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Summary

The purpose of this study is to understand how people participate in sustainable waste management behaviours (SWMBs) through protection motivation theory (PMT). The solid waste in Yangon has increased from 0.395 kg in 2001 to 0.5 kg per capita per day in 2015, and the estimated waste generation amount for 2050 is 1.22 kg per capita per day. Several environmental problems caused by waste are mainly because of human actions; hence, public participation in SWMBs should be extensively promoted. The Yangon metropolitan area is selected as a case study because it has had severe waste management issues in the previous 10 years because of rising solid waste volumes. Based on PMT, perceived severity of consequences caused by waste related problems, perceived probability of receiving those impacts, self-efficacy (perceived adaptation capability) and response efficacy (perceived effectiveness of SWMBs) are investigated for their effect on people's engagement in SWMBs—including waste reduction, reusing, recycling, disposal and green purchasing behaviours. The sociodemographic factors such as age, gender, education, occupation, income and housing types are also investigated to determine whether they can moderate the relationship between people's perception on risks and uncertainties and their waste management behaviours. The 156 respondents complete the questionnaire surveys. Multiple linear regression analyses are applied to explain how people's SWMBs are influenced by their perceptions of environmental contamination from waste disposal and their perceived coping abilities. According to the findings, people's perceived effectiveness of SWMBs is the highest among other PMT variables while they show higher participation in waste reusing behaviours than other SWMBs. Self-efficacy is the only one predictor for collective SWMBs. For each behaviour, people's perceptions of the severity of negative effects produced by pollutants could influence waste reduction and green purchasing behaviours while self-efficacy could influence waste reduction and reusing behaviours of the respondents. Response efficacy, on the other hand, is able to influence recycling, disposal and green purchasing behaviours. People perceptions of the likelihood of being affected by pollutants is also not a significant predictor of all actions. Any sociodemographic factors could not moderate the extents of their relationship. As a result, PMT might be a good fit for explaining the basic SWMBs that will take low cost and simple effort. People's stronger perception on risks and uncertainties can strengthen their engagement in SWMBs in Yangon regardless of their sociodemographic characteristics.

Keywords

Sustainable Waste Management Behaviours, Protection Motivation Theory, Perceived severity, Perceived probability, Self-efficacy, Response efficacy, Pro-Environmental Behaviours

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Abbreviations

3R	Reduce, Reuse, Recycle
IHS	Institute for Housing and Urban Development Studies
ISWM	Integrated Sustainable Waste Management
PEB	Pro-environmental Behaviours
PMT	Protection Motivation Theory
MSW	Municipal Solid Waste
MSWM	Municipal Solid Waste Management
SWM	Solid Waste Management
SWMBs	Sustainable Waste Management Behaviours
YCDC	Yangon City Development Committee

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Chapter 1: Introduction

1.1 Background Information

Globalisation of economic and social life has significantly urbanized both developed and developing countries (Clark, 2003). With the increased urbanization, the volume of solid waste continues to rise, and waste disposal continues to pose environmental issues. Solid waste is usually made up of daily things we use and discard. These come from the homes, classrooms, hospitals, and workplaces (U.S. Environmental Protection Agency, 2016). Waste has long been considered pollutants that are inherently harmful to human wellbeing and the environment.

Solid waste disposal and management is a challenge in both urban and rural areas globally. Increasing levels of solid waste are causing environmental difficulties in several cities. Cities throughout the world created 2.01 billion tonnes of solid waste in 2016, to 0.74 kilos per person each day (The World Bank, 2019). Annual waste generation is anticipated to increase by 70% in 2016 to 3.40 billion tonnes in 2050 due to high population and urbanization (The World Bank, 2019). Every individual is a potential waste creator and hence a contribution to the problem. Waste generation is one thing; the sort of waste is another, and the behaviour in which the waste is managed or disposed of is still another.

The issue how to enhance public participation in sustainable waste management has become a hot topic because people who have higher levels of perceived severity, susceptibility and self-capability are more likely to engage in sustainable waste management behaviours to reduce the risk. According to Protection Motivation Theory (PMT) (Rogers, 1975), individuals' decisions to engage in risk-avoidance activities are founded on their motivation to defend themselves from the risks. People with poor settlements are generally not mindful of the consequences of the waste. As a result, they had low perception toward waste management and its negative impacts. Longe and Ukpebor said that low levels of education have a negative impact on people's attitudes toward solid waste disposal (2009). People's willingness toward sustainable waste management are heavily influenced by the level of knowledge.

Myanmar is the largest nation in Southeast Asia, covering 677,000 square kilometers. (Environmental Conservation Department, 2018). In 2019, Myanmar's population was about 51.14 million, with nearly one-third of the population residing in urban areas. (Department of Population, 2020). Urban solid waste generation was over 9,000 tonnes/capita/day with waste generation totalling 0.53/056 kilogram/capita/day (Jeske, Muller, Moller, & Rothenberg, 2020). By 2025, the World Bank expects to reach 21,012 tonnes/day, or 0.85 kilogram/capita (World Bank, 2015). Underinvestment in infrastructure and services, such as solid waste management, resulted in deficient services, especially in the cities (Environmental Conservation Department, 2018).

The Yangon metropolitan area is selected as a case study because it has faced serious waste management problems, caused by increasing amounts of solid waste over the last ten years. Yangon is the commercial city of Myanmar with urban inhabitant 5.4 million in 2019 (Department of Population, 2020) and comprises of 45 townships. The highest amount of waste generated is due to household waste, 2500 ton among total 2837.9 ton per day (Maung, 2019) since Yangon has the largest population among other cities in Myanmar. Hence, the need for better solid waste management such as waste collection, disposal, segregation, and recycling is greater than in other cities.

There is general lack of knowledge in Yangon community for the value of recycling, waste segregation, and proper disposal (Gone Adventurin, 2018). Although the government offers

separate containers for wet and dry garbage in some areas of the city, it is unable to provide them everywhere throughout Yangon. Furthermore, individuals are not hesitant to discard garbage, litter, leftover food, plastic, and other debris on the roads and sidewalks (AIT RRC.AP, 2018). Given the situations in Yangon, individuals' perceptions of risks and their ability to handle those risks can affect their decision to engage in sustainable waste management behaviours (SWMBs). People who have higher perceived severity of consequences caused by waste problems, perceived probability of receiving those impacts, perceived response efficacy, and self-efficacy are more likely to engage in SWMBs to reduce the risks. Therefore, this study focus on how public involvement in SWMBs is influenced by their perceptions of threats associated with waste management and their expected capacity to handle those risks.

1.2 Problem Statement

Due to lack of awareness and low motivation of engagement in proper waste polices and practices, solid waste management has become increasing problems on environment and social aspects in Yangon. Since some issues exacerbated by waste disposal are consequences of human actions, citizens' participation in SWMBs should be encouraged. The individual's engagement is the starting point of municipal solid waste (MSW) management scheme, and without their participation, the system would fail. JICA highlighted that public awareness and cooperation in dissemination on waste issues are critical requirements in Yangon (2019).

Many scholars have asserted that people can change their actions to effectively minimize environmental effects, since many environmental issues are embedded in human activity (Vlek & Steg, 2007). The theory of planned behaviours, suggested by Ajzen (1991), is used to describe individual's pro-environmental behaviour. According to Ajzen, the behaviour of residents is determined by their intentions, which are influenced by their attitude, perceived behaviour management, and subjective norms. In 1999, the value belief norm theory which covers the moral aspect of human decision-making and perceived environmental values was initiated by Stern (2000). According to Stern, social demographic variables can influence people attitudes towards classification behaviour intention, but how the veritable change of their behaviour is not explained.

Both theories can clearly explain how pro-environmental attitude and perceived normative social influence can rise pro-environmental behaviour. They cannot explain the potential motivators for pro-environmental behaviour in the context of risks and uncertainties . Although risks and uncertainties can mediate the relationship between intentions and actual responsible behaviour, the theories do not take into consideration of them. Both environmental and health threats will increase individual's willingness to take steps to reduce the risks. The protection motivation theory (Rogers, 1975), which addresses another theoretical viewpoint of pro-environmental behaviour and emphasizes the effect of risk perception on an individual's participation to reduce future impacts, is investigated and explored in depth in this study.

Some work on this theory have been done in different sectors of other countries but there is limited knowledge about how this theory works in Myanmar cities, especially in waste management. Moreover, within the field of waste management in Myanmar, many projects have focused on various facets of waste management systems including waste handling and collection. Nevertheless, peoples' behaviour and attitude on waste management have received little attention as very few studies have been performed on this topic. Given the limited studies about human behaviour and dissatisfied residents' involvement in SWMBs, it is important to

explore how people's SWMBs are influenced by their perceptions and willingness through the application of PMT.

1.3 Relevance of the study

The country started transformation to a market-based economy, as well as rapid urbanization, the average waste production per household is rapidly growing, as is the proportion of single-use plastic and other non-biodegradable materials (Jeske et al., 2020). Hence, the citizens' behaviours and attitudes are critical to waste management progress. This study focuses on the application of PMT by exploring particularly on SWMBs, which comprise several types of waste management behaviours. Understanding on different individuals' engagement helps to establish a strategy to encourage people for engaging in each type of SWMBs.

The distribution of knowledge about the environmental and health effects of solid waste disposal will encourage the residents to partake in waste-disposal behaviours such as waste isolation and reusing and recycling (Mcallister, 2015). Knowledge regarding human attitude to solid waste disposal can also affect incentive to participate in reusing and recycling. The findings and recommendations will facilitate that have similar demographic and economic conditions to achieve their goal of enhancing solid waste disposal facilities and ensuring environmental sustainability.

1.4 Research Objectives

This research aims to investigate how people's perception and belief of risks and uncertainties influence their engagement in sustainable waste management behaviours (SWMBs) in Yangon, Myanmar by the application of protection motivation theory (PMT).

1.5 Research Questions

The main research question is - To what extent do people's perception and belief of risks and uncertainties affect their engagement in sustainable waste management behaviours in Yangon, Myanmar?

The four concepts of Protection Motivation Theory are used to answer the main research question since PMT emphasizes the effect of risk perception on an individual's participation to reduce impacts. It is comprised of four variables - Perceived Severity, Perceived Probability, Self-Efficacy and Response Efficacy (Rogers, 1975).

The main question can be operationalized into following sub questions.

- 1) To what extent does people's Perceived Severity affect their engagement in sustainable waste management behaviours?
Perceived Severity is the respondent's opinion how serious the waste related problems and its consequences.
- 2) To what extent does people's Perceived Probability affect their engagement in sustainable waste management behaviours?
Perceived probability is the respondent's opinion of possibility to receive those impacts of waste problems.
- 3) To what extent does people's Self-efficacy affect their engagement in sustainable waste management behaviours?

Self-efficacy is the respondent's willingness to change their behaviours for waste management.

- 4) To what extent does people's Response Efficacy affect their engagement in sustainable waste management behaviours?

Response efficacy is the respondent's belief on the importance of waste management behaviours on environment.

Chapter 2: Literature Review

This chapter presents a review of applied theory, sustainable waste management behaviours and existing literatures of waste management. The first session focus on understanding the variables of applied theory that can affect on sustainable waste management behaviours, the concepts of people's waste management behaviours and sociodemographic factors. The last part provides the concept of integrated sustainable waste management.

2.1 Protection Motivation Theory

The protection motivation theory, introduced by Rogers (1975), proposed conceptual framework to describe the variables that influence risk-averting behaviours. Rogers (1975) argued that people weigh the costs and benefits of various options, assess the magnitude and probability of being subjected to a depicted noxious occurrence, assess their ability to deal with it, and adjust their attitudes as a result. Protection Motivation Theory was subsequently revised to become a more general theory of persuasive communication (Rogers, R., Cacioppo, & Petty, 1983) with a focus on neural mechanisms that mediate behavioural change. While a number of scholars have looked at using PMT to analyse pro-environmental behaviours, this analysis focuses on SWMBs, which are a broad category of waste management behaviours that include a variety of levels and types of effort, including financial, physical, and mental effort. Threat appraisal and coping appraisal are two cognitive mechanisms that are triggered by environmental or intrapersonal forms of threat initiatives. Thus, the decision is taken based on the results of threat and coping appraisal.

2.1.1 Threat Appraisal

The threat appraisal assesses the variables that increase or decrease the likelihood of a maladaptive reaction being made (Prentice-Dunn & Rogers, 1986). The maladaptive behaviour may be a potential future behaviour (Prentice-Dunn & Rogers, 1986) for sustainable waste management behaviours, such as starting to use over packaging products, or a current behaviour, such as not disposing into identify places. The overall threat appraisal is the number of the factors that increase or decrease the risk of maladaptive behaviour. The perceived severity and perceived probability to the threat are two factors that influence the likelihood of a maladaptive reaction, which are explained below.

(i) Perceived Severity

The first component of a fear appeal under protection motivation theory is perceived severity which means magnitude of noxiousness of a depicted event (Rogers, 1975). The extent of serious of the potential harms that a person perceives is referred to as perceived severity. According to Rogers (1975), fear manipulations influence the perceived seriousness of a threat and thereby promoted attitude change. However, there are also negative attitudes and cultures that have undermined the critical aspect of people involvement (Kaseva & Mbuligwe, 2005). Individuals may be motivated to perform adaptive responses, such as pro-environmental actions, based on their perception severity. Many PMT variables, including perceived severity of climate change effects, had a substantial impact on people's intentions to take in pro-environmental activities (Kim, Jeong, & Hwang, 2013). The degree to which a vulnerability (e.g., waste pollution) is perceived to have extreme negative effects is referred to as perceived severity.

(ii) Perceived Probability

Perceived probability, the second components of a fear appeal under protection motivation theory (Rogers, 1975) is the individual's opinion of possibility to receive those impacts. It refers to one's perception of how exposed they are to the threat (e.g., health problem of waste pollution) and how likely they are to be harmed by it. People with poor settlements are generally not mindful of the consequences of the waste (Boadi, 2016). Low levels of desire to engage in public managements are influenced by some factors such as low living standards, high levels of illiteracy, and the economic conditions (low GDP per capita) (Rebellion, 2012). High perceived probability is likely to lead to sustainable waste management behaviours such as reducing plastic use and reusing. Individual desire to undertake risk preventative behaviour is likely to be enhanced by a higher sense of severity and vulnerability, but higher perceptions of benefits from existing practices are likely to hinder risk preventative activity.

