like Thant Myanmar and other environmental organization mobilize people on social media to notice the adverse effects of plastic pollution, and these organizations encourage people to participate in plastic pollution elimination activities, and to practice 3R.

Table (4.5) Occurrence of Plastic Wastes

Occurrence	No of Respondents	Percent
Parks	20	7.5
Markets	46	17.4
Residential Places	27	10.2
Roadsides	56	21.1
Drainage System	108	40.8
Open Spaces	4	1.5
Do not aware	4	1.5
Total	265	100.0

Source: Survey Data, 2019

As shown in table (4.5), 40.8 percent of respondents answer that plastic waste are mostly occurred in drainage system, and 21.1 percent of respondents answer plastic waste are mostly occurred on the road sides. 17.4 percent in markets, 10.2 percent in residential places, 7.5 percent in parks, 1.5 percent in open spaces and 1.5 percent of respondent do not notice anywhere. Most of the urban flood during rainy season is directly related to the blockage of plastic in the drainage system.

Table (4.6) Types of Problems Caused by Plastic Pollution

Problems	No of Respondents	Percent
Animal Health	13	4.9
Human Health	54	20.4
Blockage of drainage	120	45.3
Deterioration of the beauty of environment	75	28.3
Nothing else	3	1.1
Total	265	100.0

Source: Survey Data, 2019

Table (4.6) shows that the problem mostly occurred by plastic waste in study area is blockage of drainage, and deterioration of the beauty of environment is the second most occurred problem in study area. The other problem such as animal health and human health problem are least occurred. The blockage of drainage problem is mostly occurred not only in rainy season but in others season, and it cost extra charges to clean the plastic wastes, and mosquitoes breed in drainage system, and road are flooded during the monsoon.

Table (4.7) Knowledge of the Origin of Plastic by Respondents

Origin	No of Respondents	Percent
Fossil Fuel	38	14.3
Chemical	214	80.8
Tree Product	13	4.9
Total	265	100.0

Source: Survey Data, 2019

According to table (4.7), 80.3 percent of respondent answer that plastic is made from chemical, 14.3 percent answer fossil fuel, and the rest of 4.9 percent answer it is made from tree product. More than 99% of plastics are produced from chemicals derived from oil, natural gas and coal.

Table (4.8) Knowledge of Health Problems Caused by Excessive Consumption of Plastic

Health Problems	Yes	Percent	No	Percent
Heart, Nerves and Hormones Problem caused by plastic	208	78.5	57	21.5
Cancer caused by carrying hot items in plastic bags	249	94.0	16	6.0
Cancer caused by dioxin gas	241	90.9	24	9.1

Source: Survey Data, 2019

As in table (4.8), 78.5 percent of respondents out of 100 percent know that excessive consumption of plastic can affect heart, nerves and hormonal problem in human beings, but 21.5 percent of respondents do not know these adverse effects. 94 percent of respondents know that carrying hot items in plastic bags can cancer, but only 6 percent of respondents do not know that. 90.9 percent of respondents know that burning from plastic releases toxic gas called dioxin which can cause orthopedic cancer, but only 9.1 percent do not know these adverse effects. Although there are no evidence that the above mentioned diseases are caused by plastics, but there is a relations with those diseases and plastics are in certain way. Medical researches shows that the additive used in plastic like BPA can affect the male reproductive system.

Table (4.9) Knowledge of Treatment after Used Plastics

Treatment	No of Respondents	Percent
Incineration	66	24.9
Landfill	22	8.3
Recycle	177	66.8
Total	265	100.0

Source: Survey Data, 2019

According to table (4.9), most of the respondents (66.8) percent answer that plastic can be treated by recycling it after using it, 24.9 percent of respondents answer incineration is the way to treat the used plastic, but 8.3 percent answer landfill is the another way to treat it. Therefore most of the respondents have waste management practice and some respondent practice wrong methods. People think that landfill and incineration is the best way to curb plastic, but they exist for thousands of years without degrading. Moreover, toxic gas from burning plastics can cause cancer related diseases.

4.3.3 Attitude of Respondents on Plastic Pollution

In this section, respondents are asked their attitude on plastic pollution and how they identify this problem.

