MAIN FACTORS INFLUENCING LANDED HOMEOWNERS FROM INSTALLING RAINWATER HARVESTING SYSTEM

BY

IAN LOW MING HANS

A research project submitted in partial fulfillment of the requirement for the degree of

BACHELOR OF BUILDING AND PROPERTY MANAGEMENT (HONS)

UNIVERSITI TUNKU ABDUL RAHMAN

FACULTY OF ACCOUNTING AND MANAGEMENT

DEPARTMENT OF BUILDING AND PROPERTY MANAGEMENT

NOVEMBER 2022

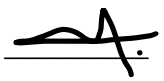
DECLARATION

We hereby declare that:

(1) This undergraduate research project is the end result of our own work and that due acknowledgement has been given in the references to ALL sources of information be they printed, electronic, or personal.

(2) No portion of this research project has been submitted in support of any application for any other degree or qualification of this or any other university, or other institutes of learning.

(3) The word count of this research report is 10001

Name of Student:	Student ID:	Signature:
Ian Low Ming Hans	2000572	

Date:

12/6/2022

ACKNOWLEDGEMENTS

First, I would like to thank my supervisor Dr. Elia Syarafina Binti Abdul Shakur for assisting me throughout the year in completing my Final Year Project. She has been guiding me and providing me with helpful recommendations and insights throughout the year, that helped me improve and complete my research in Rainwater Harvesting Systems. She is always ready to answer my questions, even during her off days such as the weekends, public holidays, and even when she is on leave. Additionally, I would also like to thank my second examiner, Dr. Goh Hong Lip on giving me constructive advice on my research. I could not have done it without the help from them.

Next, I would like to express my gratitude to Universiti Tunku Abdul Rahman in allowing me this opportunity to conduct my research without worrying about not having the resources.

Furthermore, I would also like to thank the respondents who have participated in my survey. Especially those who went out of their way to help me spread the survey to their neighbours.

Finally, I am very grateful to my parents for their understanding and support throughout the year for me to complete this project.

TABLE OF CONTENTS

Page

LIST OF TABLES

Page

LIST OF FIGURES

Page

LIST OF ABBREVIATIONS

CMCO	Conditional Movement Control Order
FOMCA	Federation of Malaysian Consumer Association
GEC	Global Environment Centre
LCD	Litres Capita per Day
MCO	Movement Control Order
NAHRIM	National Hydraulic Research Institute of Malaysia
NAPIC	Malaysia Property Market Centre
RII	Relative Importance Index
RMCO	Recovery Movement Control Order
RWHS	Rainwater Harvesting System
SPAN	Malaysia's National Water Services Commission
SPSS	Statistical Package for Social Science
WHO	World Health Organisation

PREFACE

This research was conducted as part of the fulfilment of requirement for the course of Bachelor of Building and Property Management (Honours) which is offered by the Faculty of Accountancy and Management in Universiti Tunku Abdul Rahman. The period for completing this research is from May 2022 to December 2022.

This research is focused on the study of the Main Factors influencing Landed Homeowners from installing Rainwater Harvesting System. The researcher always found that Rainwater Harvesting Systems were a norm for strata buildings but that was not the case for landed homes. Hence the motivation for the researcher to find out more about the reasons why this was so.

Due to time limitations, the researcher was not able to achieve the targeted 400 responses. However, the results will still be similar, the researcher hopes that this research would enlighten everyone on the workings of Rainwater Harvesting System, and also what can be done to improve the consumer's perception and acceptance of Rainwater Harvesting Systems.

ABSTRACT

The research aims to identify some of the factors that will influencing the landed homeowners from installing Rainwater Harvesting Systems, and then evaluate which are the most impactful factors that will influence the landed homeowners. A total of 5 factors were identified: Cost Factor, Awareness Factor, Incentives Factor, Water Demand Factor, and Government Policies Factor. To evaluate the impact of these 5 factors, a survey is done in Greater Kuala Lumpur, and the survey received 102 responses. The collected data was proven reliable with a Reliability Analysis using the SPSS Analysis Tool, and then further analysed using Descriptive Analysis and the Relative Importance Index (RII) methods. It is found that the Water Demand Factor would be the most influencing factor to the landed homeowners in Greater Kuala Lumpur. At the end of the study suggested the limitations of the research, and the improvements that can be made to the research.

CHAPTER 1: RESEARCH OVERVIEW

1.0 Introduction

This chapter will discuss about the general overview of the study being conducted in this project. In the following sections below, includes research background, problem statement, research questions, research objectives, significance of the study and chapter layout. The research topic of this project is concerning towards the Rainwater Harvesting in Malaysian landed residence owners.

1.1 Research Background

Water is one the most essential natural resources on our planet and in our daily lives. It is used every day in our daily lives, whether for drinking, cleaning, or even manufacturing (Evans, 2019). Although there is an abundance of water available for use, many people take water for granted, so all of us need to be reminded that water is a finite resource that is crucial in keeping the world functioning (US EPA, 2022). Not to mention the infamous Malaysia's water crisis back in 1998, which caused the worst water shortage in Malaysia, lasting over 150 days for the entire Klang Valley residents to suffer drought (The Star, 2014). To avoid this, the implementation of such system can be beneficial as it is expected to help reduce the demands for public water, decrease of water bills, and help overcome the water shortage during extreme drought (Che-Ani et al., 2009).

Moreover, Voda (2022) also stated that ever since the disaster, in 1999, the Malaysian government have started embarking on guidelines for installing Rainwater Harvesting System, also known as RWHS in case of any similar disaster occurs again. Moreover, around early 2012, the Malaysia's states of Johor, Kelantan, Malacca, Perak, and Selangor has issued a ruling of an amendment to the Uniform Building By-Laws 1984 made for recommending newly built buildings such as

terraced buildings, bungalows, and detached buildings with a roof area of 100 square meter and above to be equipped with a Rainwater Harvesting System.

Research by Shahwahid (n.d.) studies the incentives and policies implemented by the Malaysian government to encourage the use of RWHS, it added that although RWHS has its advantages, there are also issues that comes with it. For example, issues such as mosquito breeding, designs that may take up too many spaces, the cost to implement such a system. Furthermore, in terms of statistics, the amount of Malaysian landed homes that implemented the RWHS has been very low. Henceforth, the goal of this research is to identify the main factors that are affecting homeowners' decisions to purchase RWHS. This can help homeowners, developers, the government, and the community understand why homeowners in Malaysia are reluctant to install RWHS, so that they can bring improvements that will encourage homeowners to install RWHS.

1.2 Problem Statement

In Malaysia, the country and the residents can benefit tremendously from implementation of Rainwater Harvesting System. This is due to the high usage and wastage of water, the increase of water tariffs, and the constant pollution of water in Malaysia. Furthermore, the Rainwater Harvesting System can help achieve a more sustainable environment for the country and the people. In addition, Malaysia is a tropical climate where the monsoon season takes place annually, which is an optimal opportunity to accumulate rainwater. Unfortunately, the report by Shahwahid (n.d.) showed that Malaysian landed buildings need to be executing the RWHS regularly. This may be because the idea or the issues have not approached Malaysians with installing RWHS as previously mentioned.

1.2.1 High Water Usage and Wastage in Malaysia

Lani et al. (2018) explained on how Malaysia is one of the highest in domestic water consumption, where it ranges between 209 to 228 litres per capita per day (LCD). The researchers also added that the World Health Organization (WHO) has discussed that the recommended amount should be only 165 lcd. Which was why back in 1998, the Minister of Housing and Local Government had expressed the Malaysian Government to investigate collecting rainwater for buildings (Shaaban & Huang, 2007). Furthermore, it was suggested that Malaysia's future rainfall might decrease due to climate changes taking effect as time passes (Lani et al., 2018).

1.2.2 Increase in Public Water Cost

Even though Malaysia's water tariff is considerably cheap compared to other countries, it can also be increased because of inflation. In 2009, Selangor has proposed up to 12% increase in water tariff (The Edge, 2009). Another case was in 2010, and in the recent case of 2022, Air Selangor (2022) mentioned an increase in water tariff in Malaysia as recently as the year 2022, where the cost increased by RM0.20 for each cubic meter of water. This shows that water tariffs will inevitably increase as time passes, especially due to inflation.

1.2.3 Water Pollution

As study by Rahman et al. (2014) showed that water treatment plants are easily one of the most extensive supplies of water, but the pollution of water may also cause the treatment process to be delayed. This is because wastewater around the world is being discharged back into the ocean without undergoing a treatment process, which means that the discharged water will slowly pollute the surface water, which means the originally clean

water would have to undergo an even lengthier treatment process. Hence, water treatment plants will only become slower in supplying clean water, so it is important to not rely too heavily on the water treatment plants and start searching for an alternative water supply such as Rainwater Harvesting Systems.