2.1.2 Coping Appraisal

In addition to that, the person assesses his or her ability to cope, known as coping appraisal. This includes assessments of one's abilities to effectively execute and complete an adaptive response (self-efficacy), as well as judgments regarding the effectiveness of a proactive response that will avert the perceived threat (response efficacy). Evaluations of response efficacy and self-efficacy are considerations that increase the likelihood of making an adaptive response (Bandura, 1977).

(i) Self-efficacy

Rogers (1975) mentioned that interest value on the importance of the avoidance response is self-efficacy. It is the people's desires to change their behaviours for the good movement. Self-efficacy affects not just the initiation of the coping response, but also the amount of energy spent and a person's perseverance in the face of challenges (Bandura, 1982). An individual with a high sense of self-efficacy can quickly conquer any obstacles such as inconvenience, while a person with a low sense of self-efficacy can be frustrated by the same obstacles (Tsai, 2008). Regarding waste management, both public and private organizations have made significant efforts to allow their employees to behave in an environmentally friendly manner when it comes to waste management. For example, some businesses now have waste separation bins to encourage employees to participate in waste management. People may be discouraged from engaging in suggested actions due to the excessive cost of undertaking preventative measures.

(ii) Response Efficacy

The second efficacy of a protective response in PMT is response efficacy. Perceived response efficacy is the efficacy of the recommended protective actions (University of Twente, 2004). It is an individual's assessment of the perceived effectiveness of engaging in a recommended action such as perception for the importance of their behaviour on waste management to avoid risk. For instance, people will not use the single used cup to reduce the waste amount because they understand their accumulated actions can determine on waste generation and environment in the long term. According to Rebellion (2012), coping response may be an explicit behaviour (e.g. start to separate waste) or the inhibition of an action (e.g. quitting to use plastic bags).

2.2 People Behaviour in Waste Management

Households' environmental awareness and attitudes should be investigated in order to better understand their behavior and how to support waste management (Singhirunnusorn, Donlakorn, & Kaewhanin, 2012a). Tsai argues that participation in waste management behaviours is challenged by many factors, depending on the approach selected for this purpose and the characteristics of the household in a specific area (2008). For instance, it is observed that adequate opportunities, services, convenience, and knowledge affect attitudes toward sustainable waste management behaviours. People differ in terms of their knowledge base as well as what they consider to be convenient for them. As a result, their perspectives are automatically divergent. The other consideration is that the information, knowledge and awareness gaps among the public make their engagement difficult. Hence, people behaviours in waste management are studied as following.

2.2.1 Waste Reduction Behaviour

Waste reduction is also known as waste prevention to reduce the amount and/or toxicity of discarded waste. In simple terms, "reducing waste by not producing it" (USEPA, 2002). According to waste hierarchy (reduce, reuse, recycle), which is the product lifecycle concept that underpins European waste law (European Commission, 2014), the most efficient way to decrease waste is to reduce waste in the first place. Waste reduction includes different practices such as avoiding products with excessive packaging and consuming fewer products. Relating the waste problem to oneself as well as the global environment is assumed to increase one's desire to reduce the waste (Barr, W. Gilg, & J. Ford, 2001). Being female, older, and knowledgeable about policy tools help to reduce waste. Individual's attitude and behaviours are concerned with one's awareness, comprehension, interpretation, and impression of others, as well as knowledge of a situation or occurrence (Barr et al., 2001).

2.2.2 Waste Reusing Behaviour

After waste reduction, reusing is the second most popular waste management strategy. It is the practice of reusing a substance in its existing form repeatedly. Empty food containers may be used to store leftover, foods and plastic shopping sacks may be used to line waste containers. Values and concerns drive attitudes toward reuse and reduction behaviour (Barr et al., 2001). Many studies in environmental psychology have concentrated on the gap between environmental values and environmental action, commonly known as the "value-action gap," which is influenced by both individual attitudes and external factors (Nixon & Saphores, 2009). Feelings of ease of reusing and the extent to which reusing will make a difference encourage waste reuse (Barr et al., 2001). This is related to how people see the waste problems in terms of their knowledge, beliefs, expectations and availability of enabling environments. Hence, waste reusing behaviour may differ from person to person.

2.2.3 Waste Recycling Behaviour

The process of turning waste into new materials and products is known as waste recycling. Many theories tried to explain the recycling behaviour as the pro-environmental behaviours such as the theory of planned behaviour, for example, pro-environmental behaviours (Ajzen, 1991). In the context of environmental psychology, there is a relationship between pro-environmental behaviours and recycling behaviour (Singhirunnusorn et al., 2012a). People's

environmental awareness, in general, and waste management has been regarded as one of the most important variables affecting household recycling (Nixon & Saphores, 2009). Recycling cuts down the usage of new resources, helping to long-term sustainability. Paper, glass, steel, plastic, and aluminium may all be recycled, allowing them to be reclaimed and reused instead of being discarded. The most significant advantage of recycling is decreasing the generation of greenhouse gases by diverting waste from landfills (Kirunda, 2009). Organic waste and waste separation are high among households with high income levels (Bandara, Nilanthi J. G. J., Hettiaratchi, Wirasinghe, & Pilapiiya, 2007). This might suggest that high-income households can afford a large number of rubbish containers to accommodate different types of waste. Many studies show links between these criteria and the adoption of recycling methods. Following in-home retention of valuable items, Gyankumah (2004) found that waste-pickers often remove the majority of valuable goods either before the trash enters the waste stream or route in low- and middle-income regions of many cities. Recycling is common in their low and middle income families, and it is linked to the households' secondary income. Despite producing the least amount of waste each day, these families sell reusable and recyclable products.

2.2.4 Waste Disposal Behaviour

Waste disposal is an immediate issue for the community, and inefficient or irresponsible waste disposal pollutes the environment and puts public health at risk. Due to people's unfavourable perceptions of solid waste disposal, efforts to solve solid waste disposal problems in developing nations have failed (Gyankumah, 2004). People with low economic levels are generally believed to pollute the environment via inappropriate solid waste disposal techniques (Murad, Hasan, & Shoeb-Ur-Rahman, 2012). They also said that low-income households had willingness to conduct proper disposal, but their financial difficulty forces them to dispose of waste indiscriminately. Jinjang Utara, Murad, Hasan & Rahman (2012) discovered that low-income families generated less garbage per person than middle and high-income families. It might reveal that low-income households contribute less to environmental degradation by their improper waste disposal. According to Browne and Allen (2007), awareness-building campaigns and educational measures on the negative effects of inadequate waste collection on public health and environmental conditions, as well as the importance of effective waste disposal, can positively influence attitudes toward solid waste disposal. Hence, people who have favourable views about waste disposal facilities are more likely to do proper waste disposal, which promotes environment quality.

2.2.5 Green Purchasing Behaviour

Green purchasing behavior is buying environmental friendly items that are generally recycled and helps the environment (Mostafa, 2007) by generating low waste and recyclable. Furthermore, green products do not affect both society and the environment. It contains environmentally friendly bags, recycled papers, energy-efficient lighting, and other environmentally friendly goods. Green purchasing intentions can be influenced by their attitude, subjective norms, and perceived behavioural control (Yadav & Pathak, 2017). People's perceptions of green purchasing are important because if people have low value for their environment quality, they will pay little or no attention to it, and vice versa. According to Netemeyer et al. (2005), the more positive buyers' attitudes toward green products are, the more likely to purchase green items. Perceptions may be favourably affected by raising knowledge and educating people about the detrimental effects by the high amount of waste generation.

Wang et al. (2020) found that people prefer to buy more environmentally friendly packages when they are more environmentally conscious.

2.3 Sociodemographic Factors

In the waste management sector, a general assumption is that there is a link between household waste and the sociodemographic features of the household that generate the waste. According to Stern (2000), sociodemographic factors such as age, occupation, and sex may also have an impact on people's attitudes. Education plays, or may play, a part in shaping people's attitudes on the environment (Al-Rabaani & Al-Mekhlafi, 2009). Tsai argued that people attitude toward sustainable waste management behaviour may be differed in terms of their knowledge base and the characteristics of the household (2008). A number of studies on recycling behaviour yield mixed results on the influences of demographic and socioeconomic characteristics (Nixon & Saphores, 2009). According to their study, the recycling rates are greater in the higher-income families and its behaviour is shown to be favourably correlated with formal education and awareness about recycling. However, the extent to which these sociodemographic factors have an impact varies from person to person. Thus, effect of people's sociodemographic characteristics on the their attitude toward the pro-environmental behaviours is examined in this study.

2.4 Integrated Sustainable Waste Management Framework

Integrated Sustainable Waste Management (ISWM) is a holistic system for addressing municipal waste management issues. It is a conceptual and systemic approach to interpreting and solving waste issues. The ISWM framework was first promoted to increase the effectiveness of the Municipal Solid Waste Management (MSWM) system by waste segregation, collection, transportation, transfer station, treatment and final disposal (Klundert & Anschutz, 2001). It is made up of three interdependent and interrelated ISWM dimensions that must be considered when implementing a sustainable waste management scheme: multi stakeholder involvements, waste management hierarchy elements, and enabling environments. All three dimensions are explained by Hoornweg and Bhada-Tata (2012) in Figure - 1.

Stakeholders: any organizations or group of people or individual who have interest or play a role in waste management sector. It's important to distinguish between them and where they're really participating in the program. According to Tsai (2008), a society that is willing to collaborate creates opportunities for “creativity and innovation” in managing waste. Tsai's findings point out the importance of the people willingness to collaborate on managing waste problem. In real life, people's behaviours are always influenced by the environment in which they conduct (Bernstad,2014). Per Bernstad, participation in waste management is influenced by the convenience and availability of specific infrastructure. Hence, people's behaviours and determining their willingness to engage in SWMBs is investigated in this study.

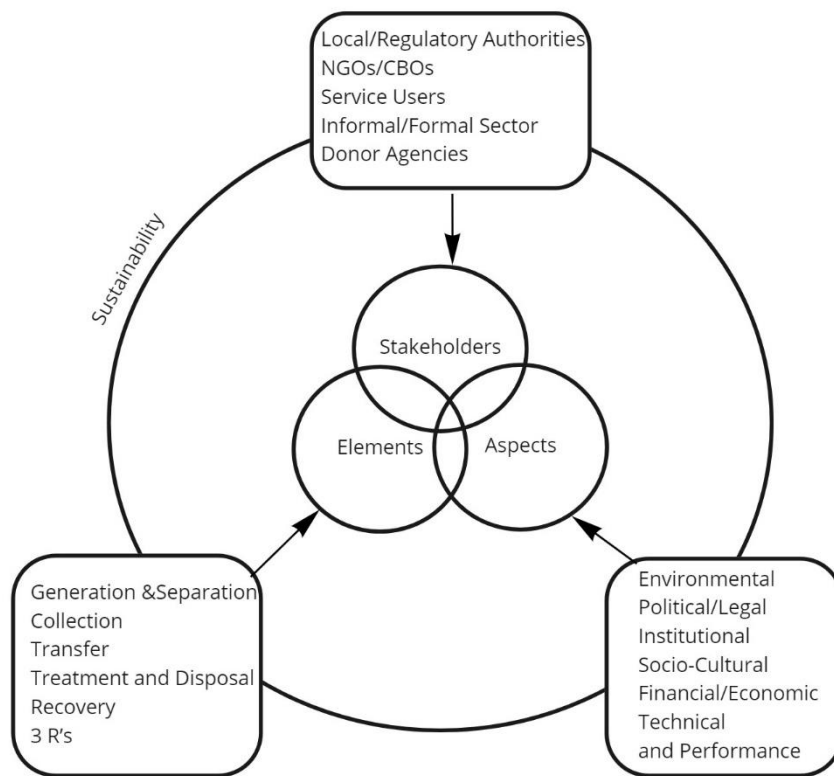
Elements: include the technical and practical aspects of solid waste management. One or all of the components may be influenced by the stakeholders. The waste management hierarchy is the foundation for implementing the ISWM concept. Waste hierarchy is comprised of five steps: reducing waste, reuse of materials, recycling, energy recovery, and landfilling. To construct an efficient and effective SWM program, all components must be considered. Since this study focus on the intrinsic motivation of individual (household) actors to engage in sustainable waste management practices, energy recovery and landfilling are not taken into

account to analyse. Thus, people’s behaviour on 3R approach (reduce, reuse and recycle) green purchasing and disposal approach are analyzed as one of the waste reduction strategy.

Aspects: The regulatory, environmental, and financial realities under which the waste management system exists are all factors to consider. These are measured and prioritized based on the local, national, and global dimensions. The aspects also play in the significant role for the provision of solid waste management and disposal services because policy and regulations have an impact on solid waste management and people’s willingness to engage in. However, according to Sauro's study, such activities have not thrived in most areas of the developing countries due to a lack of clear public policies as well as the economic unavailability of investments in waste segregation and recycling (Joardar, 2000). It is difficult to successfully include the people in solid waste management within a framework that lacks clear public policies and systems. Given the significance of external factors, not only intrinsic motivation, but also the external factors can influence the individual’s waste management behaviours.

Figure 1. Integrated Sustainable Waste Management Framework

Source: (Hoornweg & Bhada-Tata, 2012)



2.6 Conceptual framework

The research develops a conceptual framework based on the literature and theories listed above. Waste management mechanism has the potential to cause environmental and health problems (El-Fadel, Findikakis, & Leckie, 1997). Thus, it is likely that an individual's threat and coping appraisal, will impact their participation in waste management behaviours. The aim of this study is to investigate the impact of PMT variables on people's participation in SWMBs. People’s waste management practices, such as waste reducing, reusing, recycling, disposal and green purchasing, can help to solve waste issues by reducing the waste amount and harmful disposal methods. Individuals' perceptions of risks and their ability to handle those risks can

affect their decision to engage in SWMBs. It will help to understand and forecast what influence people to change their habits.