Table (4.10) Main Reason for Using Plastic Products

Main Reason for using plastic	No of Respondents	Percent
Cheap	25	9.4
Light weight	38	14.3
Easily available	143	54.0
No Alternative	59	22.3
Total	265	100.0

Source: Survey Data, 2019

According to table (4.10), among 265 respondents, 54 percent of respondents answer that they are using plastic as it can get easily in the market, 22.3 percent answer that since they have no alternative, they are using plastic, 14.3 percent answer that plastic is light weight to carry, and 9.4 percent answer that the main reason for using plastic is it is cheap. Since plastics are easily available in the market, most of the people do not bring their own bag to carry items. Moreover, some shops use the plastic bags more than necessary and customers sometimes also ask to give more plastic bags.

Table (4.11) Reasons to Reduce Plastic Pollution by Respondents

Attitude	Reasons			
Yes	Animal death	Human health	Environmental damages	Total
	15.8	24.9	43.4	84.2
No	No interest	No Alternative	Follows to others	Total
	4.2	4.9	6.8	15.8

Source: Survey Data, 2019

According to table (4.11), 15.8 percent of respondents wish to reduce plastic pollution due to its impact to animal, 24.9 percent of respondents want to do it because it can affect to human health, and 43.4 percent of respondents have willingness to reduce plastic pollution as it damages the environment. But 4.2 percent of respondents do not want to do it as they have no interests on it, 4.9 percent of respondents also do not have desire since they have no alternative to choose, and 6.8 percent of respondents are still follows to others. According to survey result, Respondents know well about the adverse effects of plastics pollution and most of the respondents have intention to preserve natural environment, but some respondents do not want to change their attitude since others people also still use them, so public participation is the key to success to solve the problem.

Table (4.12) Attitude on Main Responsible Person to Reduce Plastic Pollution by Respondents

Responsible Person	No of Respondents	Percent
Government	31	11.7
NGO	6	2.3
Business Owner	13	4.9
Ourselves	215	81.1
Total	265	100.0

Source: Survey Data, 2019

Table (4.12) shows the respondents answers to question regarding the most responsible person for reduction plastic pollution. 81.1 percent of respondents answer that they are the most responsible person for doing it, 11.7 percent of respondents

answer that government have to take responsibility, 4.9 percent of respondents assume that business owners are the most responsible person to do so, and only 2.3 percent of respondents answer non-governmental organizations are the most responsible to do it. Self-awareness is the key to solve this problem without enforcing any kinds of measures. Government regulation is the additional key to solve the problem. All stakeholders participation can give the best solution for this problem, since only one cannot solve the problem.

Table (4.13) Attitude on No Plastic Day in Supermarket by Respondents

Opinion	No of Respondents	Percent
It is good for environmental conservation	238	89.8
It is inconvenient for me	27	10.2
Total	265	100.0

Source: Survey Data, 2019

Table (4.13) shows respondents' opinion for no plastic day in supermarket. 89.8 percent of respondents answer that it is good for environmental conservation, but 10.3 percent of respondents answer that it is inconvenient for them. In supermarket such as City Mart supermarket sets every Tuesday as no plastic day and customers must bring their own belongings. If someone else did not bring its own, they have to buy reusable bags from them.

Table (4.14) Opinion on the Most Necessary Options to Reduce Plastic Consumption by Respondents

Opinion	No of Respondents	Percent
Less plastic packaging, Plastic free items, Plastic alternatives	72	27.2
More recycle bins,	35	13.2
Places to buy reusable cups/bottles	98	37.0
More information on plastic pollution and how to cut down	60	22.6
Total	265	100.0

Source: Survey Data, 2019

The above table (4.14) shows the respondent's opinion of the most necessary options to reduce using plastics. 37 percent of respondents answer that providing places where can buy reusable cups and bottles is the most necessary to do it. 27.2 percent answer that using less plastic in packaging, selling plastic free items, and plastic alternatives is also the best way to curb plastic pollution. 22.6 percent of respondents answer that providing more information on plastic pollution and how to cut down it is the another options to reduce it, and 13.2 percent answer that placing more recycle bins is also the way to reduce plastic pollution. Changing without alternative cannot be successful in certain way. Although some people want to change their behavior, environment does not create the adaptable conditions, so they have to follows the other.