1.3 Research Questions

The project aims to identify what and which main factors that influences Malaysians to purchase and install RWHS. This research question can be used for research objectives. Which can be broken down into the following:

1. What are the main factors influencing Malaysian's intention to install Rainwater Harvesting System
2. Which are the main factors most influencing Malaysian's intention to install Rainwater Harvesting System

1.4 Research Objectives

As discussed in Research Background and Problem Statement, there are problems of water supply and usage in Malaysia. The goal for these objectives is so that it can help Malaysians to install RWHS in landed residential homes. With that, the research objective is broken down as follows:

1. To determine the main factors influencing Malaysian's intention to install Rainwater Harvesting System
2. To evaluate the most main factors influencing Malaysian's intention to install Rainwater Harvesting System

1.5 Significance of Study

The significance behind this research project is to provide insight of the cause of means for Malaysians to start implementing the rainwater harvesting system into their landed residential homes.

This study is aimed at not only for landed residential homeowners but as well as for developers to know more on how to implement them, for the country's environmental department to help spread awareness and as well as benefitting the community and the country by using RWHS.

1.6 Chapter Layout

In this case study report it is structured in 5 different layouts, where Chapter 1 discussed the study and description of our case study topic. It provides the information of research background, problem statement, research questions, research objectives, and significance of study.

In Chapter 2, will contain literature review of the case study, where it also includes the dependents and independent variables, the conceptual framework, and finally the hypothesis of the study.

Next in Chapter 3, will be the research design and research instruments used for conducting the survey, this would also include the tools, the websites, and the formulae that is being used to analyse the data.

Chapter 4 would be the chapter with all the numbers which will show the results of the study conducted, and the tools will be used to analyse and interpret the data.

Chapter 5 will be the final chapter which will conclude the research, discuss on the major findings, whether the objectives has been achieved, and also give the implications, limitations, and recommendations for the research.

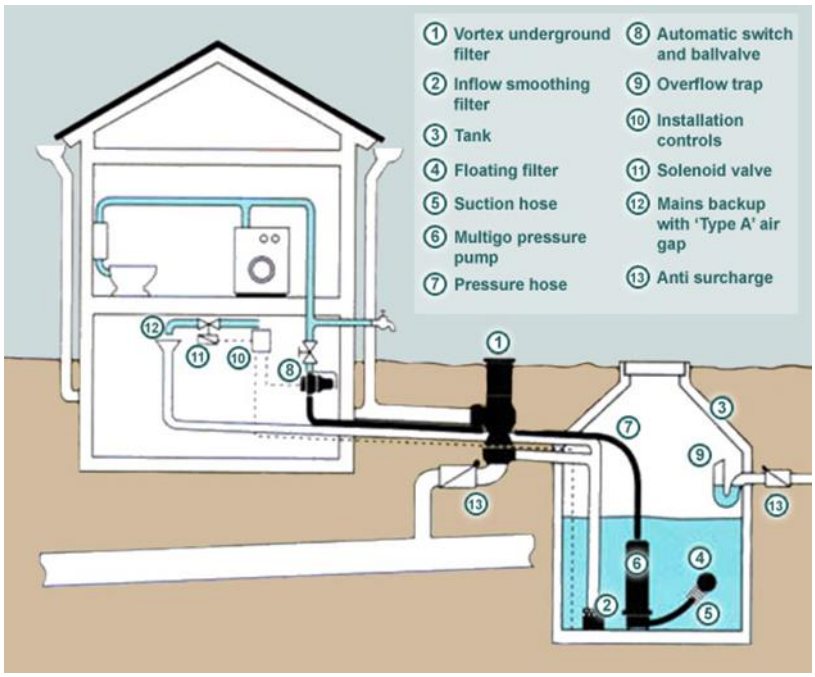
CHAPTER 2: LITERATURE REVIEW

2.0 Introduction

The research and theories developed by the said researchers as quoted previously will be discussed in this chapter. Furthermore, it will also discuss about the dependent and independent variables based on previous research. In addition to that, the formulation of the hypotheses, conceptual framework, and theoretical models will also be covered in relation to the dependent and independent variables.

2.1 What is Rainwater Harvesting System

Figure 2.1: Detailed RWHS (SuDS Wales, n.d.)



A Rainwater Harvest System (RWHS) is a system that helps collects rainfall as a water supply source for household, industrial and commercial buildings (Local Government Department, 2011). Generally, the rainwater water is collected from the roof, going into the water collecting pipe, then arriving through water filtering system where the water can be store for normal daily water usage, a more detailed

demonstration can be depicted in Figure 1. There are also different variations of RWHS as well, where the tank is setup above ground or on top of the building, or the variation where rainwater is collected through the study and moulding of the ground, which will guide the rainwater into the drainage system, and into an underground tank where rainwater will be stored, however, such RWHS are usually very expensive to implement. Moreover, the tanks could be quite bulky to implement in the yard, which is usually the only option for low to medium income families. More well-off homeowners could afford to build the tank underground, but the poorer homeowners will not be able to afford digging out a hole, and they also do not have space for the tank, this may discourage them from implementing the Rainwater Harvesting System in their homes.

2.2 Implementation of Rainwater Harvesting System by Foreign Countries

2.2.1 Brazil

Although Brazil is home to 18% of the world's freshwater, most of the freshwater is located far north of Brazil, while the more populated Southern Brazil is stricken with drought. To counter this, their community came up with a plan called "One Million Cisterns" in 2003, its goal was to install Rainwater Harvesting Systems on their rooftops (Cleanwater, 2015). The RWHS will catch the rainwater and store them into an underground storage, and it will only be used when the dry season comes. This initiative was proven to be very successful as the Brazilian government has even made Rainwater Harvesting Systems mandatory in the future buildings.

2.2.2 Singapore

Singapore is one of the countries who have successfully integrated Rainwater Harvesting Systems (RWHS) into their community. One of their

main supplies of water is the NEWater -a water treatment plant- which supplies water to 40% of Singapore's population (Teo, 2019). However, it is not a completely reliable solution, which is why they opted for alternative ways to water, which is through Rainwater Harvesting Systems. About 50% of Singaporean land is used as catchment land which will guide rainwater into its drainage systems and prepared for use, which is why laws against pollution is heavily enforced (Cleanwater, 2015). Furthermore, according to Cheng (2022), Singapore has planned for the installation of advanced RWHS in 90 buildings. Then, they will analyse the cost effectiveness of the RWHS, and further decide if they will install more.

2.3 Homeowner's Intention to Install Rainwater Harvesting System

In relation to the growing concern for global warming and climate change, more consumers are starting to go green to do their part in reducing their usage of natural resources. According to SAGE (2010), green consumers are known as people who are aware of their duty to protect the environment by choosing products or services which have been produced in an environmentally friendly way. They try to live in a way that does not threaten the future viability of our planet, in addition to being happy to pay extra to protect it from environmental harm. A green product is one that is made to have as little of an impact as possible towards the environment during its entire life cycle and even after it has served its purpose. Reducing waste and improving resource efficiency are often the two fundamental goals of green products. An example of a green product's attributes is recyclable, reusable, and naturally biodegradable. Other than that, it must be eco-efficient with a diminished carbon footprint or none at all.

Consumers are more likely to purchase goods that meet their criteria for environmental preservation and sustainability, according to the concept of green purchase intention. Positive sentiments towards green products do not always convert into a favourable view towards these products. According to Salomon

(2009), consumer mindset directly influences their intention to make a purchase. The intention and decision to buy can also be influenced by several things such as others' views on buying green products or the consumer's income, lifestyle, knowledge, or anticipated product advantages (Mei et al., 2012; Wang et Tung, 2012).

2.4 Main Factors Affecting Homeowner's Intention to Install Rainwater Harvesting Systems

2.4.1 Cost Factor

According to Al Mamun et al (2018), the socio-economic situation and level of education of Malaysian consumers greatly influence how much they perceive the cost of any given goods to be. Depending on its features and intended use, the cost of an ordinary rainwater harvesting system might range from RM1,500 to RM10,000 or more. Furthermore, in an article by Voda, it is said that for most of the rainwater harvesting systems to work, electrical pumps are needed to transfer the captured rainwater from the rainwater tanks to toilets. The paper also said that not only does it use more electricity unnecessarily, but such systems are also not economically viable should the price of electricity rise in the future. Given Malaysia's low water rates, it will be 20 to 30 years before users start to save money which is not a motivator to the consumers (Voda, n.d.). In addition to that, based on an article in The Star, an analysis reveals that the costs for installing water harvesting systems in semi-detached and detached bungalows range between RM12,000 and RM25,000 (The Star, 2017). While ecologically friendly, rainwater collecting devices have a high price tag that makes them a difficult investment to make for the average Malaysian.

2.4.2 Awareness Factor

Product knowledge shapes a consumer's impression towards the product and their partialities. Prior research has demonstrated that customers are

more certain about the benefits of using green items the more knowledgeable they are about eco-friendly goods (Ansu-Mensah, 2021). Based on an article in 2022 made by Business News Daily, when customers believe that using green energy may better the environment, solve environmental issues, the more inclined they are to buy such goods. It is difficult for consumers to trust that purchasing rainwater harvesting systems will help the environment if they are unaware of the environmental protection benefits that these items bring. According to earlier research in relationship marketing, consumers' trust in a product directly affects their desire to make a purchase (Abdullah, 2014). On the same note, previous studies in green consumption have shown that customers' intentions to make green purchases can be influenced by their trust in green consumerism (Ansu-Mensah, 2021; Joshi, 2015; Morel, 2012). For instance, Malaysians are more inclined to purchase rainwater harvesting systems since they are aware of the environmental benefits of it especially in the face of draughts or water supply disruptions that occur frequently in many states (The Edge Market, 2022).