In this study, there are two independent variables of threat appraisal:

- 1) **Perceived severity** - the individual's opinion of how serious waste related problems and its consequences
- 2) **Perceived probability** – the individual's opinion of possibility to receive the impacts of waste problems

Another two independent variables of coping appraisal are:

- 1) **Self-efficacy** – the individual's willingness to change their behaviours for waste management
- 2) **Response efficacy** – the individual's belief on the importance of waste management behaviours on the environment

These four independent variables are investigated to see whether they could determine the extent of sustainable waste management behaviours. Hence, the dependent variable is:

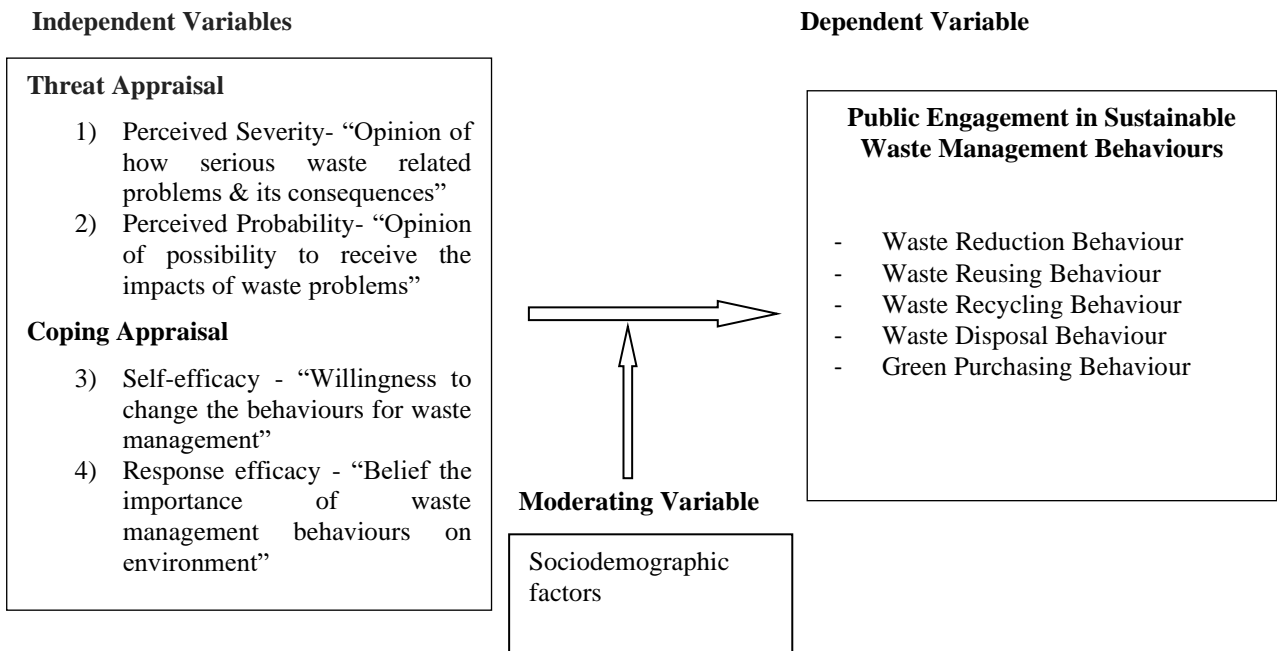
Public Engagement in Sustainable Waste Management Behaviours such as-

- waste reduction behaviour
- waste reusing behaviour
- waste recycling behaviour
- waste disposal behaviour and
- green purchasing behaviour.

Sociodemographic factors are assumed as the moderating variable in this study. Hence, social demographics of the respondents such as age, sex, education level, occupation, income level and housing type, are added as the moderating variables that can affect the strength of relation between dependent variable and independent variable.

Higher levels of severity and probability are likely to lead to pro-environmental behaviour, and higher levels of response efficacy and self-efficacy are linked to more adaptive behaviour (Kim et al., 2013). Thus, in this research people with a high degree of perceived threats and perceived coping capacity are assumed to be more engaged in SWMBs (Figure - 2).

Figure 2. Conceptual Framework



Chapter 3: Research Design, Methods and Limitations

This chapter presents research strategy, methods and analysis, concepts, variables and indicators used. In addition to that, the chapter describes validity and reliability issues, scope and limitation.

3.1 Research Design and Method

3.1.1 Research Strategy

Survey is used as the research strategy to collect primary data. Questionnaire survey has become the common research method in behavioural science, social science and psychology (Bhattacharjee, 2019). Through many literature reviews, this study found out that questionnaire survey would be a common quantitative research strategy used in waste management behaviour field. According to Thiel (2014),

1. Survey is particularly well suited to theory-driven or deductive analysis,
2. Survey is not only enough to evaluate hypotheses; it may also be used to learn more about or explain people's attitudes.
3. The survey's large size and high degree of standardization not only make it an easy way of gathering data, but it also allows the data to be conveniently generalized, implying a high level of external validity.
4. The analysis method is simple to handle, and the data values and codes are straightforward.
5. The analysis technique is relatively simple to replicate.

Therefore, the reasons to use this strategy in this study are –

1. Large numbers of responses are required for this study.
2. Survey allows to use random sampling since this study requires different types of respondents.
3. It is useful in describing the characteristics of large sample size.
4. It is more convenient to predict the people's behaviour and attitude.
5. Although survey could not provide detailed information, it will be suited for this study because the design will be more breadth than depth.
6. It is easy to ensure the value of variables and the relationship between variables.
7. It could be used to test and deepen the results of qualitative research for further study.

3.1.2 Sample Size and Selection

Considering time and budget limitation, the simple random sampling method will be used. Random sampling is the ideal and highly representative if all subjects participate (Black, 2009). With random sampling, each unit of the population has an equal chance of being included in the sample (Bryan Alan, 2012). The respondent will be urban residents over the age of 18 who lives in 33 townships of Yangon where the Yangon municipality is responsible for urban services. Based on the 2019 inter-censal survey data, total urban population of those who are over 18 years in the study area is summarised in Table - 1.

Table 1. Uran Population of 33 Townships in Yangon (September 2019)

Source: (General Administration Department, 2019)

No	Township	Urban Population over 18 years old
1	Ahlon	38,045
2	Bahan	63,551
3	Botahtaung	28,807
4	Dagon	18,817
5	Dagon-East	122,012
6	Dagon-North	142,034
7	Dagon Seikkan	123,987
8	Dagon-South	224,739
9	Dala	87,112
10	Dawbon	50,112
11	Hlaing Tharyar	235,379
12	Hlaing	93,228
13	Insein	232,549
14	Kamaryut	58,879
15	Kyauktada	21,993
16	Kyeemyinding	76,938
17	Lanmadaw	29,826
18	Latha	22,462
19	Mayangone	128,490
20	Mingalar Taung Nyunt	98,397
21	Mingalar don	110,091
22	North Okkalar	190,022
23	Pabedan	23,459
24	Pazundaung	35,823
25	San Chaung	67,575
26	Seik Kan	1,198
27	Seik Kyi Khanaungto	26,112
28	Shwe Pyi Thar	174,196
29	South Okkalar	114,244
30	Tarmwe	129,803
31	Tharketa	171,907
32	Thingangyun	175,478
33	Yankin	50,963
	Total	3,045,369

To calculate the sample size, the following formula by Sloven (1960) is used,

$$n = N / (1 + Ne^2)$$

n = no. of samples
N = total population
e = margin of error

Calculation

$$N = 3045369$$

$$e = 8\%$$

$$n = 3045369 / (1 + (3045369 * 0.08^2))$$

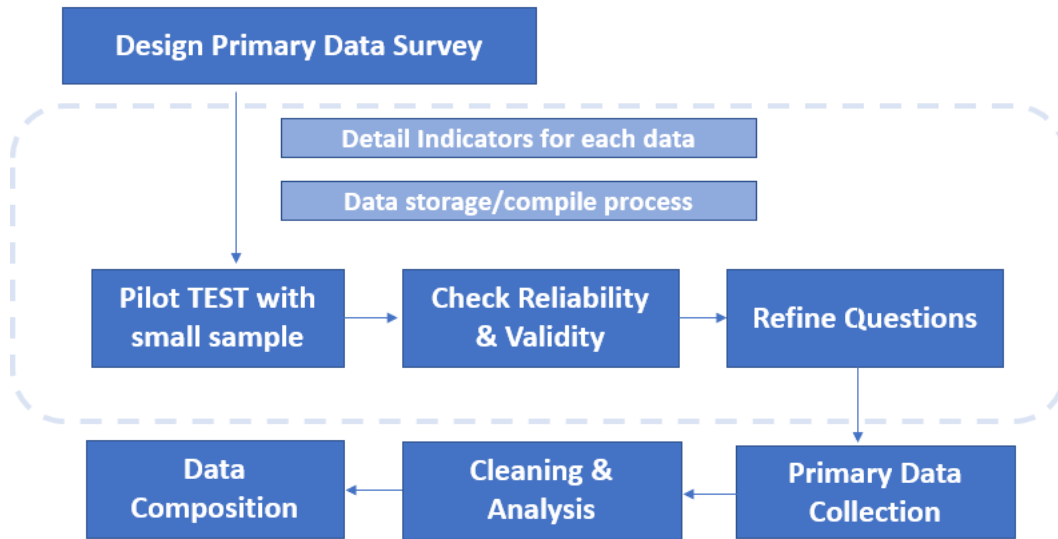
$$n = 156.24$$

According to the calculation, 156 responses for the questionnaire are needed to attain a confidence level of 95% and 8% margin of error. Most survey researchers typically agree an acceptable margin of error is between 4% and 8% at the 95 percent confidence level (Pollfish, 2021).

3.1.3 Data Collection Method

Questionnaire based survey is aimed to collect data based on peoples' experience and perceptions (Thiel, 2014). According to Theil (2014), survey allows to collect a great amount of data on a wide range of topics, making it a very efficient method of study. Due to the political situation in Myanmar and covid-19 pandemic, field survey will not be possible to be conducted. Therefore, KoBoToolbox is used as online survey tool to collect primary data. It can be developed in both English and Myanmar language, and shareable on social media such as facebook. Questionnaire permits respondents time to think about their answers without being interrupted by others, such as an interviewer, and allow anonymity (EN Economics Network, 2020). In 2021, around 53.1 percent of Myanmar's population is engaged on social media (statista, 2021). This is more than double the percentage in 2016, when 20% of Myanmar's population was engaged on social media (statista, 2021). Thus, this online survey is shared via facebook to answer randomly by urban inhabitant in Yangon who is over 18 years old. The below Figure - 3 presents how data is collected and processed.

Figure 3. Diagram of Data Preparation and Processing



3.2 Data Analysis

After the data has been collected, it will be analyzed with the aid of StataMP 14. To make the analytic process easier, charts and tables are employed. In addition, descriptive and statistical analyses are used to assess the quantitative data from the questionnaire in this study. There are two types of statistical analysis of data: descriptive statistics and inferential statistics (Thiel, 2014). Descriptive statistics describes how to organize raw data into charts and graphs. These procedures include gathering, sorting, and describing relevant data. In this study, descriptive analysis is performed to summarize the basic information that can be gleaned from the questionnaire data and to assist readers in gaining a general understanding of the findings. Regression analysis, in particular, is commonly used in quantitative data (Thiel, 2014) under inferential analysis. Since this study is quantitative research, linear regression analysis is applied to analyse the data and answer the research question for the behaviours and attitude among PMT attributes. Prior to that, Cronbach’s alpha and Pearson correlations are applied for internal reliability and validity tests.

3.3 Operationalization

The theoretical structure in Chapter - 2 is the foundation for operationalization. Likert scale is used as the indicator. As Berdie (1989) pointed out, the five-point Likert scale is the most reliable in most situations, therefore, it is applied in the questionnaire. The concept, variables, and indicators used are mentioned as following.

3.5.1 Concepts and Variables

Concept -1

The **protection motivation theory** is a theory that has been used to explain how fear appeal messages cause people to modify their behavior (Milne, Sheeran, & Orbell, 2000). It deals with how people cope with and make decisions under stressful and harmful times. These choices are made as a means of protecting oneself from potential threats (Rogers, R. et al., 1983; Rogers, R. W., 1975).

Independent Variables

This study streamlines the original PMT theory and select to analyze the factors linked to threat and coping appraisal to motivate the development of environmental risk communication that can lead to behavioural changes. The threat appraisal and coping appraisal leads to the desire to execute adaptive responses (protection motivation) or to the intention to conduct maladaptive responses that place an individual at risk (University of Twente, 2004).

Under threat appraisal, the two independent variables are measured for the following reasons:

- 1.1- **Perceived Severity** is investigated since perception of people plays a major role in solid waste management (Boadi, 2016) as well as the level of public awareness and knowledge in waste problems are important.
- 1.2- **Perceived Probability** is analysed because people's opinion for the occurrence of the waste related impacts may determine their behaviour.

The two further independent variables connected to coping appraisal are as follows.

- 1.3- **Self-efficacy** is worthy to understand because the aspect of self-efficacy is critical for avoiding the threatening situation (Bandura, 1977) such as pollution.
- 1.4- **Response efficacy** is investigated since the individuals' belief that execute the recommended actions may eliminate the threat (University of Twente, 2004).

Concept - 2

Public Engagement in Sustainable waste management behaviour is the people participation concerned with waste minimization, environment friendly purchasing and disposal to enhance sustainable waste management (Wiedemann & Femers, 1993). SWM aims to minimize the natural products used, ensure that all items obtained from nature are reused as many times as possible, and keep waste to a minimum.

Dependent Variables

In this study, respondents with high degree of threat and coping appraisal are assumed to be more engaged in waste-management behaviours since attitudes and opinions are crucial in shaping behaviour (Barr et al., 2001). People's behaviour on waste minimization, disposal and green purchasing are selected as five independent variables.