Table (4.15) Opinion on Plastic Consumption Rising by Respondents

Reasons	No of respondents	Percent
It is cheap	41	15.5
It is light weight	59	22.3
It is easily available	106	40.0
there is no alternative	7	2.6
Less knowledge of its adverse effect	52	19.6
Total	265	100.0

Source: Survey Data, 2019

In table (4.15), respondents' answers regarding the reason for the consumption of plastic rising are expressed. 40 percent of respondents answer that the reason for the consumption rising is it is easily available, 22.3 percent of respondents answer that it is light weight, 19.6 percent of respondents answer that less knowledge of its adverse effects is also the reason for consumption rising, and 2.6 percent of respondents point out that there is no alternative apart from plastic. As long as plastics are easily available in the market, there will still have consumption. However, awareness promoting activities are being done. It would not be successful without restriction the usage to some extent.

Table (4.16) Attitude on Banning the Consumption of Plastic by Respondents

Feelings	No of Respondents	Percent
It doesn't bother me	133	50.2
Should find other ways	56	21.1
Totally agree it	76	28.7
Total	265	100.0

Source: Survey Data, 2019

The above table (4.16) shows the feelings of respondents upon if the government banned the using of plastics. 50.2 percent of respondent answer that it does not affect them, but 21.1 percent suggest to find other ways instead of banning, and 28.7 percent of respondent totally agree on it.

Table (4.17) Attitude on An Extra Charge for Plastic Products by Respondents

Attitude of respondents	No of Respondents	Percent
Shall continue using it by paying extra charge	32	12.1
Bring my own items	233	87.9
Total	265	100.0

Source: Survey Data, 2019

The above table (4.17) shows the attitude of respondent upon an extra charge on plastic bag, bottle and cup. With the question regarding consumer have to pay extra charge for plastic products, 87.9 percent of respondent will bring their own items instead of paying extra charge for using plastic bag, bottle, and cup, but 12.1 percent shall continue using it by paying an extra charge. According to survey data, most people are still using plastics since it is easily available and no charge for it. If someone has to pay extra money for using it, consumption would be reduced, and consumer would find alternative to replace it.

4.3.4 Practice on Plastic Pollution by Respondents

In this section, respondents are asked their practice on plastic pollution and how they conduct this problem.

Table (4.18) The Items Used for Shopping by Respondents

Items used for shopping	No of Respondents	Percent
Plastic bag	194	73.2
Paper bag	54	20.4
Cloth bag	10	3.8
Others	7	2.6
Total	265	100.0

Source: Survey Data, 2019

In the table (4.18), the items which are used by respondents when they go shopping are shown. Most of the respondent, 73.2 percent use plastic bag for carrying item, but 20.4 percent use paper bag for same purpose, 3.8 percent use cloth bag, and 2.6 percent use others item for carrying things. Since plastic bags are easily available in the market and no extra charge for it, it is widely used in the market instead of reusable bag, cloth bag and paper bag extra.

Table (4.19) Types of Mostly Used Plastic Products by Respondents

Types Plastic Products	No of Respondents	Percent
Plastic bag	129	48.7
Plastic Bottle	106	40.0
Plastic buckets, bin, barrel	18	6.8
Plastic shoes	12	4.5
Total	265	100.0

Source: Survey Data, 2019

The above table (4.19) shows the plastic products which are used by respondents. According to the table, 48.7 percent of respondents use plastic bags, 40 percent of respondent use plastic bottle, 6.8 percent use plastic buckets, and bin, barrel and 4.5 percent use plastic shoes. As already mentioned above, easily available

in the market is the reason to choose plastic bag. There is also another reason, since plastics are cheap, and light weight.

Table (4.20) 3R Practices Done by Respondents

Practices	No of Respondents	Percent
Reduce	168	63.4
Reuse	38	14.3
Recycle	49	18.5
Above All	10	3.8
Total	265	100.0

Source: Survey Data, 2019

Table (4.20) shows the answer of respondents who practice one of the 3R practices. According to table, most of the respondent, 63.4 percent of respondent practice reduce, 18.5 percent practice recycle, 14.3 percent practice reuse and 3.8 percent of respondents practice all of these. From 3R practice, most people are familiar with reduce since it is easy to practice in anyway, and anyone can practice this way. Although recycle is the way to practice, but it costs too much and most people do not know how to conduct recycle.