Research by Syuibah et al. (2014), claims that one of the causes of Malaysia's low utilisation of rainwater harvesting systems is a lack of consumer understanding of the technology. The paper also named one of the barriers to a society adopting green energy is the residents' hesitancy to install rainwater harvesting devices until more information about its advantages is available. Most customers are reluctant to select a product they are unfamiliar with because they lack experience using it, even if it will save them money (Aminuddin et al, 2018). The adoption of renewable energy by society can therefore be deduced to be dependent on its understanding of and acquaintance with the technology (Salehah et al., 2015).

2.4.3 Incentives Factor

An essential human need is access to clean water. Although water sources are plentiful in Malaysia, the availability of clean, safe water is dramatically dwindling because of water resource contamination, water waste, urban development, and climate change (Ahmed et al, 2014). Therefore, it is crucial to ensure that domestic and non-domestic water users are aware of the principles of water conservation through consumer behaviour toward water resources and an effective management system. The use of treated water at home can be decreased by reusing water and installing rainwater gathering systems as said in research by Aminuddin et al. (2018) Rainwater may be utilised to flush toilets, wash cars, maintain gardens, and water trees (Aminuddin et al, 2018). Utilizing rainwater collecting systems not only makes Malaysians greener, but it also helps us save money (The Star, 2022). You will benefit if you can maintain your commitment over an extended period.

In addition to that, Malaysians can live healthy lives without harming the environment if they install rainwater collection devices as waters that naturally fall from the sky, such as rain, snow, and hail, are abundant in our country because it is directly affected by The Northeast and Southwest Monsoons that regulate Malaysia's climate because the country is fully in the equatorial zone (Aminuddin et al, 2018). The North-East Monsoon, which occurs from October to March, causes heavy rains that regularly create substantial floods along Peninsular Malaysia's east coast causing Sabah and Sarawak to also experience wet seasons as a result. Contrarily, the Southwest Monsoon, which comes between May and September, makes the entire country hot, and thus, causing droughts. April saw a lot of rain during the transitional period between the two monsoon seasons, leading to severe climatic conditions like floods or droughts (Buslima et al, 2018).

Therefore, even with the natural abundance of our resources, it is important for us to do our part in conservating clean water supply by collecting rainwater to do everyday tasks. For example, many parts in rural Malaysia practices rainwater collection during the Monsoon season’s floods as water supply and electricity are disrupted, ensuring that they have adequate water

for drinking and basic needs such as cooking or showering (Asmawi et al, 2020). In theory, when Malaysians depend less on utilities when they use rainwater gathering devices. As a result, monthly bills for consumers are reduced. An article by Malaysia Kini in 2010 states that rainwater harvesting can successfully lower the water cost by 20–30%, and in rare situations, by as much as 60%. Even in locations with relatively low rainfall, the deployment of rainwater harvesting systems in various sections of New South Wales, Australia, has led to significant water savings from the main supply. For instance, using rainwater tanks in a suburban area of Melbourne can cut operating expenses and network pipe sizes by up to 53% and up to 18%, respectively (Lani et al, 2018).

2.4.4 Water Demand Factor

Malaysia's population is expected to reach 32.7 million in 2022, up from 32.6 million in 2021, with an annual population growth rate of 0.2 percent (Department of Statistics Malaysia, 2022). Nearly 7 million properties exist in Malaysia, according to the Malaysia Property Market Centre (NAPIC), with approximately 5.8 million homes included in that figure (Property Guru, 2020). Based on an article by Statista, approximately 7.17 billion litres of metered water were used for household purposes daily in Malaysia in 2020. Metered water usage for home purposes increased by one billion litres per day in Malaysia compared to that of 2012 (Statista, 2022). About 97% of the raw water, that is being used for domestic, industrial, and agricultural purposes comes from surface water sources, which predominantly comes from rivers in which 189 river basins make up Malaysia; 89 are in Peninsular Malaysia, 78 are in Sabah, and 22 are in Sarawak (WWF, n.d.).

By 2020, it is anticipated that Malaysia's water consumption would reach 20 billion m3, growing at a pace of 4% annually in tandem with the country's growing population (Kailasam, 2022). According to estimates, each of us

uses more than 5,000 m3 of renewable water annually per person (WWF-Malaysia, n.d.). The daily water requirement for everyone was established at 165 litres by the United Nations (MalaysiaKini,2021). Worrisome trends show that domestic water demand is rising, tripling from 2,029 million m3 in 2,000 to 5,904 million m3 in 2050 (Stratsea, 2021). The researcher also said that according to a recent assessment from Malaysia's National Water Services Commission (SPAN), each Malaysian consumes 230 litres of water day, or around 154 of 1.5 litre bottles. The public needs to be made aware of the value of our water supply and the consequences of continuing to waste and pollute it. By 2025, SPAN plans to lower Malaysians' daily water use to 180 litres through a variety of initiatives (MalayMail, 2020).

2.4.5 Government Policies Factor

Currently according to Stratsea (2021), the Malaysian government has been trying to encourage a greener lifestyle by reducing waste starting with its communities. The paper also stated that the COVID-19 pandemic response tactics a couple years back had increased the usage of plastic waste through food delivery packaging, hand sanitizer bottles and single use disposable masks that end up in our rivers that continue to pollute our water supply thus resulting in a declining water supply. During the Movement Control Order (MCO), Conditional Movement Control Order (CMCO), and Recovery Movement Control Order (RMCO) movement control periods, several campaigns were actively carried out to address this and increase public knowledge. Those campaigns involve implementing effective water conservation techniques, growing public awareness of water consumption, promoting water recycling and reuse when feasible, and launching programmes to save and clean up the waterways and rivers. Education is at the core of all these programmes. Malaysians need to be empowered so they can play a significant part in monitoring, protecting, and handling concerns linked to water resource management while the government is addressing the issue through laws and policies. With citizen science, civil society

organisations like the Global Environment Centre (GEC) have started comparable empowerment programmes in the Klang Valley region of Kuala Lumpur. This strategy includes integrating abilities while raising awareness. Only then can the people act to address the issues at hand if awareness, knowledge, and skills are made available to them (Stratsea, 2021).

Based on Shahwahid (n.d.), the first stage of Malaysia's rainwater harvesting policy can be viewed as the 1999 "Guidelines for Installing a Rainwater Collection and Utilization System." It was executed following the 1998 drought with the intent of lowering reliance on treated water and serving as a handy safety net in case of an emergency or water supply shortage. The implementation of the new legislation was not particularly successful because many Malaysians at the time had little experience with rainwater collection and because most of the system was not available to the masses. The research also said that to stimulate the installation of a rainwater collecting and usage system in government buildings, the Ministry developed another cabinet paper for submission to the National Water Resources Council five years after the Guidelines were first introduced. As a result, the Council subsequently declared that the use of rainwater is to be promoted, but not required, in all federal and state government buildings, that a campaign to promote the use of rainwater is needed, and that a solution to avoid mosquito breeding must be provided. The National Hydraulic Research Institute of Malaysia (NAHRIM) was later founded in 2004 after the Ministry of Natural Resources and Environment was established. It intends to carry out research on all facets of water hydraulics and water environment, including rainwater collection. The government building, the mosque, and the residential home are the three primary pilot projects that NAHRIM has launched so far. Additionally, it is actively involved in planning and putting in place rainwater harvesting systems at various schools. The government's announcement to make rainwater collecting mandatory on March 27, 2006, was the most positive development for the industry's success in Malaysia. Even though it only applies to major structures like factories, schools, or bungalows, it is unquestionably a positive step towards Malaysia's development in a more sustainable direction. With the Federation of Malaysian Consumer Association

(FOMCA), the Ministry of Technology, Water & Communication has so far started a campaign to encourage water conservation that emphasises rainwater collection as a key strategy. The Ministry wants to include rainwater harvesting systems in new government buildings and schools as part of its long-term plan (Shahwahid, n.d.).

2.5 Proposed Conceptual Framework

The conceptual framework is discovered to be explored and studied in this paper. There are five factors that could affect whether Malaysians decide to buy and utilise rainwater harvesting systems, the factors can be in the following of: cost, awareness, incentives, water demand and government policies. Finally, Chapter 3 will determine the information required and create a questionnaire for respondents using the key variables outlined in Chapter 2.

Hypothesis:

1. Malaysians will purchase a product that they are more familiar with.
2. The incentives of rainwater harvesting systems will make people buy it.
3. The water demand in Malaysia increases the need for such products.
4. The cheaper the cost, the more likely they are to buy it.
5. Government initiatives help people to understand the importance of rainwater harvesting systems.