- 2.1 - **Waste Reduction Behaviour** is one of waste minimization methods. It is measured because citizens' waste management practices help to solve waste problems by reducing the volume of waste generated (Xiao, Zhang, Zhu, & Lin, 2017).
- 2.2 - **Waste Reusing Behaviour** plays in the second role of waste minimization. People's engagement in this behaviour are increased when they hold a positive attitude toward environment (Russell, Young, Unsworth, & Robinson, 2017).
- 2.3 - **Waste Recycling Behaviour**, public have the ability to play a part in waste recycling to reduce waste generation (Matter, Dietschi, & Zurbrugg, 2013). Thus, it is important to know how their motivations behind people's recycling behaviour are.

2.4 - **Waste Disposal Behaviour**, sustainable waste management will not be effective without proper study of disposal activities (Murad et al., 2012). So, the behaviour on waste disposal should be investigated to grantee a sustainable waste management process.

2.5 - **Green Purchasing Behaviour**, the most important driver of customers' green purchasing intention is their attitude toward green items (Yadav & Pathak, 2017). Therefore, understanding on people's engagement in green purchasing behaviour is important.

Moderating Variable

Sociodemographic Variable -Socioeconomic variables and settlement conditions may impact household involvement and support in waste management initiative(Singhirunnusorn, Donlakorn, & Kaewhanin, 2012b). In this study, therefore, some sociodemographic variables are used as moderating variables that may moderate the relation between their perceptions and behaviours.

Table 2. Operationalization

Concept	Variable	Indicator	Scale of Measurement	Data Collection Methods
Concept 1: Protection Motivation Theory (Independent Variable)	Variable 1.1: Perceived Severity	Indicator 1: Level of opinion on the waste related problems 1 = Very Low 5 = Very high	Ordinal, Likert scale	Questionnaire
		Indicator 2: Level of opinion on the consequences of waste problems 1 = Very Low 5 = Very high	Ordinal, Likert scale	Questionnaire
	Variable 1.2: Perceived Probability	Indicator 1: Level of opinion on the chances to receive the effects of waste problems 1 = Very Low 5 = Very high	Ordinal, Likert scale	Questionnaire
		Indicator 2: Level of opinion on the vulnerability from that occurrence 1 = Very Low 5 = Very high	Ordinal, Likert scale	Questionnaire
	Variable 1.3: Self-Efficacy	Indicator: Level of willingness to change their behaviours for waste management 1 = Strongly Unwilling to change	Ordinal, Likert scale	Questionnaire

		5 = Strongly willing to change		
	Variable 1.4: Response efficacy	Indicator: Level of agreement on the importance of waste management behaviour on the environment 1 = Very Low 5 = Very high	Ordinal, Likert scale	Questionnaire
Concept 2: Public engagement in sustainable waste management behaviours (Dependent Variable)	Variable 2.1: Waste Reduction Behaviour	Indicator 1: Level of waste avoidance in daily life 1 = Never 5 = Regularly	Ordinal, Likert scale	Questionnaire
		Indicator 2: Level of waste reduction in daily life (Eg-stopping single use cups/plastic bag) 1 = Never 5 = Regularly	Ordinal, Likert scale	Questionnaire
	Variable 2.2: Waste Reusing Behaviour	Indicator: Level of waste reusing in daily life (Eg-use of cotton bag instead of single use bag) 1 = Never 5 = Regularly	Ordinal, Likert scale	Questionnaire
	Variable 2.3: Waste Recycling Behaviour	Indicator: Level of waste recycling in daily life (Eg-recycling bag/bottle/box/printing paper) 1 = Never 5 = Regularly	Ordinal, Likert scale	Questionnaire
	Variable 2.4: Waste Disposal Behaviour	Indicator 1: Level of waste separation when disposed. 1 = Never 5 = Regularly	Ordinal, Likert scale	Questionnaire
		Indicator 2: Level of disposing to the identified bins instead of informal dumping 1 = Never 5 = Regularly	Ordinal, Likert scale	Questionnaire
	Variable 2.5: Green Purchasing Behaviour	Indicator 1: Level of buying environmental friendly products	Ordinal, Likert scale	Questionnaire

		1 = Never 5 = Regularly		
		Indicator 2: Level of skipping unnecessary items 1 = Never 5 = Regularly	Ordinal, Likert scale	Questionnaire
Social Demographic (Moderating Variable)	Variable 3.1: Social Demographic Factors	Sex Age Education Occupation Monthly income Housing Type	Nominal	Questionnaire

3.4 Data Reliability and Validity

3.4.1 Reliability

The more precisely and systematically the variables are measured, the more likely the outcomes will be systematic and representative rather than coincidental (Thiel, 2014). A high-reliability tool indicates that a group of people receives the same measurement at different times and in different places, yet the outcome is relatively comparable. Test-retest reliability, parallel-forms reliability, and internal consistency reliability are the three most common types of reliability tests. Internal consistency analyses whether each topic assesses the same substance or quality, and it mostly represents the relationship between the test subjects (Tavakol & Dennick, 2011). Test-retest reliability and parallel-forms dependability are more difficult to assess and have some disadvantages when compared to internal consistency reliability. Thus, the internal consistency reliability of the questionnaire is employed to assess its reliability in this study. I make sure the consistency of the results of measurement tools, transparency of the procedures and consistency in the application to get similar result for the same research by someone else. To ensure reliability, primary data is collected using techniques and existing theories in this similar field.

3.4.2 Validity

(i) - Content Validity

Examining content validity entails systematically evaluating the measurement content's appropriateness and determining if the content accurately reflects the nature of the concept as it is perceived (Oktavia, Irwandi, Rajibussalim, Mentari, & Mulia, 2018). The different literatures are examined in this study to determine acceptable measuring methodologies. This study involves the development of structured questionnaires and outlines to be adopted at different levels and checklist, and have enough questions to assess competence. The questionnaire is designed to be full and unbiased, with the attention to the layout, which makes it much easier to understand. Furthermore, this study attempts to eliminate all types of mistakes from the beginning of the questionnaire design. The pilot testing is conducted first to make sure accuracy, correct operationalization and how correct the pilot results of a survey are. Based on

the results of pilot study, the questionnaires are reviewed or redeveloped, and start the official survey only after that.

(ii) - Construct Validity

Construct validity is a measure of the instrument's constructions' propriety. Researchers most commonly calculate construct validity metrics by providing correlations between a measure of a construct and a variety of other measures that are either conceptually connected with the construct to test convergent validity or change independently of the construct to test discriminant validity (Oktavia et al., 2018). Pearson correlations are commonly used by psychologists to estimate test retest reliability and validity (Furr & Heuckeroth, 2019). Therefore, in this study, Pearson's correlation coefficient of the respondents' answers to an item with their total scores is used to test construct validity.

3.5 Scope and Limitations

3.5.1 Scope

The scope of this research is studying how people's perception and belief influence their engagement the sustainable waste management behaviour in Yangon through Protection Motivation Theory. There are 45 townships in Yangon region, but the study focusses on those who live in 33 townships where the Yangon municipality is responsible for urban services. Among those residents, the survey conducts only urban inhabitants whose age are over 18 years.

3.5.2 Challenges and Limitations

Unlikely with other academic years, this period is in covid 19 pandemic with many restrictions including travelling and social distancing. Survey cannot be conducted in person because there are travel restrictions for going back to Yangon and returning to the university. Moreover, military seized control on 1 February 2021 in Myanmar, and there are the protests over the coup across the country. The military has imposed restrictions, including curfews and limits to gatherings (Cuddy, 2021). This recent unstable political situation are the challenges to conduct survey physically. Typical group of online users are mostly youth, therefore, receiving some old age respondents are also the limitations.

The researcher can have more confidence in the results if the margin of error is minimal. The larger the margin of error, the further they can deviate from the total population's view (Thiel, 2014). As the population is high in this study area, relative sample size is large as well. Based on time availability and voluntary participation of the online respondents, large sample size is not possible to conduct, therefore, the margin of error is assumed as 8% for moderate sample size. Hence, high error margin is also the limitation for this study.

Chapter 4: Research Findings

The data gathered through questionnaire is examined in this chapter. Firstly, descriptive analysis, and mean value and standard deviation of each question are presented. Data reliability and validity tests are also performed to do regression analysis. Finally, the data is analysed using linear regression analysis for the selected variables.

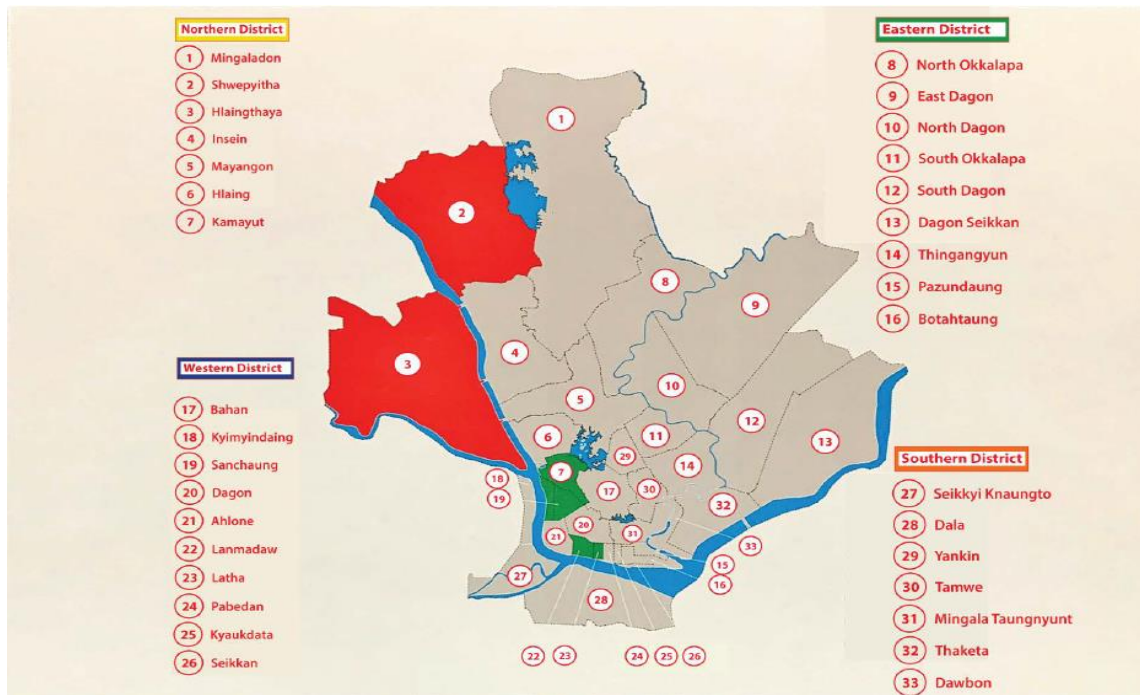
4.1 Description of the Study Area

Myanmar is the largest country in mainland Southeast Asia by geography, with a population of 51.14 million as of 2019 (Department of Population, 2020), 30 % of whom live in cities and the other 70 % in rural areas (Gone Adventurin, 2018). As a result of the economic expansion, as well as changes in consumption and production habits, waste generation has increased. With this, the amount of waste has increased dramatically, notably in the packaging and plastics, e-waste, industrial, medical, and hazardous waste streams. Myanmar government has enacted Environmental Conservation Law in 2012, the Yangon City Development Committee Law in 2018, National Waste Management Strategy and Action Plan (2020-2030) in 2018. But the actual implementation and enforcement lag behind.

Yangon is Myanmar's largest city and the most significant commercial center, with a population of about 5.4 million inhabitants (Department of Population, 2020). Yangon functioned as Myanmar's administrative capital until 2006, when the military government moved the country's administrative operations to Nay Pyi Taw, a purpose-built city in central Myanmar. Yangon is located in lower part of Myanmar about 30 kilometers from the Gulf of Martaban at 16° 48' North and 96° 09' East (Japan International Cooperation Agency, 2019). Yangon Region is administered by Yangon Regional Government. North, East, South, and West are the four districts that make up Yangon Region. Yangon Region comprises 45 townships in total, and the Yangon City Development Committee (YCDC) is responsible for municipal works in 33 townships among them. This study focuses on the 33 townships under YCDC's responsibility as in Figure - 4.

Figure 4. District and Townships of Study Area

Source: (Naing, 2021)



The administration of municipal affairs in Yangon and Mandalay differs from that of the rest of the country. YCDC is in charge of municipal service delivery and public works (waste management, water supply, roads and bridges, parks and sports grounds, street lighting, funeral services, and firefighting, among other things), as well as city planning, urban land administration, and tax collection (Japan International Cooperation Agency, 2019). Therefore, YCDC is responsible for Solid Waste Management in Yangon. Under YCDC, Pollution Control and Cleansing Department (PCCD) is in charge of both daily waste management and pollution control.

There are six dumpsites in Yangon, namely: Htein Bin, Htawe Chaung, Kyi Su, Da La, Hlaw Gar and Shwe Pyi Thar. Htein Bin, constructed in 2002 is the largest open dumpsite that can accept 847 tons per day (Institute for Global Environmental Strategies, 2016). Yangon faces a serious air pollution due to occasional dumpsite fires. One of the most serious incidents was Htein Bin dumpsite fire which burned for 14 days starting from 21st April 2018 (KYAW, 2018). The fire started and spread rapidly until more than half of the total area (48 Ha of total 60 Ha), linked to that fire, more than two dozen of people were hospitalized for injuries and smoke inhalation by worsening air quality in the commercial capital (The Guardian, 2018). This is also one of the most significant concerns at the generating source.