Table (4.21) The Amounts of Daily Using Plastic Bags by Respondents

Amount of Daily Using Plastic Bags	No of Respondents	Frequency
1-3 bags	100	37.7
4-6 bags	131	49.4
above 7 bags	34	12.8
Total	265	100.0

Source: Survey Data, 2019

The above table (4.21) shows the amount of plastic used by respondents daily. According to table, most of the respondents 49.4 are using between 4 to 6 plastic bags every day, 37.7 percent are using between 1 to 3 plastic bags for daily purpose, and 12.8 percent are using above 7 plastic bags daily. There are 265 respondents in this survey. If 7 bags per day is multiplied by 265, there are 1855 plastic bags are being

used daily. The number is tremendous, and if consumption pattern is still in this way without changing much, pollution level would increase more and more.

Table (4.22) The Practice After Using Plastics Bags by Respondents

Practice	No of Respondents	Percentage
Separately dispose into bin	32	12.1
Dispose with other waste	52	19.6
Keep for using it again	170	64.2
Land fill	7	2.6
Incineration	4	1.5
Total	265	100.0

Source: Survey Data, 2019

As in table (4.22), most of the respondents, 64.2 percent keep the used plastic bags to use it again, 19.6 percent of respondents dispose it with other waste, 12.1 percent dispose separately into bin, 2.6 percent bury it in the land, and 1.5 percent of respondent incinerate them. Reuse is the mostly practiced method by respondent, but some of the respondents conducted the wrong way. Since plastic are non-biodegradable and it exists without degrading more than thousands of years, and toxic gas released from burning the plastic could be harmful to human health.

Table (4.23) The Practice on Reduction in use of Plastic Products by Respondents

Plastic Products	Yes	No	Occasionally
Plastic Bag	47.2	32.5	20.4
Plastic Bottle	53.2	36.4	10.4
Plastic Straw	21.9	70.3	7.8

Source: Survey Data, 2019

The table (4.23) shows the respondents' practice of avoiding plastic bag, bringing of own bottle and avoiding plastic straw. For the plastic bag, 47.2 percent of respondents avoid using plastic bags, but 32.5 percent do not avoid it, and 20.4 percent of respondent avoid it occasionally. For the plastic bottle, 53.2 percent of respondent bring their own bottle instead of buying new bottle, but 36.4 percent do

not bring it, and 10.4 percent bring it occasionally. For the plastic straw, 70.3 percent of respondent do not avoid it when they drink something, but 21.9 percent avoid it, and 7.8 percent avoid it occasionally. Although plastics bottles are collected to recycle, but plastic bag and straw remain unchanged and are dumped into the final disposal site without any treatment. Moreover, plastic bag resembles to jelly-fish in the water, so tortoise and other marine animals swallow it. The biggest source of plastic pollution in the ocean is from land, and annually billion tonnes of plastic pollutants flows into the ocean through river. Moreover, since plastics are similar to jelly fish in the ocean, marine animal such as tortoise and otters swallow them and their digestive system are blocked.

CHAPTER V

CONCLUSION

5.1 Findings

The findings from the results of the community's perception and practice on the plastic pollution in Kyee Myin Daing Township are as follows: Most of the respondents notice the plastic pollution problem. It is the good point to say that people are aware of the threat of plastic pollution. There are three main sources from which the respondents obtain knowledge about plastic pollution. The first one is social media, the second one is books, and the third one is television. By looking these facts, much knowledge about plastic pollution can be delivered by using these three sources, and these are the best way to communicate and mobilize people. Moreover, the study finds that plastic are mostly occurred in drainage system, and the problem mostly occurred by plastic waste in study area is blockage of drainage, and deterioration of the beauty of environment is the second most occurred problem in study area. But respondents do not have enough knowledge about the origin of plastic, and they do not know that plastic is made from fossil fuel.