Figure 2.2: Proposed conceptual framework of factors influencing Malaysian's intention to install Rainwater Harvesting Systems

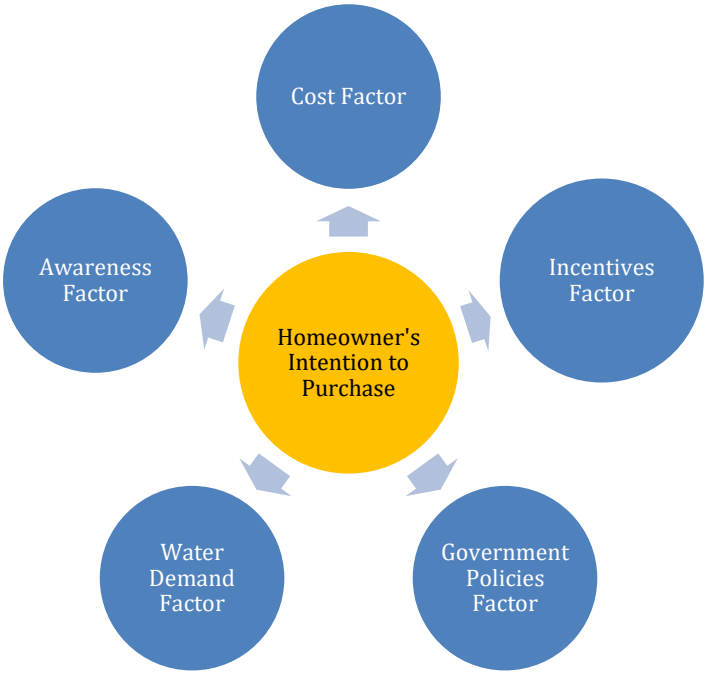


Table 2.1: Previous studies on Factors influencing Landed Homeowners from installing Rainwater Harvesting Systems

Factors	Source
Cost	Lani et al., 2018 Al Mamun et al.,2018
Awareness	Syuibah et al., 2014 Ansu-Mensah, 2021 Aminuddin et al, 2018
Incentives	Syuibah et al., 2014 Asmawi et al., 2020 Lani et al., 2018
Water Demand	Syuibah et al., 2014 Shahwahid, n.d. Kailasam, 2022
Government Policies	Shahwahid, n.d. Stratsea, 2021

CHAPTER 3: METHODOLOGY

3.0 Introduction

The quantitative research method is the most suitable method for this research. The quantitative research method is used for collecting data from a crowd of audience, and analysing the data to find a trend, which can be used to test our hypothesis.

3.1 Research Design

The type of quantitative research method applied in this research is the correlational research design. An online survey will be conducted which respondents can respond to using a link, which will lead to the questionnaire. This can help us obtain a large amount of data within the shortest time span. Then analyse whether or not each of the factors poses as a positive or negative correlation in influencing the homeowners. The correlation will correspond to how much do the factors influence landed residential homeowners, the positive being very much, and negative being not at all. There may also be some outliers which do not affect the landed residential homeowner's decision, which will be expressed as null correlation.

3.2 Data Collection Method

As mentioned previously, the data collection method will be through an online survey, which can be accessed through a link. The website used will be Google Form.

3.3 Sampling Design

3.3.1 Sampling Population

The target population of the survey will be towards the landed residential homeowners. Ideally, the respondent should be the property's owner or the spouse. The younger generation of the family would not be ideal as they are not actual "homeowners".

3.3.2 Sampling Location

The survey will be done in landed residential area in Greater Kuala Lumpur, which includes the states of Kuala Lumpur, Selangor, and Putrajaya. This is to ensure that all our respondents are related to the research.

3.3.3 Sampling Technique

The sampling technique used for this research is the snowball sampling. Snowball sampling is a non-probability sampling technique used when the respondents have a common trait that is difficult to find. So, once a homeowner is found, the main goal will be to do the survey, and the second goal will be to ask them to spread the survey to their neighbours. As it is too challenging to find homeowners who are willing to do the survey, it will be easier for other homeowners to approach their neighbours to spread the survey through their neighbourhood group chats. Hence, the reason why the snowball sampling technique was chosen.

3.3.4 Sampling Size

Although the neighbourhood communities can be found easily, it is still tough to convince them to do the survey. To calculate optimal sampling size, the formula used will be the Taro Yamane formula. According to PropertyGuru (2020), the number of landed residential homes accounts for 70% of the total residential properties. Furthermore, the number of residential units in Greater Kuala Lumpur is about 2.1 million. 70% of that makes it the population size around 1.5 million. Using the formula, the calculation has arrived at a sample size of 400 respondents.

Taro Yamane Sampling Formula: $n = \frac{N}{1+Ne^2}$

n = Sample size

N = Size of population

e = Sampling error (5)

3.4 Research Instruments

The survey will be done through Google Survey, so respondents can access it wherever they are, and are not limited to answering and submitting the papers. The first section of the questionnaire will contain a series of questions asking about the respondent's demographics, this is so that the results can be identified and categorised into their respective groups. Also, to ensure that our respondents are related to our survey. The second section will be asking questions about the main topic, which is the factors affecting landed residential homeowner's decision in installing a rainwater harvesting system. Since the survey is an online survey, the link to the survey will be posted online on as many platforms as possible. Our target for this is about 2 weeks, and if it does not reach our desired number of targets, the survey will need to be shared to our neighbours either through flyers with the QR code, or through neighbourhood group chats.

3.5 Constructs Measurement

The questions will be answered on a Likert scale basis, from 1 to 5. Disagree, Somewhat Disagree, Neutral, Somewhat Agree, and Agree respectively. Likert scale help us get more specified answers, such as how do each of the factors influence our respondents. 1 and 2 being negative influence, 4 and 5 being positive influence, and 3 being no influence at all.

3.6 Data Processing

Since the survey is relatively simple, only outliers will need to be identified and isolated as they will mess up the data. For example, answers from a condominium owner are the type of answers should be filtered out as they are not related to our research.

3.7 Data Analysis

3.7.1 Relative Importance Index

The type of data analysis technique used will be Relative Important Index (RII). RII is used to find out the importance or influence of each factor that will affect our respondents. Each factor will have about 3-4 questions, based on the answer of the likert scale, the RII formula will make out which questions do the respondents think are more important, then in the end, a comparison will be made between each factor to see which of them affects our respondents the most.

Formula of Relative Importance Index (RII) = $\frac{\sum W}{AN}$

W = The rating given by respondents

A = Highest possible rating (5)

N = Number of respondents

3.7.2 Pilot Study

A reliability test will be conducted using IBM's SPSS, which is a data management tool. Once the questionnaire is complete, the data will be put into SPSS, which we will then use to calculate the Cronbach Alpha. Typically, a 0.8 and above result would mean that this test is sufficiently reliable. The reliability test by SPSS is typically used for Likert scale questionnaires, which makes it perfect for the research.

3.7.3 Descriptive Analysis

After finding the RII, a descriptive analysis will be done to interpret and describe the data so that all the comprehensive information can be fully communicated. This corresponds to the researcher's goal to ensure that the research is available for everyone in the community.

3.8 Conclusion

In summary, the Google Survey will be prepared first, this process will be relatively quick as Google Survey is easy to manoeuvre. The process of collecting responses will be the toughest and the most time consuming as it is not easy to find willing respondents. After that will be the process of data compiling, filtering, inserting, and analysing the results. This will be done using SPSS to find out the Relative Importance Index, and then a reliability test will be conducted to ensure the validity of the research. The results will be shown in Chapter 4.

CHAPTER 4: DATA ANALYSIS

4.0 Introduction

This chapter will mainly show the analysis of the responses and determine the most influencing or important factors in the respondent's opinions. Due to time constraints, only 102 responses were collected and analysed.

4.1 Pilot Study

The pilot study method is the Reliability Analysis on the SPSS Analysis tool. After finding the first 20 respondents, the pilot study is done to find out the Cronbach Alpha of the 5 factors. If the Cronbach Alpha is within an acceptable range (0.6 and above), then the study would be feasible. The Reliability Analysis is used to determine the strength of the association between each question of a factor. For example, if the respondent chose 5 for the first question, and the respondent chose 5 again for the second and third questions, then the strength of association here would be very strong. From the results of the pilot study, it can be observed that the strength association is the strongest for the incentives factor at 0.938, which proves to be an excellent association. The second would be the awareness factor which was observed to have the association strength of excellent as well at 0.907. Next is the government policies factor at 0.860, and the cost factor at 0.843, both showing very good strengths of association. Lastly, the weakest strength of association is the water demand factor, but still showing a solid 0.773 which represents a good strength of association. In essence, the strength of association for the 5 factors are determined to be on the very strong side, proving the credibility of the research.

Table 4.1: Cronbach Alpha of All Factors

Factor (s)	Cronbach Alpha	Number of Items	Strength of Association
Cost Factor	0.843	3	Very Good
Awareness Factor	0.907	3	Excellent
Incentives Factor	0.938	3	Excellent
Water Demand Factor	0.773	3	Good
Government Policies Factor	0.860	4	Very Good

4.2 Descriptive Analysis

4.2.1 Respondent's Demographics

4.2.1.1 Gender

Table 4.2: Respondent's Gender

Gender	Respondents	Percentage (%)
Male	56	54.9
Female	46	45.1

From the table above, it is observed that the gender ratio for male and female is quite even at 56 (54.9%) male respondents and 46 (45.1%) female respondents out of the total of 102 respondents.