The full potential of reuse, reduce and green purchasing have been challenged by the consequences of economic growth and rising consumer demand for disposal items. Young people in Yangon prefer in the disposable consumption culture, and they are eager to buy new luxury items (Myint & U Mann, 2020) that result in low waste reusing, reducing, recycling and green purchasing. The recycling and reusing rate are low due to the low quality of scrap. The garbage 86 ton of 1690 ton per day could be recycled, accounting for approximately 5% of the total waste in Yangon (AIT RRC.AP, 2018). Despite the fact that organic waste accounts for more than three-quarters of total waste, the recycling rate is poor due to the lack of a

composting infrastructure (AIT RRC.AP, 2018). Glasses are the most often recycled, while cardboard and paper are the second most recycled goods (Myint & U Mann, 2020). With the exception of Yangon's unenforced wet and dry household segregation scheme, the official municipal programs for source-separated collection of valuable waste streams are lack (Jeske et al., 2020). 97 % of municipal waste is formally collected and only 3% is illegally disposed (AIT RRC.AP, 2018). Uncollected waste is mostly released into the environment through neighborhood-level burning and direct dumping into rivers. Individual, marketplace, business, schools, and other organizations all take part in various disposal methods. Given the current scenario in Yangon, individuals' perceptions of risks and uncertainties , and their capacity to manage such risks might influence their decision to participate in SWMBs.

Figure 5. Yangon urban curb side "bin" in waste collection area

Source: (Jeske et al., 2020)



Figure 6. Audit of roadside waste in Yangon, divided into recyclables and disposed waste

Source: (Jeske et al., 2020)

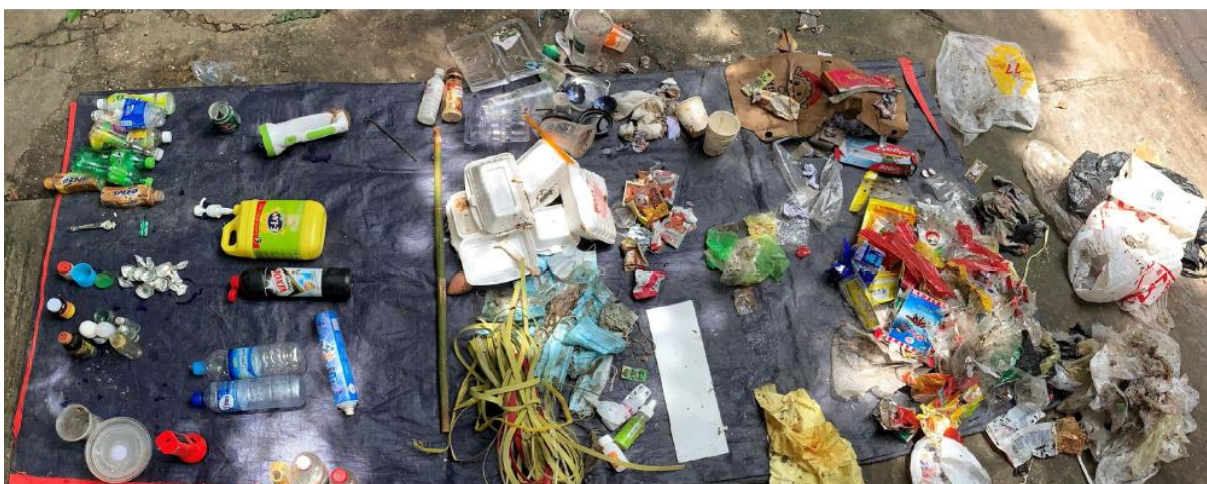


Figure 7. Informal waste dump in Yangon's back alley

Source (Roell, 2020)



4.2 Descriptive Analysis

4.2.1 Characteristics of the Respondents

Table - 3 shows the sociodemographic characteristics of the respondents. Female respondents account for 66.03 %, while male respondents accounted for 33.97 % of the total. Majority of the respondents who took part are between 31-45 years of age. According to the data, 47.44% of respondents have bachelor's degree which is the majority of total respondents, while 38.46 % have a master's degree. The majority of those are the staffs from companies and organizations, while 37.8% work for a government agency. Most of them have income over 400 \$. More than a quarter of the respondents have an average monthly income of between 201 -400 \$, and between 100 – 200 \$ respectively. In terms of housing conditions, majority of the respondents live in a flat and the second majority live in a single house.

Table 3. Sociodemographic characteristics of the respondents

	Freq.	Percent
Gender		
Female	103	66.03
Male	53	33.97
Age		
18 – 30	32	20.51
31- 45	100	64.1
46-60	20	12.82
Over 61	4	2.56
Education Level		
Basic Education	6	3.85
Bachelor	74	47.44
Master	60	38.46
Above Master	16	10.26
Occupation		
Government Staff	59	37.82
Staff (Company/Organization)	68	43.59
Own Business	12	7.69
General Worker	1	0.64
Student	7	4.49
Dependent	9	5.77
Income		
< 100\$	3	2.14
100 \$ - 200 \$	37	26.43
201 \$ - 400 \$	40	28.57
> 400 \$	60	42.86
Housing Type		
Apartment	73	46.79
Single House	63	40.38
Hostel	16	10.26
Others	4	2.56

N = 156

4.2.2 People's Perception on Risk and Uncertainties

This part is separately analysing perceived severity, perceived probability, self-efficacy and response-efficacy descriptive analysis method, considering Mean and Std. deviation in general (Table – 4). Since the questions use the 5-point Likert Scale, it is easy to use mean value to represent the tendency. If the mean value is more than 3.4, the city is showing a positive tendency; if the value is less than 3.4, it is showing a negative tendency (Suebwongsuawan & Nomnian, 2020). The number of research questions about the perceived severity are six, the questions about perceived probability are six, and one question each for self-efficacy and response efficacy respectively.

Under perceived severity- the respondent's opinion on the following six questions are analyzed.

- Severity of water pollutant caused by waste disposal
- Severity of air pollutant caused by waste disposal
- Severity of soil pollutant caused by waste disposal

- Severity of water pollutant's effect on human
- Severity of air pollutant's effect on human
- Severity of soil pollutant's effect on human

In terms of perceived probability, the respondent answered for the below questions.

- Possibility of occurrence from water pollutant's effects
- Possibility of occurrence from air pollutant's effects
- Possibility of occurrence from soil pollutant's effects
- Vulnerability from the occurrence of water pollutant's effects
- Vulnerability from the occurrence of air pollutant's effects
- Vulnerability from the occurrence of soil pollutant's effects

For self-efficacy, the respondent's willingness to change their waste management practices to sustainable manners is asked. In terms of response efficacy, the respondent's belief on the degree of one person's action to help for enhancing environmental quality is examined.

Table 4. Descriptive statistics of potential predictors on sustainable waste management behaviours

Variables	Mean	Std. Dev.	Min	Max	Cronbach's α
Perceived severity	4.316239	.5591146	2.5	5	0.8385
Perceived probability	3.986111	.8158287	1.333	5	0.7712
Self-Efficacy	4.410256	.7350382	1	5	
Response Efficacy	4.698718	.5613333	2	5	

With an average score of 4.32 and a standard deviation of 0.56, respondents indicated a high perceived severity of unfavourable effects induced by environmental pollution. Perceived probability has an average score of 3.99 and a standard deviation of 0.81. The respondents thought that the probability of receiving the environmental pollution by waste disposal is high. However, it is not as high as other variables: perceived severity, self and response efficacy. Respondents' perceived self-efficacy and response efficacy are somewhat different, at average score 4.41 with standard deviation 0.74 and at average score 4.7 with standard deviation 0.56 respectively. The results imply that the respondents' willingness to change their waste management practice into sustainable one is the second highest while their perception on the help of individual's waste management practices for enhancing environmental quality is the highest. As all mean values are higher than 3.4, people's perception on risks and uncertainties is higher than average level. Since all standard deviations of these variables are smaller, the more of the data are cluster about the mean value.

4.2.3 People's Engagement in SWMBs

This part is analysing sustainable waste management behaviours of the respondents based on their waste reduction, reuse, recycle, disposal and green purchasing practices. The results are shown in descriptive analysis method, considering Mean and Std. deviation in general (Table – 5). Since the questions used the 5-point Likert Scale, the respondents' behaviours are positive tendency if the mean value is more than 3.4 (Suebwongsuawan & Nomnian, 2020). If the mean value is between 2.61 and 3.4, the data is in central tendency (Suebwongsuawan & Nomnian, 2020). It means that the respondent's waste management behaviours are in moderate level.

In research questions, the questions about the waste reduction are three as following:

- Frequency of refusal to accept a plastic bag in shopping
- Frequency of using cotton bag instead of plastic bag
- Frequency of using reusable cup/box in the place of single use

The four questions under waste reusing section are as follows:

- Frequency of reusing plastic bags
- Frequency of reusing bottles
- Frequency of reusing food containers and parcel boxes
- Frequency of printing double-sided paper and writing note on single side.

The below three questions are used for examining the waste recycling behaviours.

- Frequency of recycling plastic bags
- Frequency of recycling bottles
- Frequency of recycling food containers and parcel boxes

The following three questions are investigated for the respondents' waste disposal practices.

- Frequency of waste separation
- Frequency of emptying bottles before disposal
- Frequency of disposing into identified bins

Under green purchasing behaviours, the questions used are as follows.

- Frequency of avoidance to purchase form containers
- Frequency of buying environmental-friendly goods
- Frequency of avoidance to purchase unnecessary products for the family and self

Table 5. Descriptive statistics of sustainable waste management behaviours

Variables	Mean	Std. Dev.	Min	Max	Cronbach's α
Waste Reduction	3.108974	.9415068	1	5	0.6102
Waste Reusing	3.5625	1.068095	1	5	0.7520
Waste Recycling	2.980769	1.292515	1	5	0.8345
Waste Disposal	3.096154	1.321186	1	5	0.7710
Green Purchasing	3.035256	1.108053	1	5	0.7338

Apart from waste reusing, the data of the rest variables are in central tendency. With an average score of 3.11 and a standard deviation of 0.94, respondents' engagement in waste reduction practice is medium, but it is slightly higher than the value of disposal practices. Waste reusing has an average score of 3.56 and a standard deviation of 1.07. It reveals that the respondents have positive engagement in the waste reusing practices. Compared to other SWMBs, engagement in waste recycling behaviours has the lowest score, with an average score of 2.98 and a standard deviation of 1.29. Engagement in waste disposal practice is the moderate level with an average score of 3.1 and standard deviation of 1.32. Green purchasing behaviours show mean value 3.04 and standard deviation 1.1, that indicate medium engagement of the respondents in that practice.

4.3 Reliability and Validity Test

4.3.1 Reliability Test

This study uses the internal consistency reliability to test the reliability. Calculating the coefficient of reliability, commonly known as the Cronbach's alpha. It is used to do internal consistency reliability analysis. The value and interpretation of Cronbach's alpha is shown in Table - 6.

Table 6. Value of Cronbach's alpha coefficient

Source: (Tavakol & Dennick, 2011)

Cronbach's alpha	Internal consistency
$\alpha \geq 0.9$	Excellent
$0.9 > \alpha \geq 0.8$	Good
$0.8 > \alpha \geq 0.7$	Acceptable
$0.7 > \alpha \geq 0.6$	Questionable
$0.6 > \alpha \geq 0.5$	Poor
$0.5 > \alpha$	Unacceptable

Table 7. Internal consistency reliability test

Variables	Cronbach's α	Interpretation
Perceived Severity	0.8385	Good
Perceived Probability	0.7712	Acceptable
Waste Reduction	0.6102	Questionable
Waste Reusing	0.7520	Acceptable
Waste Recycling	0.8345	Good
Waste Disposal	0.7710	Acceptable
Green Purchasing	0.7338	Acceptable

Table - 7 presents the reliability of scales of the research data. Apart from waste reduction behaviours, all other variables demonstrate good and acceptability reliability with Cronbach's alphas above 0.70.

4.3.2 Validity Test

As mentioned in chapter - 3, each variable's measurement is based on a comprehensive literature reviews and related research articles. Before formal testing, the questionnaire is pre-tested to ensure its quality, and based on the input from pilot test. Some of the items and questions are removed or merged to make it more consistent with the actual scenario and avoid excessive entry that would cause inconvenient for the respondents. Pearson's correlation coefficient is used to test validity. The validity coefficient values represent the accuracy of the measurement as displayed in Table - 8.

Table 8. Interpretations of validity coefficients

Source: (Saad, Carter, Rothenberg, & Israelson, 1999)

Validity coefficient values	Interpretation
Above 0.35	Very beneficial (Strongly Valid)
0.21-0.35	Likely to be useful
0.11-0.20	Depends on circumstances
Below 0	Unlikely to be useful

Table 9. Internal consistency validity test

Variables	Correlation Coefficient	Significance	Interpretation
Perceived Severity	0.4592*	0.0000	Strongly Valid
Perceived Probability	0.4522*	0.0000	Strongly Valid
Self-Efficacy	0.5198*	0.0000	Strongly Valid
Response Efficacy	0.4700*	0.0000	Strongly Valid
Waste Reduction	0.6934*	0.0000	Strongly Valid
Waste Reusing	0.6384*	0.0000	Strongly Valid
Waste Recycling	0.6861*	0.0000	Strongly Valid
Waste Disposal	0.6000*	0.0000	Strongly Valid
Green Purchasing	0.7445*	0.0000	Strongly Valid

All items in Table - 9 construct are strongly valid following the rule of thumb in Table - 8. The internal consistency coefficients of validity and reliability of the questionnaire confirm that the collected data is high validity and reliable, therefore, it can be used to perform an inferential statistical analysis, such as a multiple regression analysis.

4.4 Regression Analysis

4.4.1 Influence of Protection Motivation Variables on People’s Engagement in Sustainable Waste Management Behaviours

Multiple regression analyses are used to see if people’s perception and belief on risks and uncertainties affect their engagement in sustainable waste management behaviours. In other words, perceived severity, perceived probability, perceived self-efficacy, or perceived response efficacy might predict respondent’s participation in sustainable waste management. Before examining the influence of each kind of SWMBs, the collective SWMBs predictors are first evaluated. As a result, the criteria variable is specified as the average SWMBs score and the four indicators are chosen as predictors.