With regard to the health problem caused by excessive consumption of plastic, 78.5 percent of respondents out of 100 percent know that excessive consumption of plastic can affect heart, nerves and hormonal problem in human beings, 94 percent of respondents know that carrying hot items in plastic bags can cause cancer, and 90.9 percent of respondents know that burning from plastic releases toxic gas called dioxin which can cause orthopedic cancer. By looking these facts, respondents have quite enough knowledge about the health problem caused by excessive consumption of plastic, so it is the good point to curb the plastic pollution.

Although the respondents know well about the health problem caused by plastic, they do not know well about how the plastic can be treated after using it. According to the survey results, only 66.8 percent of respondent answer recycling is the best way to treat plastic wastes, and the rest of respondent answer incineration and

landfill is the way to treat plastic wastes. Therefore, respondents' knowledge about the treatment of plastic wastes is not in good condition, so knowledge sharing programs are required to know them how to treat plastic wastes. According to these results, recycle is the least practice way in 3R, so much knowledge about recycling is needed to deliver among public.

Regarding to reason why the respondents are using plastic, availability of plastic in the market is the main reason to cause plastic pollution and there is no alternative part from plastic is also the another reason to cause plastic pollution. Most of the respondents 84.2 percent have willingness to reduce plastic pollution because of its impact to living things, human health, and environment. With the question regarding the most responsible person for reduction plastic pollution, 81.1 percent of respondents answer that they are the most responsible person for doing it. Moreover, 89.8 percent of respondents answer that no plastic day in supermarket is good reason for environmental conservation.

The study finds out that plastics are easily available in the market, and less knowledge about its adverse effects is the main reason for consumption is rising. Half of the respondents 50.2 percent of respondent express that banning of using plastic from government would not affect them, and 28.7 percent of respondent totally agree on it, but 21.1 percent suggests finding other ways instead of banning. They also express their willingness to pay for imposing an extra charge on plastic bag, bottle and cup. According to survey results, 87.9 percent of respondent will bring their own items instead of paying extra charge for using plastic bag, bottle, and cup, but 12.1 percent shall continue using it by paying an extra charge.

The study also finds that most of the respondent, 73.2 percent use plastic bag for carrying item when they go shopping. Therefore, plastic bags are the most widely used items for carrying things. Among 265 respondents, 49.4 percent are using between 4 to 6 plastic bags every day, 37.7 percent are using between 1 to 3 plastic bags for daily purpose, and 12.8 percent are using above 7 plastic bags daily. The study also finds out that 47.2 percent of respondents avoid using plastic bags, 53.2 percent of respondent bring their own bottle instead of buying new bottle, and 70.3 percent of respondent do not avoid it when they drink something,

5.2 Recommendations

The following recommendations are based on the findings from the sample survey of the community's perception and practice on the plastic pollution in Kyee Myin Daing Township. Much of the respondents has quite enough knowledge about plastic pollution, and also has willingness to reduce plastic pollution, and they know well that the most responsible person to reduce plastic pollution is themselves. But there are some weakness in waste management practice, so providing waste management program is the best way to solve it. Moreover, most of the respondent have good attitude concerned with plastic pollution, but they could not change their practice due to the broken window effects since plastics are easily available and they have no alternative for them. By providing alternative is the way to reduce consumption of plastics.

Moreover, rules and regulations are already established, but it is not in operational. Therefore, law enforcement and punishment is necessary to reduce it. Most of the people do not want to give an extra charge for using plastic products. Therefore, imposing an extra charge for using plastic products would reduce consumption of plastic in some extent. Most of the respondent faced blockage of drainage problem due to clog of plastic wastes in drainage system. Therefore, banning plastic bags and single use plastic products would be advantage. Encouragement using less plastic in packaging, selling plastic free items, and plastic alternatives is also the best way to curb plastic pollution.

Instead of above mentioned way, voluntary agreements between the government and producers/retailers can be alternatives to bans and can achieve reduction in the consumption of single use plastics. Retailers and producers are critical partners in effecting behavioral change by building awareness and providing alternatives. The progressive introduction of voluntary reduction strategies can be great way to successfully allow enough time for the population to begin changing consumption patterns and for affordable and eco-friendly alternatives to become available in the market. Public awareness is a common for the success of any of the mentioned ways. Similarly, awareness raising, monitoring and continued communication to progress to the public will help to build commitment to the cause.