4.2.1.2 Age

Table 4.3: Respondent's Age

Age	Respondents	Percentage (%)
18 - 24	7	6.9
25 - 34	22	21.6
35 - 44	22	21.6
45 - 54	29	28.4
Above 54	22	21.6

Out of the 102 respondents that was gathered, the age categories of 25 – 34, 35 – 44, and Above 54 recorded the same number of respondents at 22, each

of them makes up for 21.6% of the respondents. The age category 45 – 54 recorded the most respondents at 29, which is about 28.4% of the respondents, and only 7 were recorded for the age category of 18 – 24, which is 6.9% of the respondents. It can be observed that the age of the respondents is mostly quite senior, as there were only 7 young adults who responded. This could be due to the fact that most people in Malaysia are only able to afford a house only after working for a few years. Unless they are able to gain financial support from their family, who would be willing to help them relieve some of their financial burden.

4.2.1.3 Employment

Table 4.4: Respondent's Employment Status

Employment	Respondents	Percentage (%)
Government sector	28	27.5
Private sector	34	33.3
Self-employed	24	23.5
Unemployed	5	4.9
Retired	11	10.8

From Table 3, 28 (27.5%) out of 102 respondents are government employed, 34 (33.3%) are employed in private sectors, 24 (23.5%) are self-employed, 5 (4.9%) are unemployed, and only 11 (10.8%) are retired.

4.2.1.4 Family Income (Monthly)

Table 4.5: Respondent's Monthly Income Level

Family Income (Monthly)	Respondents	Percentage (%)
RM10,960 and above	49	48
RM4,850 to RM10,959	42	41.2
RM4,849 and below	11	10.8

The income category in Table 4 is split into 3 categories, RM10,960 and above which represents T20, RM4,850 to RM10,959 which represents M40, and finally RM4,849 and below which represents the B40 category. From

the table, it can be observed that 49 (48%) out of 102 respondents are in the T20 category, 42 (41.2%) are in the M40 category, while 11 (10.8%) are in the B40 category. The ratio here is different from the typical Top 20%, Middle 40%, and Bottom 40%. This could be because all these people are homeowners, plus the fact that this is the total monthly income, so it would also include the income from their spouse.

4.2.1.5 Education

Table 4.6: Respondent's Education Level

Education	Respondents	Percentage (%)
SPM	27	26.5
Foundation / Diploma / STPM	14	13.7
Bachelor's Degree	28	27.5
Master's Degree	22	21.6
PhD	11	10.8

Most of the respondents have graduated with a bachelor's degree, at 28 (27.5%) out of 102 respondents. Next are SPM graduates who make up for 27 (26.5%) of the respondents. Followed by master's degree at 22 (21.6%). 14 (13.7) respondents were recorded to have graduated with foundation / diploma / STPM. Finally, only 11 (10.8%) of the respondents have graduated with a PhD.

4.2.1.6 Marital Status

From Table 6, it can be observed that 35 (34.3%) of the respondents are single, 59 (57.7%) of the respondents are married. Moreover, both the separated and widowed categories have recorded 4 (3.9%) respondents respectively.

Table 4.7: Respondent's Marital Status

Marital Status	Respondents	Percentage (%)
Single	35	34.3
Married	59	57.8

Separated	4	3.9
Widowed	4	3.9
Prefer not to say	0	0

4.2.1.7 State

Table 4.8: Respondent's Home Location

State	Respondents	Percentage (%)
Kuala Lumpur	39	38.2
Selangor	37	36.3
Putrajaya	26	25.5

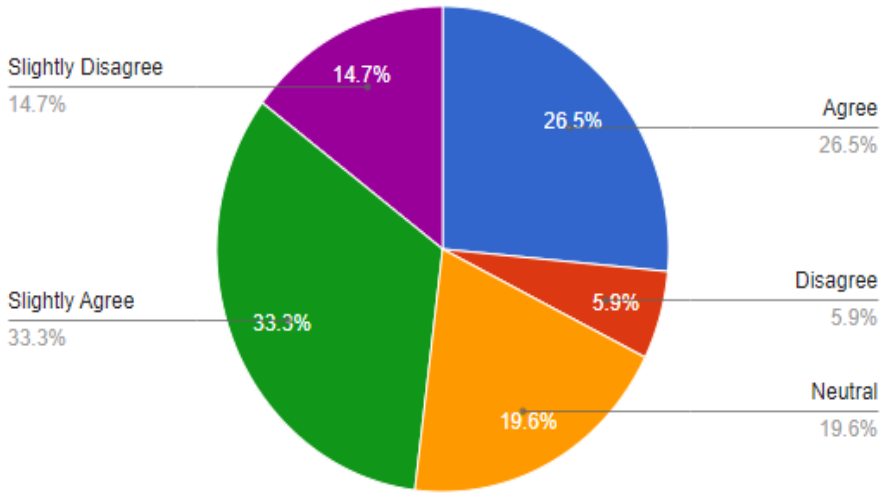
Since the target sampling location is Greater Kuala Lumpur, all 102 of our respondents are living in either Kuala Lumpur, Selangor, or Putrajaya. Table 7 shows the location of the respondent's homes. 39 (38.2%) of the respondents are living in Kuala Lumpur, 37 (36.3%) of the respondents are living in Selangor, while 26 (25.5%) of the respondents are living in Putrajaya.

4.2.2 Main Factors Affecting Homeowner's Intention to Install Rainwater Harvesting Systems

4.2.2.1 Cost Factor: I know the cost of Rainwater Harvesting Systems

From Chart 1, it is observed that 27 (26.5%) out of 102 respondents have agreed that the know the cost of Rainwater Harvesting Systems. 34 (33.3%) of the respondents slightly agreed, 20 (19.6%) of the respondents are neutral, 15 (14.7%) slightly disagree, and 6 (5.9%) implied that they do not know the cost of Rainwater Harvesting Systems.

Figure 4.1: I know the cost of Rainwater Harvesting Systems



4.2.2.2 Cost Factor: I can afford to install a Rainwater Harvesting System

Figure 4.2: I can afford to install a Rainwater Harvesting System

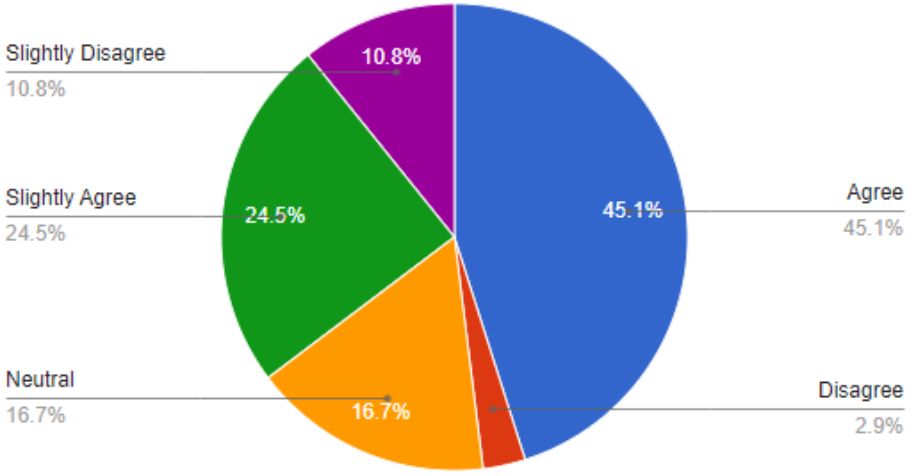


Chart 2 shows that 46 (45.1%) respondents out of 102 agrees that they can afford a Rainwater Harvesting System. 25 (24.5%) slightly agree, 17 (16.7%) are neutral, 11 (10.8%) slightly disagree, and only 3 (2.9%) think they can't afford a Rainwater Harvesting System.

4.2.2.3 Cost Factor: I would install a Rainwater Harvesting System

Figure 4.3: I would install a Rainwater Harvesting System

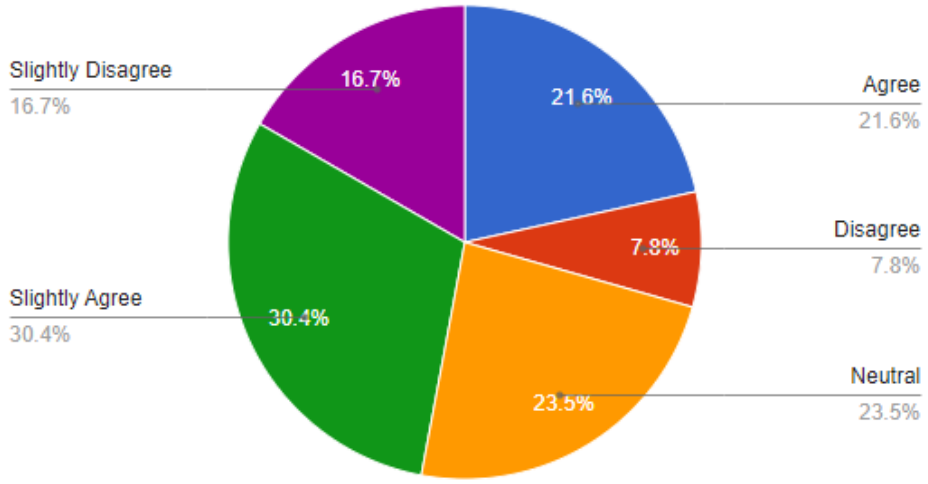


Chart 3 shows that 22 (21.6%) of the respondents agree that they would install a Rainwater Harvesting System, 31 (30.4%) slightly agree, 24 (23.5%) are neutral, 17 (16.7%) slightly disagree, and 8 (7.8%) disagree that they would install a Rainwater Harvesting System.