Table - 10 summarises the findings. With $F(4, 151) = 4.99$, $p = 0.0008$, the entire model is significant. R square value is 0.1168. This means that the linear combination of the chosen predictors may explain for about 12% of the variance in sustainable waste management behaviours. VIF in this study are within 1.15 and 1.91. If VIF values are below the threshold value of 10, there is no multicollinearity (Field, 2009). The collective sustainable waste management behaviours could only be predicted by perceived self-efficacy at 5% significant level. Perceived severity, perceived probability and response efficacy are not able to predict their waste management behaviours since the variables are not significant.

Therefore, the respondent’s willingness to change their behaviours to sustainable manners are only strong predictor for their collective waste management behaviours. People with high sense of adaptation are more likely to engage in SWMBs. People’s perceptions on the severity of waste related problems, the probability of receiving the waste’s effects and the help of their actions on the environment are not strong enough to explain waste management behaviours.

Table 10. Summary of regression analysis for variables predicting sustainable waste management behaviours

Protection Motivation Variables	Sustainable Waste Management Behaviours		
	Coefficient	Std. Err.	VIF
Perceived severity	0.79	0.61	1.91
Perceived probability	0.26	0.41	1.81
Self-Efficacy	0.71 **	0.36	1.2
Response Efficacy	0.72	0.47	1.15
F (4, 151)	4.99		
Prob > F	0.0008		
R2	0.1168		
Adjusted R2	0.0934		

Notes: N = 156; * p<0.1, ** p<0.05, ***p<0.01.

4.3.2 Influence of Protection Motivation Variables on People’s Engagement in Waste Reduction Behaviours

Under sustainable waste management behaviours, the factors’ effects on each behaviour is investigated. In waste reduction behaviours, perceived severity and self-efficacy are significant at 5%. The entire model is significant at p = 0.0005. Since all VIF values are below the threshold value of 10, multicollinearity is not an issue in this case (Table - 11). Since R square is 0.1231, the linear combination of chosen independent factors may explain for approximately 12.3 percent of the variance in waste reduction behaviours. This behaviour cannot be predicted by perceived probability and response efficacy. People’s perception on the waste related problem and people’s willingness to change their behaviours are strong predictors for the waste reduction behaviours. People with high perceived severity and self-efficacy are more likely to follow waste reduction. People perceptions of the likelihood of being affected by pollutants and the help of their actions on the environment quality are not significant predictors of waste reduction behaviour.

Table 11. Regression analysis for variables predicting sustainable waste reduction behaviours.

Protection Motivation Variables	Waste Reduction Behaviours		
	Coefficient	Std. Err.	VIF
Perceived severity	0.37 **	0.18	1.91
Perceived probability	0.07	0.12	1.81
Self-Efficacy	0.21 **	0.10	1.2
Response Efficacy	0.05	0.14	1.15
F(4, 151)	5.30		
Prob > F	0.0005		
R2	0.1231		
Adjusted R2	0.0999		

Notes: N = 156; * p<0.1, ** p<0.05, ***p<0.01.

4.3.3 Influence of Protection Motivation Variables on People’s Engagement in Waste Reusing Behaviours

When each factor's effect on waste reusing management behaviour is considered, it is shown that self-efficacy is significant at 5% while other factors: perceived severity, perceived probability and response efficacy are not significant. The model is significant at 10% with $F(4, 151) = 2.05$. Since value of R square is only 0.05, a linear combination of the selected variables may account for roughly 5% of the variation in waste reusing practices. Also in this regression, multicollinearity is not a problem since VIF range are between 1.15 and 1.91 (Table - 12). People's perceptions of the severity of negative effects, perceived probability of being impacted by waste pollutants and perceived effectiveness of the risk reduction practices for the waste are not significant predictors for waste reusing practices. People’s perception on their adaptive capacities are only significant predictor for their waste reusing behaviours. The higher sense of adaptation to sustainable practices they have, the more waste reusing actions they do.

Table 12. Regression analysis for variables predicting sustainable waste reusing behaviours

Protection Motivation Variables	Waste Reusing Behaviours		
	Coefficient	Std. Err.	VIF
Perceived severity	0.08	0.21	1.91
Perceived probability	0.01	0.14	1.81
Self-Efficacy	0.28 **	0.12	1.2
Response Efficacy	0.07	0.16	1.15
F (4, 151)	2.05		
Prob > F	0.0898		
R2	0.0516		
Adjusted R2	0.0999		

Notes: N = 156; * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

4.3.4 Influence of Protection Motivation Variables on People’s Engagement in Waste Recycling Behaviours

When each factor's effect on waste recycle behaviour is investigated, response efficacy is found to be significant at 10%, whereas other factors such as perceived severity, perceived probability, and response efficacy are unable to predict people’s waste recycle practices. With $F(4, 151) = 4.48$, the model is significant at 5%. As the R square value is 0.106, a linear combination of the selected factors may explain approximately 10.1% of the variation in recycling behaviours. Multicollinearity is also not an issue in this regression because the VIF values are under 10. For all these results in Table - 13, only individual’s perceived effectiveness of the recommended actions for reducing risk can be significant factor for waste recycling. People who believe the single person’s actions will help environmental quality, try to participate in recycle activities.

Table 13. Regression analysis for variables predicting sustainable waste recycling behaviours

Protection Motivation Variables	Waste Recycling Behaviours		
	Coefficient	Std. Err.	VIF
Perceived severity	0.32	0.25	1.91
Perceived probability	0.12	0.16	1.81
Self-Efficacy	0.17	0.15	1.2
Response Efficacy	0.35*	0.19	1.15
F(4, 151)	4.48		
Prob > F	0.0019		
R2	0.1061		
Adjusted R2	0.0824		

Notes: N = 156; * p<0.1, ** p<0.05, ***p<0.01.

4.3.5 Influence of Protection Motivation Variables on People's Engagement in Waste Disposal Behaviours

The fourth model is forecasting waste disposal behaviours of the respondents (Table – 14). The entire model is significant at 5%, with $F(4, 151) = 4.34$, $p = 0.0024$, according to the results, R square is 0.103, while the adjusted R2 is 0.0793. Multicollinearity is also not an issue in this regression, since all VIF values are below the threshold of 10. Furthermore, only response efficacy is shown to be a significant factor at 5% in explaining respondents' waste disposal actions. Self-efficacy, perceived severity and perceived vulnerability of waste's negative effects do not show significant influence on waste disposal behaviours. People who acknowledge the individual's actions will help environment quality, are more likely to participate in sustainable waste disposal behaviours.

Table 14. Regression analysis for variables predicting sustainable waste disposal behaviours

Protection Motivation Variables	Waste Disposal Behaviours		
	Coefficient	Std. Err.	VIF
Perceived severity	0.18	0.25	1.91
Perceived probability	0.15	0.17	1.81
Self-Efficacy	0.20	0.15	1.2
Response Efficacy	0.41*	0.19	1.15
F (4, 151)	4.34		
Prob > F	0.0024		
R2	0.1031		
Adjusted R2	0.0793		

Notes: N = 156; * p<0.1, ** p<0.05, ***p<0.01.

4.3.5 Influence of Protection Motivation Variables on People's Engagement in Green Purchasing Behaviours

The model for examining green purchasing behaviour is presented in Figure - 15. With $F=3.98$ and $p = 0.0042$, the entire model is significant at 5%. R square is 0.095, therefore, the protection motivation variables can only explain 10% for the green purchase behavior of the respondents. The VIF indices are likewise below the ten-point VIF-index criterion. The degree of response efficacy is the most significant predictor, with a coefficient-value of 0.30 and significant at 5%. The perceived severity is the second highest predictor, with a beta-value of 0.21 and significant

at 10%. On the one hand, the green purchasing habit is unaffected by perceived probability and self-efficacy. On the other hand, people with higher perceived severity and response efficacy are likely to enhance this habit. Therefore, the respondent's belief on the importance of their action to enhance the environment quality and the perceived degree of negative effects produced by waste can influence their green purchasing manners.

Table 15. Regression analysis for variables predicting sustainable green purchasing behaviours

Protection Motivation Variables	Green Purchasing Behaviours		
	Coefficient	Std. Err.	VIF
Perceived severity	0.21*	0.21	1.91
Perceived probability	0.09	0.14	1.81
Self-Efficacy	0.17	0.13	1.2
Response Efficacy	0.30**	0.16	1.15
Constant	-0.3822		
F(4, 151)	3.98		
Prob > F	0.0042		
R2	0.0954		
Adjusted R2	0.0715		

Notes: N = 156; * p<0.1, ** p<0.05, ***p<0.01

4.3.6 Moderating Effects of Sociodemographic Factors

Some sociodemographic factors may moderate the degree of effect on people's engagement in sustainable waste management behaviours by their perception and belief. Hence, the collective SWMBs is investigated by each social demographic factor along with each PMT variables: perceived severity, perceived probability, self-efficacy and response efficacy. Gender, age, education, and monthly income are the four social demographic factors. In this study, the occupation and housing type are also taken into account.

(i) Moderating Effect of Gender

The interaction terms between protection motivation variables and gender (PMT*Gender) capture the moderating effects of gender on the influence of each PMT variables on SWMBs. Table - 16 summarizes the findings of each variable.

In perceived severity, with $F(3,152) = 3.64$, $p = 0.01$, the entire model is significant. Since R square value is 0.07, the linear combination of the selected predictors may explain only 7% for sustainable waste management behaviours. The respondent's gender is not statistically significant by itself although the perceived severity of the respondent is significant at 1% to explain SWMBs. The interaction of severity and respondent's gender is not significant as well. Therefore, the higher perceived severity of the respondent can strengthen their SWMBs whether the respondent is female or male.

Regarding perceived probability, with $F(3,152) = 2.42$, $p = 0.07$, the entire model is significant at 10%. But R squared is 0.05, therefore, only 5% of the variance in SWMBs could be explained by the selected variables. Perceived probability, gender and the interaction between probability and gender of the respondents are not statistically significant. Gender do not afford to moderate the relation of people's perceived probability and their participation in SWMBs.

Concerning self-efficacy, the model is significant at 5% with the value of $F(3,152) = 3.36$, $P = 0.02$. Because the R square value is 0.06, the linear combination of the chosen predictors can only explain 6% of the variance in respondents' behaviours. Self-efficacy, gender and the interrelation of self-efficacy and their gender could not explain the SWMBs of the respondents. So, the relationship between perceived self-efficacy and SWMBs cannot be explained by gender.

The last model presents about response efficacy, gender and interaction of gender and response efficacy. The entire model is statistically significant at 5 % as well with F value 3.17 and P value 0.03. Response efficacy is itself significant at 10 % to predict the respondent's SWMBs. Whether the responder is female or male, the higher response efficacy of the respondent can enhance their SWMBs. In conclusion, the sociodemographic variable, gender of the respondents do not change the relationship between PMT variables (severity, probability, self-efficacy and response efficacy) and the respondents' SWMBs.

Table 16. Regression analysis for moderating variable (gender)

Variables	SWMBs (Severity)	SWMBs (Probability)	SWMBs (Self Efficacy)	SWMBs (Response Efficacy)
PMT Variables	2.4*	1.08	0.50	2.42*
Gender	2.91	0.38	-2.12	3.38
PMT * Gender	-0.72	-0.19	0.44	-0.70
F (3,152)	3.64	2.42	3.36	3.17
Prob > F	0.0142	0.0685	0.0205	0.0261
R2	0.07	0.05	0.06	0.06
Adjusted R2	0.05	0.03	0.04	0.04

Notes: N=156; * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

(ii) Moderating Effect of Age

The moderating effects of age on the influence of each protection motivation component on SWMBs are investigated by the interaction between protection motivation variables and age (PMT*Age) in Table - 17.

The interaction between perceived severity and the respondent's age is not significant as well as perceived severity and age themselves are not significant to predict SWMBs. But the entire model is significant at with the value of $F(3,152) = 4.72$ and $P = 0.004$. The selected predictors could only explain 9% of the variance in respondents' waste management behaviours. Age factor could not strengthen or weaken the relationship between perceived severity and SWMBs of the respondents.

In perceived probability, although the entire model is significant at 5%, perceived probability, age and the interaction between respondent's age and perceived probability are not statistically significant to predict people's waste management behaviour. Also, the respondent's age could not able to moderate the relationship between perceived probability and their SWMBs.

The third model investigates self-efficacy, age and the interaction between self-efficacy and the respondent's age on SWMBs. With $F(3,152) = 4.7$ and $P = 0.004$, the model is significant at 5%. Like other previous models, the self-efficacy, age and interaction between the self-

efficacy and age could not explain the waste management behaviours of the respondents. The last model is about response efficacy, age and the interrelation of response efficacy and age of the respondents on the SWMBs. The respondent's age is significant at 10 % level with the coefficient -5.57. It implies that the potential of practice for sustainable waste management are higher if the respondents are younger. However, response efficacy and interaction between response efficiency and age are not significant for determining SWMBs. For these findings from the first to the last model, the age factor is not able to moderate the relation of protection motivation variables and SWMBs.

Table 17. Regression analysis for moderating variable (age)

Variables	SWMBs (Severity)	SWMBs (Probability)	SWMBs (Self Efficacy)	SWMBs (Response Efficacy)
PMT Variables	0.42	1.08	0.75	-0.74
Age	-2.62	-0.08	-1.48	-5.57*
PMT * Age	0.47	-0.16	0.16	1.07
F (3,152)	4.72	3.28	4.70	5.11
Prob > F	0.0036	0.0228	0.0036	0.0021
R2	0.09	0.06	0.08	0.09
Adjusted R2	0.07	0.04	0.07	0.07

Notes: N=156; *p<0.1, ** p<0.05, *** p<0.01

(iii) Moderating Effect of Education

The interaction between protection motivation variables and education (PMT*Education) is considered as the education effect on the relationship between protection motivation variables and SWMBs. They are investigated in Table - 18.

In the first model, the interaction between perceived severity and education, perceived severity and education are not significant to explain SWMBs. The first entire model is significant with the value of $F(3,152) = 8.76$ and $P=0.0000$. Since R^2 value is 0.15, the chosen variables can explain 15% of the variance in respondents' SWMBs. Any variables in this model could not explain SWMBs. Moreover, respondent's education could not change the relationship between perceived severity and SWMBs of the respondents.