REFERENCES

1. Bouanini S (2013) The Importance of the 3R Principle of Municipal Solid Waste Management for Achieving Sustainable Development. MJSS 4: 129-135.
2. Browne, M.A., Dissanayake, A., Galloway, T.S. *et al.* (2008) Ingested Microscopic Plastic Translocates to the Circulatory System of the Mussel, *Mytilus edulis* (L.) *Environmental Science & Technology* 42(13): 5026-5031.
3. Craig Freudenrich, Ph.D. (14 December 2007). *How Plastics Work*. HowStuffWorks.com.
4. Daniels, J. A. (2011). *Advances in Environmental Research*. New York: Nova Science Publishers, Inc.
5. Doble, M., Venkatesan, R., & Kumar Nelamane Vijayakumar, R. (2014). *Polymers in Marine Environment*. [S.l.]: Smithers Rapra.
6. EEA. (2007). *The Road from Landfilling to Recycling: Common Destination, Different Routes*, Copenhagen.
7. *Environmental Conservation Law*, (2012).
8. Field, Barry C. and Martha K. Field. (2002). *Environmental Economics*, Third Edition, McGraw-Hill, 2002.
9. Fotopoulou, Kalliopi & Karapanagioti, Hrisi. (2017). *Degradation of Various Plastics in the Environment*.
10. GESAMP. (2015). "Sources, fate and effects of microplastics in the marine environment: a global assessment"
11. Geyer, Roland & Jambeck, Jenna & Law, Kara. (2017). Production, use, and fate of all plastics ever made. *Science Advances*.
12. Hammer, J; Kraak, MH; Parsons, JR. (2012). *Plastics in the marine environment: the dark side of a modern gift*
13. Hannah Ritchie and Max Roser. (2019). "Plastic Pollution". Published online at [OurWorldInData.org](https://www.ourworldindata.org/plastic-pollution).

14. Hester, Ronald E.; Harrison, R. M. (editors). (2011). *Marine Pollution and Human Health*.
15. Hopewell, Jefferson & Dvorak, Robert & Kosior, Edward. (2009). *Plastics Recycling: Challenges and Opportunities*. Philosophical transactions of the Royal Society of London. Series B, Biological sciences.
16. Iges. (2005). *Promoting public participation in solid waste management*, Iges e-learning for sustainable development.
17. Jambeck, J. R., et al. (2015). *Plastic Waste Inputs from Land into the Ocean*. Science, vol. 347, no. 6223, 13 Feb.2015, pp. 768–771., doi:10.1126/science.1260352
18. Jibril JDA, Sipan IB, Sapri M, Shika SA, Isa M, et al. (2012). *3Rs critical success factor in solid waste management system for higher educational institutions*. JPSBS 5: 626-631.
19. Kershaw, P. J., ed. (IMO/FAO/UNESCOIOC/UNIDO/WMO/IAEA/UN/UNEP/UNDP Joint Group of Experts on the Scientific Aspects of Marine Environmental Protection). Rep. Stud. GESAMP No. 90, 96 p.
20. Kollikkathara NH, Feng ES. (2009). *A purview of waste management evolution: special emphasis on USA*. Waste Manag 29: 974-985.
21. Konteh FH. (2009). *Urban sanitation and health in the developing world: reminiscing the nineteenth century industrial nations*. Healt and Plac 15:69-78.
22. Laist, D. W., (1997). *Impacts of marine debris: entanglement of marine life in marine debris including a comprehensive list of species with entanglement and ingestion records*. In: Coe, J. M. and D. B. Rogers (Eds.), *Marine Debris -- Sources, Impacts and Solutions*. Springer-Verlag, New York, pp. 99-139.
23. Lebreton, L., Slat, B., Ferrari, F., Sainte-Rose, B., Aitken, J., Marthouse, R., Hajbane, S., Cunsolo, S., Schwarz, A., Levivier, A., Noble, K., Debeljak, P., Maral, H., Schoeneich-Argent, R., Brambini, R., ... Reisser, J. (2018). *Evidence that the Great Pacific Garbage Patch is rapidly accumulating plastic*. *Scientific reports*,
24. Marshall RE, Farahbakhsh K. (2013). *System Approaches to Integrated Solid Waste Management in Developing Countries*. Waste Manag 33:988-1003.