4.2.2.4 Awareness Factor: I am aware of the existence of Rainwater Harvesting Systems

Figure 4.4: I am aware of the existence of Rainwater Harvesting Systems

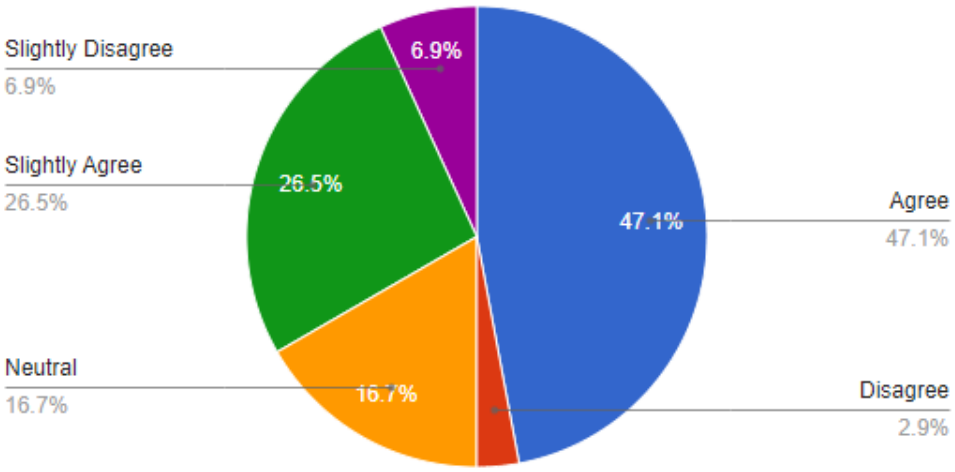
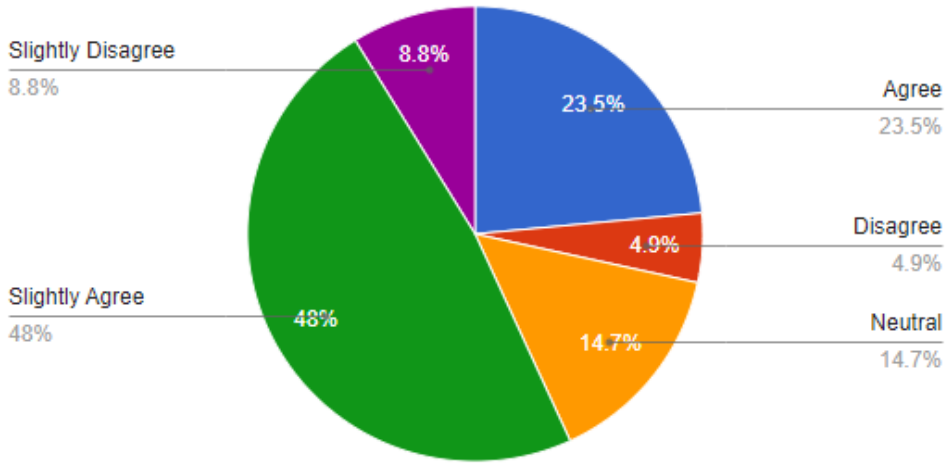


Chart 4 shows that 48 (47.1%) respondents out of 102 agree that they know the existence of Rainwater Harvesting Systems, 27 (26.5%) slightly agree, 17 (16.7%) neutral, 7 (6.9%) slightly disagree, and 3 (2.9%) disagree that they know about Rainwater Harvesting Systems.

4.2.2.5 Awareness Factor: I am aware of how Rainwater Harvesting System works

Figure 4.5: I am aware of how Rainwater Harvesting System works



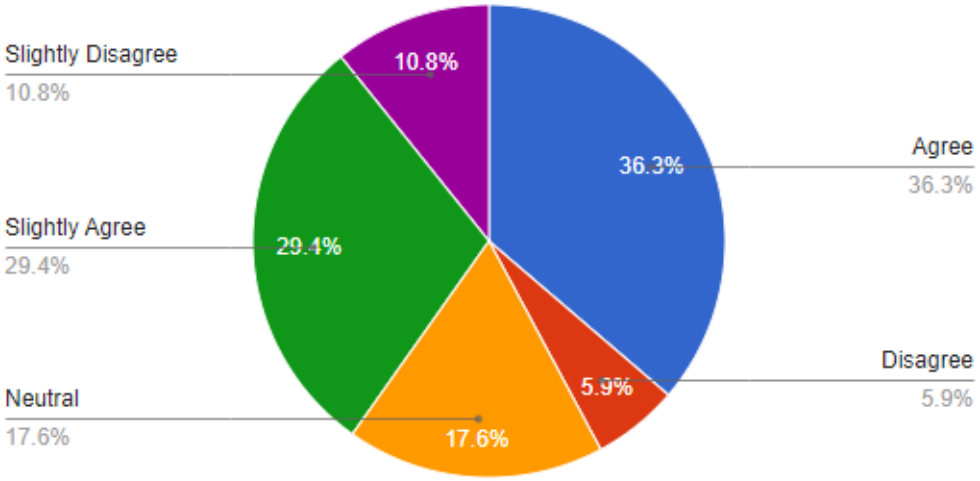
It is observed from Chart 5 that 24 (23.5%) of the respondents agree that they know how the system works, 49 (48%) slightly agree, 15 (14.7%) neutral, 9 (8.8%) slightly disagree, and 5 (4.9%) disagree that they know how Rainwater Harvesting System works.

4.2.2.6 Awareness Factor: I know people who have installed Rainwater Harvesting Systems in their homes

From Chart 6, it can be seen that 37 (36.3%) of the respondents agree that they know people who have installed Rainwater Harvesting System in their homes, 30 (29.1%) slightly agrees, 18 (17.6%) neutral, 11 (10.8%) slightly disagree, while 6 respondents (5.9%) disagree. The results were higher than

expected, but it is also understandable since Rainwater Harvesting Systems are quite common in strata buildings.

Figure 4.6: I know people who have installed Rainwater Harvesting Systems in their homes



4.2.2.7 Incentives Factor: Rainwater Harvesting Systems can help us save the environment

Figure 4.7: Rainwater Harvesting Systems can help us save the environment

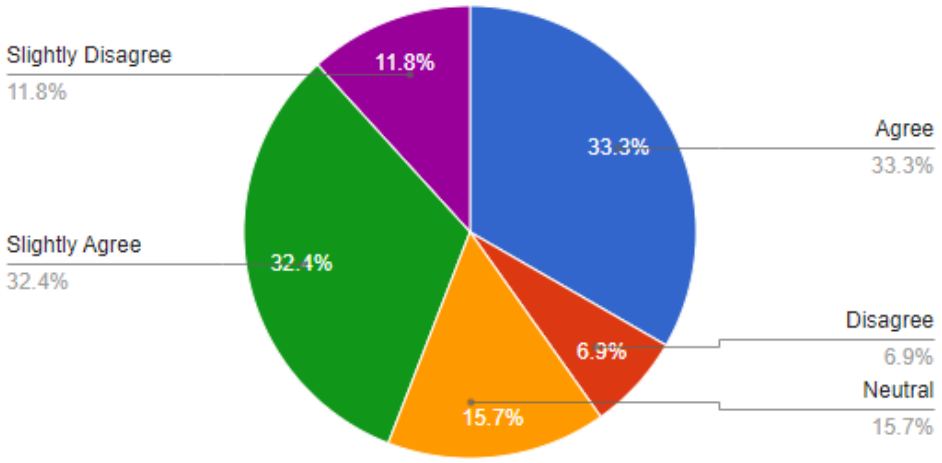


Chart 7 shows that 34 (33.3%) of the respondents agree that Rainwater Harvesting Systems can help save the environment, 33 (32.4%) slightly

agree, 16 (15.7%) neutral, 12 (11.8%) slightly disagree, and 7 (6.9%) disagree.