According to the results of perceived probability, the entire model is statistically significant at $P=0.0000$ and $F(3,152) = 9.17$. The 15% of the variance in respondents' waste management behaviours could be explained by the selected predictors. The interaction between perceived probability and education is not significant on the one hand. But on the other hand, both perceived probability and education are significant at 5% and 10% respectively. These imply that the higher perception on the probability of receiving waste effects, the better practice for sustainable waste management. Furthermore, the education level of the respondents can have positive effects on their SWMBs.

Regarding self-efficacy, the entire model is significant at F value, 8.07 and P value, 0.0001 and the chosen variables could predict the 14% of the variance for SWMBs. All of the selected variables: self-efficacy, education and interaction between self-efficacy and education are not significant. In response efficacy, the model is significant with $F(3,152) = 7.26$ and $P = 0.0001$.

the R2 value is 0.13 reveals that 13% of the variance for SWMBs could be explained by the predictors in this regression model.

Response efficacy is significant at 10% level meanwhile education itself and interaction between response efficacy and education are not significant. Hence, if the respondent believes that a single person's waste management activities help to enhance environmental quality, there are more chances for engaging SWMBs whatever their education level is. In conclusion for all models under education, the education level of respondents cannot interfere with the relationship between people's perception on risks and uncertainties and their SWMBs.

Table 18. Regression analysis for moderating variable (education)

Variables	SWMBs (Severity)	SWMBs (Probability)	SWMBs (Self Efficacy)	SWMBs (Response Efficacy)
PMT Variables	1.36	1.68**	0.91	1.65*
Education	0.66	2.12*	0.59	2.11
PMT * Education	0.04	-0.29	0.05	-0.29
F (3,152)	8.76	9.17	8.07	7.26
Prob > F	0.0000	0.0000	0.0001	0.0001
R2	0.15	0.15	0.14	0.13
Adjusted R2	0.13	0.14	0.12	0.11

Notes: N=156; *p<0.1, ** p<0.05, *** p<0.01

(iv) Moderating Effect of Occupation

Table - 19 presents the results for moderating effect of respondent's occupation on the relationship between each protection motivation variable and SWMBs. As usual in the previous regression analyses, occupation and independent variables are calculated for moderating effects. The interaction between protection motivation variables and occupation (PMT*Occupation) shows the moderating effects of the respondent's occupation on the influence of each protection motivation variables on SWMBs.

In perspective of perceived severity, the whole model is significant at 5% with $F(3/152) = 4.81$ and $P = 0.003$. Each variable such as perceived severity, occupation and the interaction between perceived severity and occupation is not statistically significant. Hence, each variable could not explain the respondents' SWMBs. Since R2 value is 0.09, only 9% of the variance for the SWMBs is explained by the chosen predictors in this regression.

The second model displays the results of perceived probability, occupation and the interaction between perceived probability and occupation on predicting the respondent's SWMBs. They do not have effect on the people's SWMBs in this model because each variable is not significant statistically. The entire model is significant with $F(3/152) = 3.89$ and $P = 0.01$. R2 value 0.07 reveals that 7% of the variance for the SWMBs is explained by the chosen independent variables in this model.

The third model discusses the analysis of self-efficacy, occupation and interaction between self-efficacy and occupation on the SWMBs. It is significant at F value, 4.88 and P value 0.003. R2 value 0.09 implies that a linear combination of the selected factors may explain approximately 9% of the variation in waste management behaviours. Each variable is not statistically significant, therefore, there is no significant relationship between self-efficacy,

occupation and SWMBs. Moreover, respondent's occupation could not change the relationship between self-efficacy and SWMBs of the respondents.

The last model presents the analysis the relationship between response efficacy, occupation and people behaviours on waste management practices, and the interaction effect of response efficacy and occupation. The model is significant at 10% with F value 4.3 and P value 0.006. According to the results, any variable could not affect the people's SWMBs because each variable is not statistically significant in this model. A linear combination of the selected variables may explain only 8% of the variation in sustainable waste practices. In conclusion, the effect of people's occupation could not have any changes on the relationship between people's perception on risks and uncertainties and their waste management behaviours.

Table 19. Regression analysis for moderating variable (occupation)

Variables	SWMBs (Severity)	SWMBs (Probability)	SWMBs (Self Efficacy)	SWMBs (Response Efficacy)
PMT Variables	0.93	-0.30	0.75	0.57
Occupation	-0.06	-0.62	0.09	-0.36
PMT * Occupation	0.11	0.26	0.08	0.16
F (3,152)	4.81	3.89	4.88	4.30
Prob > F	0.0032	0.0103	0.0029	0.0061
R2	0.09	0.07	0.09	0.08
Adjusted R2	0.07	0.05	0.07	0.06

Notes: N=156; *p<0.1, ** p<0.05, *** p<0.01

(v) Moderating Effect of Income Level

The study also examines the influences of income on the relation between people's perception and attitude and their SWMBs by using regression analysis. Table 17 shows the results of regression for each protection motivation variable, income factor and interaction between income and protection motivation.

In terms of perceived severity, the whole model is significant with $F(3,152)=3.65$, $P=0.01$. Since R2 value is 0.07, approximately 7% of the variation in waste practices could be explained by the selected variables. Perceived severity is significant at 10% level, it implies that the probability of following sustainable waste management practices is higher if people's perceptions of the severity of negative effects produced by pollutants is higher. Income itself and the interaction between income and perceived severity are not significant at any level. Thus, they do not have significant relationship with the respondent's SWMBs. Respondent's income could neither strengthen nor diminish the relationship between perceived severity and their SWMBs.

In terms of perceived probability, the model is significant at F value 2.62 and P value 0.05. Since R2 value is very low with 0.05, only 5% of the variation in waste practices could be explained by the chosen predictors. The variables of probability, income and interaction between probability and income are not significant, therefore, they do not influence the people's behaviour of waste management. Furthermore, the income level of the respondents cannot interfere with the relationship between perceived probability and SWMBs.

The third model analyses self-efficacy, income level and interaction between self-efficacy and income levels, and how these variables could influence waste management behaviours. The overall model is significant with $F(3,152)=3.4$, $P=0.02$. But each variable is not significant so it cannot be observed a significant relationship between respondent's income and waste management behaviours, and between their adaptive capacities and waste management behaviours. Also, the level of income could not moderate the relationship between people's willingness to change their behaviours and their actual behaviours on waste management.

The fourth model talks about the analysis of response efficacy, income level and interaction between response efficacy and income on the relationship between response efficacy and SWMBs. This multiple regression model for predicting waste management behavior is significant, with $F(3, 152) = 3.13$, $p = 0.03$. R^2 value, 0.06 indicates that approximately 6% of the variance in waste behaviours could be accounted for by the linear combination of those chosen predictors. Each variable is not significant so waste management behaviour is not influenced by level of income as well as their belief on the effectiveness of a single person's behaviours on the environmental quality. The level of income cannot influence the relationship between response efficacy and people's SWMBs. To be conclude that the level of income do not provide any influence on the relationship between protection motivation variables and people's SWMBs.

Table 20. Regression analysis for moderating variable (income)

Variables	SWMBs (Severity)	SWMBs (Probability)	SWMBs (Self Efficacy)	SWMBs (Response Efficacy)
PMT Variables	1.76*	1.14	1.01	1.50
Income	0.57	0.52	0.08	0.41
PMT * Income	-0.11	-0.09	0.01	-0.06
F (3,152)	3.65	2.62	3.40	3.13
Prob > F	0.0141	0.0527	0.0194	0.0275
R2	0.07	0.05	0.06	0.06
Adjusted R2	0.05	0.03	0.04	0.04

Notes: N=156; * $p<0.1$, ** $p<0.05$, *** $p<0.01$

(vi) Moderating Effect of Housing Type

Table - 21 summarizes the effects of housing type on the people's waste management behaviours by their attitude and perception about waste problems. The survey shows that the housing types do not demonstrate the significant differences for the level of severity on waste management behaviour. The model is significant with F value 3.82 and P value 0.01. As R^2 is 0.07, a linear combination of the chosen variables might explain 7% of the variation in their waste behaviours. Since all variables are not significant, the housing type cannot explain the SWMBs of the people. Also, people's perception about the severity of pollutants' negative effects may not determine their SWMBs. The housing condition could not moderate the relationship between people's perceived severity and their actual behaviours on waste management.

According to the results of perceived probability, the entire model is significant at $F(3,152) = 2.39$ and $P = 0.07$. But there is no significance for perceived probability, housing type and the interaction between probability and housing type. Thus, it can be said that people's opinion on the occurrence of waste problems and its effects, and their housing type cannot influence their

SWMBs. Furthermore, the housing type cannot provide any effects on the relation of people's opinion on the occurrence of waste problems and their waste management practices. The combination of those variables could explain only 5% of the variation in their SWMBs.

In the third model, self-efficacy, housing type and interaction between self-efficacy and housing type of the respondents on the SWMBs are analysed. Since any variables under this model is not significant, the respondent's willingness to change their behaviours to sustainable ones and their housing type may not explain their behaviours on the waste management. Also, housing type of the respondent does not have any effects on the relationship between their willingness to change and their waste management behaviours. A linear combination of those variables might be able to explain approximately 7% of the variation in the respondents' SWMBs.

In terms of response efficacy, the study examines the regression of response efficacy, housing type and interaction between response efficacy and housing type on the respondent's waste management behaviours. The whole model is significant at $F(3,152) = 3.69$ and $P = 0.01$. As the value of R^2 is 0.07, the variables in this model could explain approximately 7% of the variation in their waste management behaviours. Each variable is not statistically significant, therefore, there is no significant relationship between response efficacy, housing type of the respondents and their waste management behaviours. Housing type cannot influence the relationship between people's perception on the helps of their actions on the environment quality and their SWMBs. In summary, housing types of the respondents cannot make any changes in the relationship between people's perception of the risks and uncertainties and their waste management behaviours.

Table 21. Regression analysis for moderating variable (housing type)

Variables	SWMBs (Severity)	SWMBs (Probability)	SWMBs (Self Efficacy)	SWMBs (Response Efficacy)
PMT Variables	1.64	0.88	1.14	2.32
Housing Type	0.42	0.24	0.25	1.86
PMT * Housing type	-0.05	-0.03	-0.02	-0.37
F (3,152)	3.82	2.39	3.54	3.69
Prob > F	0.01	0.07	0.02	0.01
R2	0.07	0.05	0.07	0.07
Adjusted R2	0.05	0.03	0.05	0.05

Notes: N=156; *p<0.1, ** p<0.05, *** p<0.01

Chapter 5: Conclusions and Recommendations

5.1 Introduction

This chapter summarizes the findings of the study and makes recommendations to encourage the residents for participation in SWMBs based on the results of data analysis and literature reviews.

5.2 Conclusions

The purpose of this research is to investigate how people's perception and belief on risks and uncertainties influence their engagement in SWMBs by the application of PMT. Based on four factors of PMT, namely, perceived severity of consequences caused by waste related problems, perceived probability of receiving those impacts, self-efficacy (perceived capabilities for adaptation) and response efficacy (perceived effectiveness of SWMBs) are investigated for their effect on people's engagement in SWMBs—including waste reduction, reusing, recycling, disposal and green purchasing behaviours.

In descriptive analysis, the respondents' perceived effectiveness of SWMBs is the highest among other PMT variables. People's perception on risk and uncertainties about waste related problems are high in Yangon. But for SWMBs, only waste reusing behaviour is above the average while other behaviours are around average level. It can be said that people may have high awareness of waste related risks and willingness to enhance the environment quality, but their actual actions regarding waste management are not highly compatible with their perception. According to ISWM Framework, participation in waste management is influenced by the convenience and availability of specific infrastructures. In the case of Yangon, the people's actual engagement in waste management may also depends on the convenience and availability of infrastructures even though they have high levels of perception on risks and uncertainties of waste related problems.

Apart from waste reduction behaviours, all other variables have Cronbach's alphas over 0.70, indicating high reliability. The internal consistency coefficients represent strong validity. Thus, these findings show that all data is trustworthy and utilized to undertake inferential statistical analyses. The key findings of each sub question are as follows:

1) To what extent does people's Perceived Severity affect their engagement in sustainable waste management behaviours?

Perceived Severity is the respondent's opinion how serious the waste related problems and its consequences are. In contrast with other PMT variables, perceived severity is not able to predict their collective SWMBs. When each behaviour is investigated, perceived severity could explain waste reduction and green purchasing behaviours.

2) To what extent does people's Perceived Probability affect their engagement in SWMBs?

Perceived probability is the respondent's opinion of possibility to receive those impacts of waste problems. The results reveal that perceived probability does not influence all types of SWMBs.

3) To what extent does people's Self-efficacy affect their engagement in SWMBs?

Self-efficacy is the respondent's perception on the capability of adapting their behaviours for waste management. Self-efficacy has a significant effect on the collective SWMBs. Under each behaviour, self-efficacy could influence waste reduction and waste reusing behaviours.

4) To what extent does people's Response Efficacy affect their engagement in SWMBs?

Response efficacy is the respondent's belief on the importance of waste management behaviours on environment. Response efficacy also could not affect on the collective SWMBs in contrast with other PMT variables. But in each behaviour analysis, recycling, disposal and green purchasing behaviours are predicted by response efficacy.

In order to answer the main research question, people's perception and belief of risks and uncertainties affect their engagement in sustainable waste management behaviours in Yangon, according to the findings of each sub question. The findings are summarised in Figure - 8 and 9.