25. MCDC Law 2014.
26. Muralisrinivasan Subramanian, N. (2016). *Plastics Waste Management: Processing and Disposal*. Shawbury, Shrewsbury, Shropshire, U.K.: Smithers Rapra.
27. Mwiinga F. (2014). *Perceptions of Solid Waste Management and the role of environmental education among selected residents of Choma Township of Southern Zambia*, University of Zambia.
28. Ramachandra TV. (2011). Integrated management of municipal solid waste, environmental security. *HAH* 30: 465-484.
29. Samiha B. (2013). The importance of 3R principle of municipal solid waste management for achieving sustainable development. *MJSS* 4: 129-135.
30. Science for Environment Policy | In-depth Reports | Plastic Waste: Ecological and Human Health Impacts November (2011).
31. Sharjah City Municipality, Harmful Effects of Plastic, available from: <http://www.google.com.mm/> (accessed date-18 January 2019)
32. Srinivas. (2015). Infopac on 3Rs, continuing Research Series E-018.
33. Troschinetz AM, Mihelcic JR. (2009). Sustainable Recycling of Municipal Solid Waste in Developing Countries. *Waste Manag* 29: 915-923.
34. UNEP. (2003). *A Manual for Water and Waste Management: What the Tourism Industry Can Do to Improve its Performance*, United Nations Publication, pp: 3-13.
35. UNEP. (2014). *Annual Report ISBN: 978-92-807-3442-3*
36. Williams PT. (2005). *Waste Treatment and Disposal*, 2nd edn, West Sussex, John Wiley and Sons, England.
37. YCDC Law (2018).

Websites

1. <http://www.britannica.com/EBchecked/topic/1589019/plastic-pollution>
(accessed date 18 January 2019)
2. https://en.wikipedia.org/w/index.php?title=Plastic_pollution&oldid=877232957
(accessed date January 9, 2019)
3. https://en.wikipedia.org/w/index.php?title=Resin_identification_code&oldid=873523557 (accessed date January 9, 2019)
4. <https://home.howstuffworks.com/home-improvement/household-hints-tips/cleaning-organizing/question217.htm> (accessed date- 9 January 2019)
5. <https://science.howstuffworks.com/plastic.html> (accessed date- 9 January 2019)
6. <https://www.alansfactoryoutlet.com/how-long-does-it-take-plastics-to-break-down>
7. <https://www.sciencehistory.org/the-history-and-future-of-plastics>
8. <https://www.unenvironment.org/interactive/beat-plastic-pollution/>

APPENDIX (A)

Survey Questionnaire

I am presently engaged in the writing of a thesis for Master of Public Administration at Yangon University of Economics. My topic is **A STUDY ON COMMUNITY'S PERCEPTION AND PRACTICE ON THE PLASTIC POLLUTION**. The purpose of the study is to describe the current status of public awareness on plastic pollution and environmental conservation. The information you provide in this questionnaire will be used for research purpose only, and it will not be used in a manner which would allow personal identification from your individual responses.

Si Thu Lin

MPA-22 (18th Batch)

Part A: General Information

In this section, respondents have to answer questions concerned with the general information of participants. Please tick the (✓) in boxes.

1. Gender

Male Female

2. Age

13-19 20-29 30-39 40-49 50 and above

3. Education

Uneducated High School Middle School Graduate
 Master Degree Doctorate

4. Occupation

Own Business Dependent Student Civil Servant
 Company Staff other

Part B: Knowledge of Respondents on Plastic Pollution

In this part, knowledge of respondents on plastic pollution is asked. Please select only one answer from each question.