4.2.2.8 Incentives Factor: Rainwater Harvesting Systems can help cut down on water utility bills

Figure 4.8: Rainwater Harvesting Systems can help cut down on water utility bills

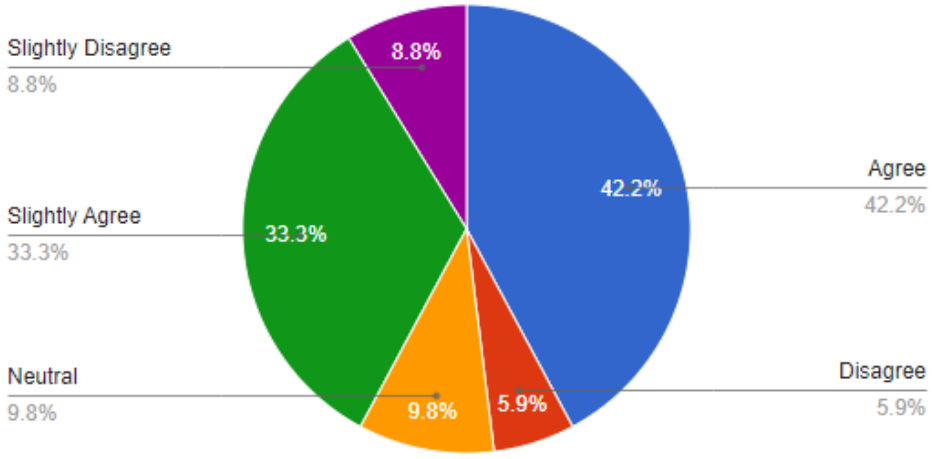
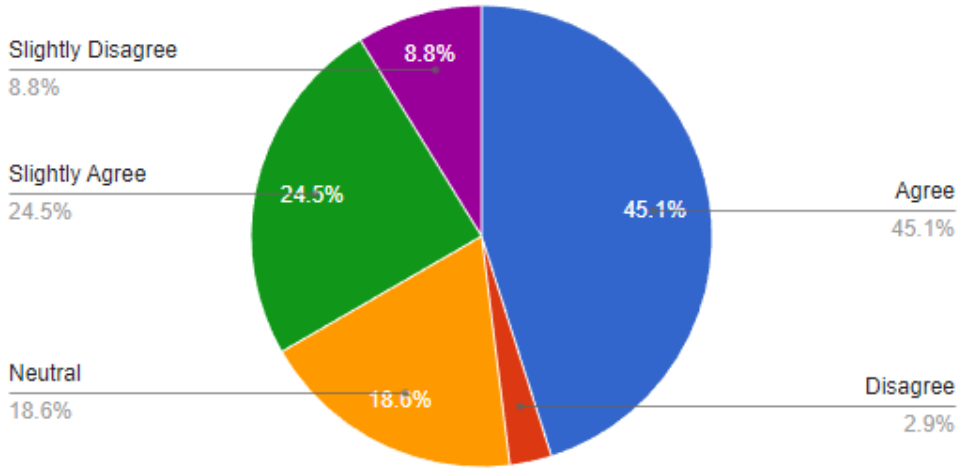


Chart 8 shows that 43 (42.2%) of the respondents agree that Rainwater Harvesting Systems can help cut down on water bills, 34 (33.3%) slightly agree, 10 (9.8%) were neutral, 9 (8.8%) slightly disagree, and 6 (5.9%) disagree.

4.2.2.9 Incentives Factor: Rainwater Harvesting Systems can help us in times of drought

From Chart 9, 46 (45.1%) of the respondents agree that Rainwater Harvesting Systems can help during the drought, 25 (24.5%) slightly agrees, 19 (18.6%) neutral, 9 (8.8%) slightly disagree, 3 (2.9%) disagree that Rainwater Harvesting System are of any use during the drought.

Figure 4.9: Rainwater Harvesting Systems can help us in times of drought



4.2.2.10 Incentives Factor: I know the difference between freshwater and saltwater

Figure 4.10: I know the difference between freshwater and saltwater

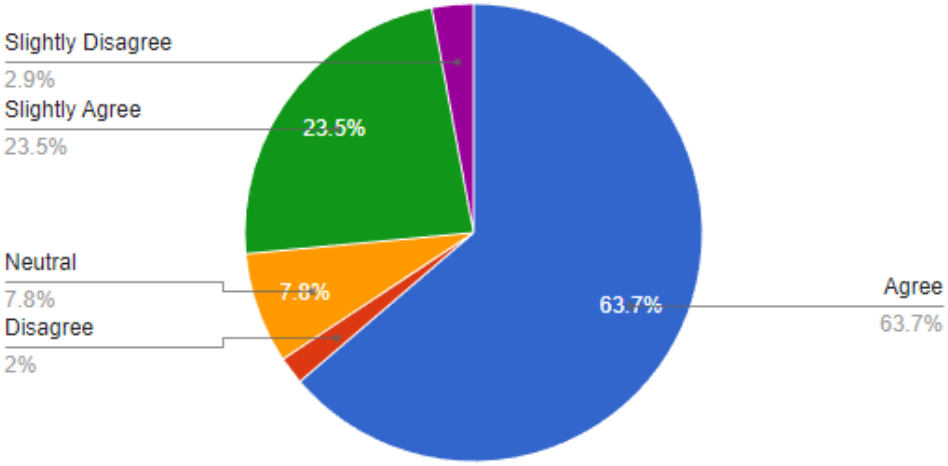
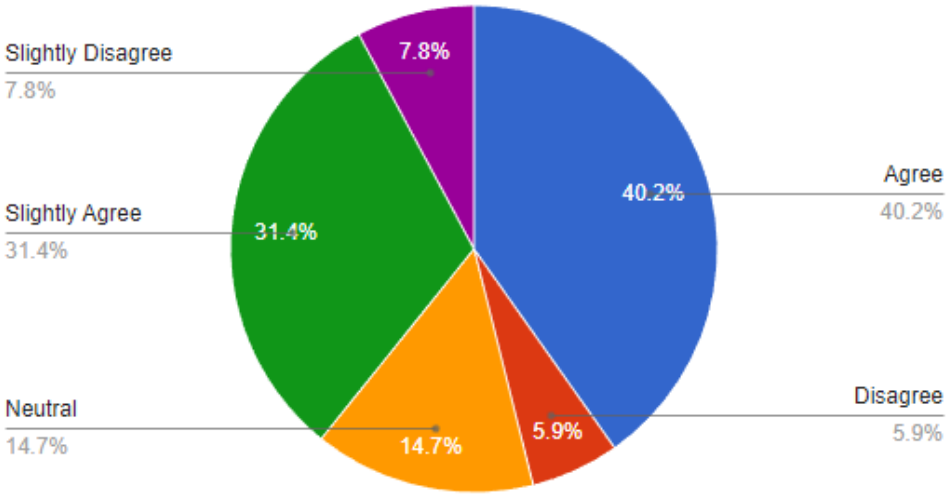


Chart 10 shows that 64 (63.7%) of the respondents know the difference between freshwater and saltwater, 24 (23.5%) slightly agree, 8 (7.8%) neutral, 3 (2.9%) slightly disagree, and 3 (2%) of the respondents do not know the difference between freshwater and saltwater.

4.2.2.11 Water Demand Factor: I know that water is a finite resource

Figure 4.11: I know that water is a finite resource

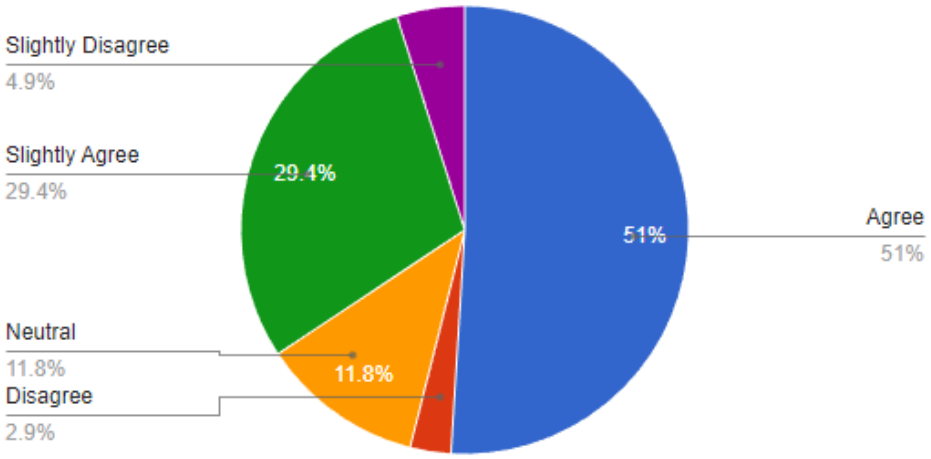


It is observed from Chart 11 that 41 (40.2%) out of 102 respondents agree that they know water is a limited resource, 32 (31.4%) slightly agree, 15 (14.7%) neutral, 8 (7.8%) slightly disagree, 6 (5.9%) disagree that they know water is a finite resource.