Figure 8. Influence of PMT variables on sustainable waste management behaviours

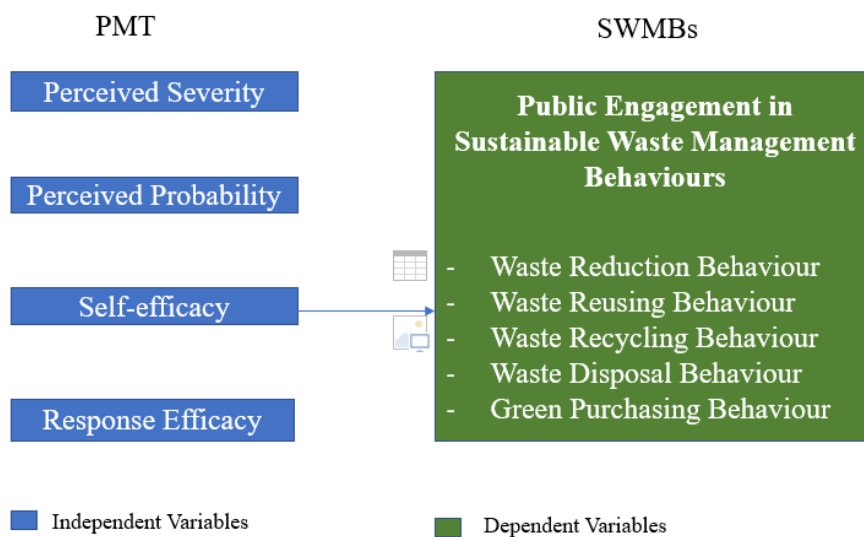
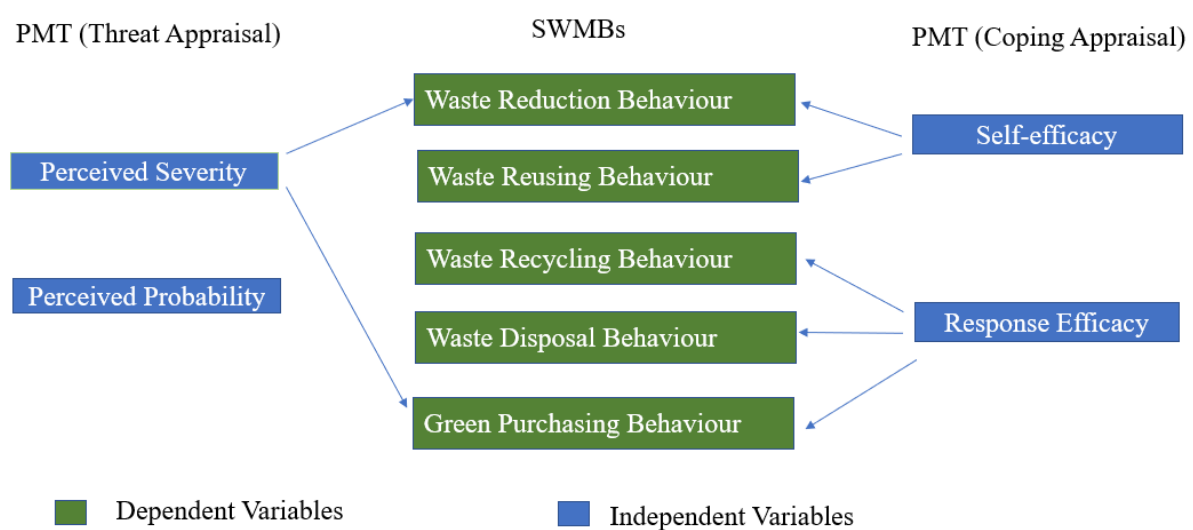


Figure 9. Influence of each PMT variable on each sustainable waste management behaviour



In conclusion, self-efficacy is the only one predictor for collective waste management behaviours (Figure - 8). In the literature, an individual with a high sense of self-efficacy can

quickly conquer any obstacles while those with low sense of self-efficacy can be frustrated by the same obstacles. This argument is compatible with this study because people with higher self-efficacy are more engaged in sustainable waste management behaviours.

Under each behaviour analysis, perceived severity could explain waste reduction and green purchasing behaviours while self-efficacy could influence waste reduction and reusing behaviours of the respondents. Although response efficacy could not predict collective SWMBs, it can predict waste recycling, disposal and green purchasing behaviours separately (Figure - 9). It reveals the literature that many PMT variables have a substantial impact on people's intentions to take in pro-environmental activities (Kim et al., 2013). This literature is somewhat supported by the case of Yangon where people with high perceived severity, self-efficacy and response efficacy are likely to engage in pro-environmental activities. As a result, the research findings support the second chapter's conceptual framework, which states that persons with a high level of perceived risks and perceived coping capacities are more likely to participate in SWMBs.

As of additional findings besides the conceptual framework, education and age of the respondents could influence their decision to engage in SWMBs under sociodemographic factors. It supports the argument of Al-Rabaani and Al-Mekhlafi (2009) that education plays a part in shaping people's attitudes on the environment. However, any sociodemographic factors could not moderate the degree of effect on people's engagement in sustainable waste management behaviours by their perception and belief. Although Tsai (2008) argued that people attitude toward SWMBs may be differed by their knowledge and household characteristics, sociodemographic factors in this study do not have the moderating effect as mentioned in the conceptual framework. Therefore, people's stronger perception on risks and uncertainties can strengthen their engagement in SWMBs regardless of their sociodemographic characteristics.

5.3 Recommendations

According to the findings, people's perception on the probability of receiving the waste's negative consequences is the lowest among other perceptions and it cannot explain peoples' SWMBs. People may think that they will not occur those problems or their vulnerability will not be high even though they have those occurrences. Hence, community awareness on waste issue and its consequences should be enhanced. YCDC implemented the "SWM in Myanmar" project in 2013, supported by European Union for community awareness on waste issue and its consequences (YCDC, 2013). However, it has not yet reached the grassroot level with small coverage area. Thus, it is critical to reach out to the grassroot level with high coverage. The 3R (reduce, reuse, recycle) promotion and waste related knowledge sharing programs should be disseminated through different medias and IEC materials (information, education and communication) such as creating slogans and displaying on LED billboards, announcing on TV/radio programs, appending sustainable waste management courses in school curriculum.

The research finding shows that engaging waste recycling behaviour is the lowest among other waste management behaviours. In Myanmar, there are no formal programs for waste recycling services. There are few informal waste recycling shops and waste pickers extracts some materials from the dumpsites or waste stream. Since this sector also helps not only the environment but also income generation, this service should be developed systematically. Private sectors' investments in recycling business should be encouraged and supported effectively. With the collaboration of international development organizations, the government

should address undeveloped financial and technical skills to identify and invest in innovative technologies for recycling industries.

Although some respondents have high awareness on the waste related problems and its consequences, high adaptive capacities for enhancing environmental quality and high appreciation for the single action on the environment, their actual engagement are not well matched with their perceptions. It might depend on the enabling environment to be able to engage in sustainable waste management behaviours. Enabling environment means improving the waste management infrastructures and the supporting relevant facilities such as providing waste segregation bins, easily accessible to waste disposal areas and promoting environment friendly goods with reasonable price. Existing infrastructure, such as timely garbage collection, safe disposal facilities and recycling technologies, should be upgraded.

People's decisions to adopt SWMBs is supported by providing not only the physical infrastructures, but also the soft components such as raising public awareness and policies enforcement. Since the problem is not a lack of waste management policies and regulations, but rather a lack of enforcement and knowledge of the law's existence, the YCDC should focus on having enough manpower for solid waste management and public awareness, monitoring, implementing fines or other penalties with legislative aims, and effective coordination among multi stakeholders to encourage a good shift in waste management. The importance of interlinkage between stakeholders, elements and aspects should be taken into high consideration to motivate people's engagement in SWMBs.

The majority of the respondents are between the ages of 18 and 45, have completed a bachelor's degree, and have monthly income that is higher than the average monthly income of majority of Myanmar people. Therefore, the findings may not represent for other groups of people with different sociodemographic conditions such as grass rote levels and non-users. The further studies should include more respondents from various backgrounds to represent a larger population. The research is part of a master's program with strict deadlines and timelines. Therefore, it cannot go into deep and very details why the respondents decide to select the typical behaviours, what are their obstacles to engage in SWMBs and how their SWMBs can be enhanced. These research findings might be also deepened into qualitative research with detailed analysis for further studies.

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Annex 1: Questionnaires

I am a student of Institute for Urban and Housing Development, Erasmus University, the Netherlands. I am conducting this academic research related to public engagement in sustainable solid waste management behaviour in Yangon, Myanmar. Therefore, I need your opinion and behaviours regarding sustainable waste management. All the information collected will be kept confidential and stored in my password-protected computer. It will be used only for the academic purpose. Participation in this study is voluntary. If you do not have willingness to participate, you do not have to. If you decide to take part and change your mind later, you are free to withdraw from the study at any stage.

Thanks for your contribution and time to answers the questions.

A: Sociodemographic:

Q1.1 Sex :

- (1) Male (2) Female (3) Others

Q1.2 Age :

- (1) 18-30 (2) 31-45 (3) 46-60 (4) Above 61 years old

Q1.3 Educational level :

- (1) Basic Education (2) Bachelor degree (3) Master degree (4) Above master degree

Q1.4 Profession :

- (1) Government Staff (2) Staff (Company/Organization) (3) General Worker (4) Own Business (5) Student (6) Dependent (7) Others.....

Q1.5 If you answer you have work in question 1.4, please answer your average monthly income :

- (1) Below 200 \$ (2) 100-200 \$ (3) 201-400\$ (4) Above 401\$

Q1.6 Housing Type:

- (1) Apartment (2) Single House (3) Hostel (4) Others

B: Perceived Severity

Q 2.1 How severely can the following pollutants caused by waste disposal?

Water pollutants

- (1) Very Low (2) Low (3) Normal (4) High (5) Very High

Air pollutants

- (1) Very Low (2) Low (3) Normal (4) High (5) Very High

Soil pollutants

- (1) Very Low (2) Low (3) Normal (4) High (5) Very High

Q 2.2 How severely can the following pollutants caused by waste disposal effect on human?

Water pollutants

(1) Very Low (2) Low (3) Normal (4) High (5) Very High

Air pollutants

(1) Very Low (2) Low (3) Normal (4) High (5) Very High

Soil pollutants

(1) Very Low (2) Low (3) Normal (4) High (5) Very High

C: Perceived Probability

Q 3.1 How is the possibility these pollutants will affect you?

Water pollutants

(1) Very Low (2) Low (3) Normal (4) High (5) Very High

Air pollutants

(1) Very Low (2) Low (3) Normal (4) High (5) Very High

Soil pollutants

(1) Very Low (2) Low (3) Normal (4) High (5) Very High

Q 3.2 How is your vulnerability if you meet the following negative effects?

Effect of Water pollutants

(1) Very Low (2) Low (3) Normal (4) High (5) Very High

Effect of Air pollutants

(1) Very Low (2) Low (3) Normal (4) High (5) Very High

Effect of Soil pollutants

(1) Very Low (2) Low (3) Normal (4) High (5) Very High

D. Self-Efficacy

Q 4. Is it likely that you can change your waste management practices into sustainable ones?

(1) Strongly Unwilling to change (2) Unwilling to change (3) Neither unwilling nor willing (4) Willing to change (5) Strongly willing to change

E. Response Efficacy

Q 5. Do you believe that a single person's waste management activities help to enhance environmental quality?

(1) Very Low (2) Low (3) Normal (4) High (5) Very High

F. Waste Reduction Behaviour

Q 6.1 Have you ever refused to accept a plastic bag when purchasing a small number of items?

(1) Never (2) Occasionally (3) Sometimes (4) Often (5) Regularly

Q 6.2 How often do you use cotton bag instead of plastic bag?

(1) Never (2) Occasionally (3) Sometimes (4) Often (5) Regularly

Q 6.3 Have you ever utilized reusable cup/box rather than single use?

(1) Never (2) Occasionally (3) Sometimes (4) Often (5) Regularly

Q 6.4 How often do you sell/donate the products instead of throwing them out?

(1) Never (2) Occasionally (3) Sometimes (4) Often (5) Regularly

G. Waste Reusing Behaviour

Q 7.1 How often do you reuse below items?

Plastic bags

(1) Never (2) Occasionally (3) Sometimes (4) Often (5) Regularly

Bottles

(1) Never (2) Occasionally (3) Sometimes (4) Often (5) Regularly

Boxes such as food container and parcel boxes

(1) Never (2) Occasionally (3) Sometimes (4) Often (5) Regularly

Q 7.2 Have you ever printed double-sided and written notes on single-sided paper?

(1) Never (2) Occasionally (3) Sometimes (4) Often (5) Regularly

H. Waste Recycling Behaviour

Q 8. How often do you recycle below items?

Plastic bags

(1) Never (2) Occasionally (3) Sometimes (4) Often (5) Regularly

Bottles

(1) Never (2) Occasionally (3) Sometimes (4) Often (5) Regularly

Plastic boxes such as food container

(1) Never (2) Occasionally (3) Sometimes (4) Often (5) Regularly

I. Waste Disposal Behaviour

Q 9.1 How often do you separate your waste into appropriate categories when you dispose into trash bin?

(1) Never (2) Occasionally (3) Sometimes (4) Often (5) Regularly

Q 9.2 Have you ever thrown a container's liquid out before discarding the container?

(1) Never (2) Occasionally (3) Sometimes (4) Often (5) Regularly

Q 9.3 How often do you dispose the waste into identified bins instead of informal dumping places such as into drainage or on the street?

(1) Never (2) Occasionally (3) Sometimes (4) Often (5) Regularly

J. Green Purchasing Behaviour

Q 10.1 How often do you avoid purchasing buying food in form containers?

(1) Never (2) Occasionally (3) Sometimes (4) Often (5) Regularly

Q 10.2 How frequently do you buy environmental friendly goods such as organic food, organic items, energy efficient lighting, and returnable boxes/containers during last 6 months?

(1) Never (2) Occasionally (3) Sometimes (4) Often (5) Regularly

Q 10.3 How often do you skip to buy the items that is not necessary for you and your family?

(1) Never (2) Occasionally (3) Sometimes (4) Often (5) Regularly

Q 10.4 How often do you repair the durable products instead of buying new one?

(1) Never (2) Occasionally (3) Sometimes (4) Often (5) Regularly

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