1. Do you care about plastic pollution?
 Yes No Haven't thought about it

2. If yes, where do you know about it?
 Documentary Film Flyer Television Book
 Social Media School Lesson Campaigns Other

3. Which parts of your environment are seriously polluted by plastic wastes?
 Parks Markets Residential Places Roadsides
 Drainage System Open Spaces did not aware

4. What are the problems caused by plastic pollution in your place?
 Animal death Human health problem Blockage of drainage
 Deterioration of natural beauty of environment No idea

5. What is the origin of plastic?
 Fossil Fuel Chemical Tree Product

6. Do you aware that over consumption of plastic can deteriorate heart, nerves, and hormone?
 Yes No

7. Do you know that carrying hot items in plastic bags can cause cancer?
 Yes No

8. Do you know that burning from plastic releases toxic gas called dioxin?
 Yes No

9. How plastic could be treated after using it?
 Incineration Landfill Recycle

Part C: Attitude of Respondents on Plastic Pollution

In this part, attitude of respondents on plastic pollution are asked. Please select only one answer from each question.

1. What is the main reason of using plastic?
 Cheap Light weight Easily available No choice
2. If yes, why do you want to do it?
 It causes animal death Impact to human health Environmental damages
3. If no, why do not you want to do it?
 not interested no Alternative follow to others
4. Who is the most responsible person for reduction plastic pollution?
 Government NGO Business owner Self
5. What is your opinion on no plastic bag day in supermarket?
 It is good for environmental conservation It is inconvenient for me
6. In your opinion, which option is more necessary in reduction of using plastics?
 Less plastic packaging, Plastic free items, Plastic alternatives in supermarkets
 More recycle bins
 Places to buy reusable cups/bottles
 More information on plastic pollution and how to cut down
7. Why is the consumption of plastic rising?
 It is cheap It is light weight It is easily available
 there is no alternative Less knowledge of its adverse effect
8. How would you feel if the consumption of plastics was banned?
 Its doesn't bother me
 Should find other ways
 Totally agree it

Part D: Practice of Respondents on Plastic Pollution

In this part, practices of respondents on plastic pollution are asked. Please select only one answer from each question.

1. Which items do you use when you go shopping?
 Plastic bag Paper bag Cloth bag Others
2. Which plastic products do you use excessively?
 Plastic bag Plastic Bottle Plastic buckets, bin, barrel
 Plastic shoes
3. From 3R concept, which concept do you practice usually?
 Reduce Reuse Recycle all of these
4. How many plastic bags do you use daily?
 between 1-3 bags between 4-6 bags between above 7 bags
5. How do you dispose plastic bags after using it?
 Separately dispose into bin Dispose with other waste
 Keep for using it again Land fill Incineration
6. Do you usually avoid using plastic bags when you go shopping?
 Yes No occasionally
7. Do you usually carry your own bottle instead of using plastic one?
 Yes No
8. Do you usually avoid using plastic straw when you dink something?
 Yes No
9. What would you and your family do if you have to pay an extra charge for using plastic bag, bottle and cup?
 Shall continue using it by paying extra charge Shall bring my own item

Thank You for your cooperation

APPENDIX (B)

Sample Size Determination

With the total population (N=101287), the sample size (n) for estimating population proportion (p) at the 95% confidence level (z=1.96) with 6% marginal error (e=0.06) optimizing precision of the survey results is calculated by using the following formula:

$$n = \frac{z^2 \cdot p \cdot q \cdot N}{e^2 (N-1) + z^2 \cdot p \cdot q}$$

n=sample size

p=sample proportion of successes

z=confidence level

q=1-p

e=marginal error

N=total population

To be safe for any population proportion estimates, p=0.5 is used for the required largest sample for any estimate of population proportion. Therefore, the required total sample at the township level is

$$n = \frac{(1.96)^2 \times 0.5 \times (1-0.5) \times 101287}{0.06^2 (101287-1) + (1.96)^2 \times 0.5 \times (1-0.5)} = 265$$

APPENDIX (C)

Figure-4 worker sorting through the main rubbish dump in Bagan, Myanmar



Source: <https://storgaardphotography.com/plastic-pollution-myanmar>

Figure-5 a backyard polluted with plastic wastes in downtown-Yangon



Source: <https://storgaardphotography.com/plastic-pollution-myanmar>

Figure- 6 (a) PCCD workers salvage the plastic wastes from drainpipe



Source: PCCD

Figure-6 (b) PCCD workers salvage the plastic wastes from drainpipe



Source:PCCD