4.2.2.12 Government Policies Factor: I know that Malaysia's National Water Services Commission are taking initiatives to lower down Malaysian’s water consumption

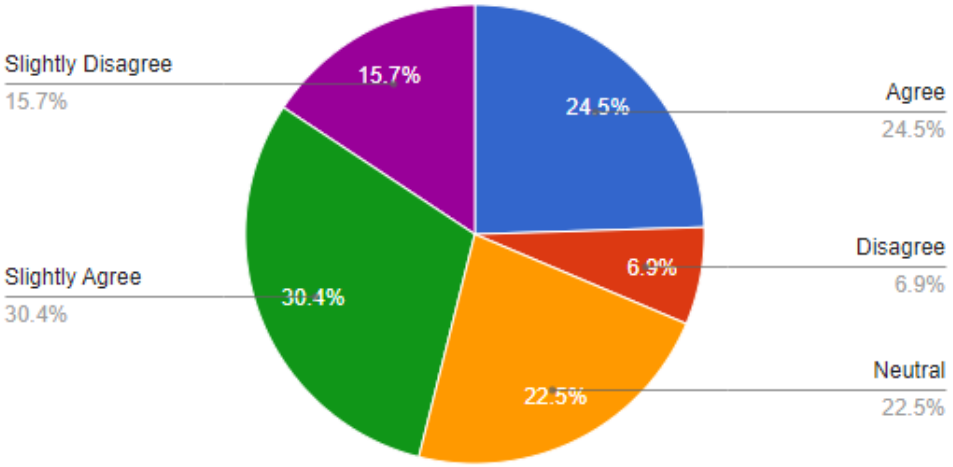
Chart 12 shows that 52 (51%) of the respondents know that Malaysia's National Water Services Commission are taking initiatives to lower down Malaysian’s water consumption, 30 (29.4%) slightly agree, 12 (11.8%) neutral, 5 (4.9%) slightly disagree, and 3 (2.9%) disagree that they know Malaysia's National Water Services Commission are taking initiatives to lower down Malaysian’s water consumption.

Figure 4.12: I know that Malaysia's National Water Services Commission are taking initiatives to lower down Malaysian's water consumption



4.2.2.13 Government Policies Factor: I know that the government has introduced guidelines on implementing Rainwater Harvesting Systems

Figure 4.13: I know that the government has introduced guidelines on implementing Rainwater Harvesting Systems



From Chart 13, it is observed that 25 (24.5%) of the 102 respondents agree that they know that the government has introduced guidelines on implementing Rainwater Harvesting Systems, 31 (30.4%) slightly agree, 23 (22.5%) neutral, 16 (15.7%) slightly disagree, while 7 (6.9%) disagree that

they know the government has introduced guidelines on implementing Rainwater Harvesting Systems.

4.2.2.14 Government Policies Factor: I know that all government buildings have installed Rainwater Harvesting Systems

Figure 4.14: I know that all government buildings have installed Rainwater Harvesting Systems

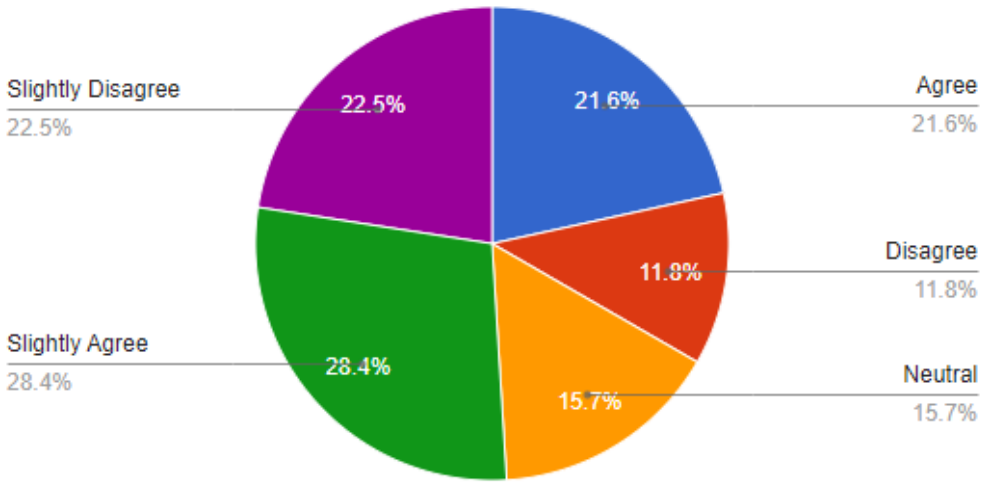


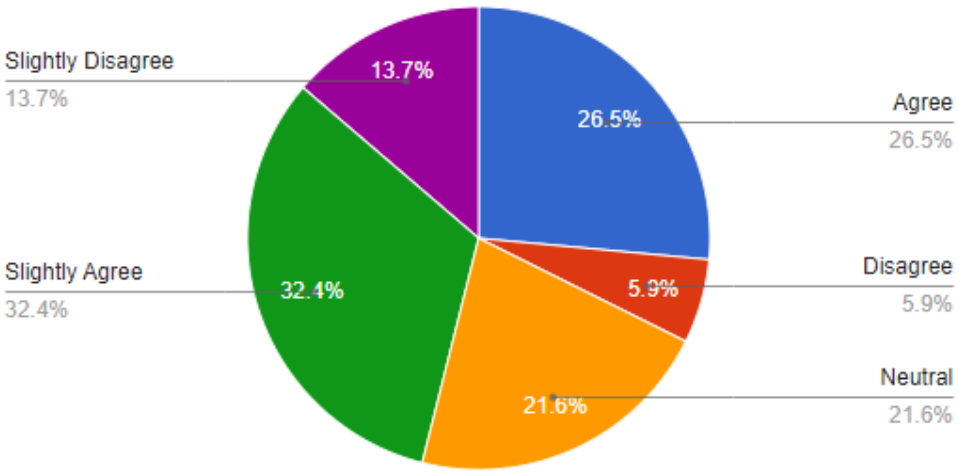
Chart 14 shows that 22 (21.6%) of the respondents agrees that they know all government buildings have installed Rainwater Harvesting Systems. 29 (28.4%) slightly agree, 16 (15.7%) neutral, 23 (22.5%) slightly disagree, and 12 (11.8%) disagree that they know Rainwater Harvesting Systems have been implemented in all government buildings.

4.2.2.15 Government Policies Factor: I know that the government is actively promoting Rainwater Harvesting Systems

From Chart 15, it can be seen that 27 (26.5%) of the respondents agree that the government is actively promoting Rainwater Harvesting Systems, 33 (32.4%) slightly agrees, 22 (21.6%) neutral, 14 (13.7%) slightly disagree, 6

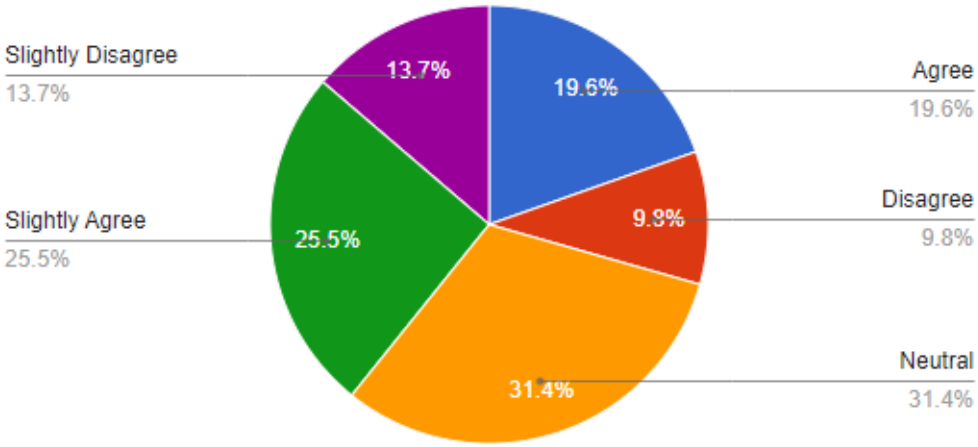
(5.9%) disagree that the government is promoting Rainwater Harvesting Systems.

Figure 4.15: I know that the government is actively promoting Rainwater Harvesting Systems



4.2.2.16 Government Policies Factor: I know that the government has made Rainwater Harvesting Systems mandatory in large buildings such as bungalows, factories, and schools

Figure 4.16: I know that the government has made Rainwater Harvesting Systems mandatory in large buildings such as bungalows, factories, and schools



It can be observed in Chart 16 that 20 (19.6%) of the respondents agree that they know Rainwater Harvesting Systems were made mandatory in some buildings, 26 (25.5%) slightly agree, 32 (31.4%) neutral, 14 (13.7%) slightly disagree, while 10 (9.8%) disagree.

4.3 Relative Importance Index (RII)

4.3.1 Cost Factor

Table 4.9: Relative Importance Index of Cost Factor

COST FACTOR	∑W	AN	RII	RANKING
I know the cost of Rainwater Harvesting Systems	367	510	0.719	2
I can afford to install a Rainwater Harvesting System	406	510	0.796	1
I would install a Rainwater Harvesting System	348	510	0.682	3

From Table 9, it can be seen that the respondents are more agreeable to the fact that they can afford a Rainwater Harvesting System, with an RII of 0.796. This is followed by knowing the cost of Rainwater Harvesting Systems at 0.719 RII. Finally, the lowest RII value at 0.682 is the question asking whether they would install a Rainwater Harvesting System. This means that although the respondents may know the price of the Rainwater Harvesting System, and are even able to afford them, they still may be against installing the system in their homes. This could be because they do not think the Rainwater Harvesting System is worth it at its price, or also because they just do not think Rainwater Harvesting Systems are necessary.

4.3.2 Awareness Factor

Chart 9 shows that respondents are very agreeable that they are aware of the existence of Rainwater Harvesting Systems, with an RII of 0.816. The next in line with an RII of 0.759 is that they know people who have installed

Rainwater Harvesting Systems in their homes. Finally, is that they are least aware of how Rainwater Harvesting Systems work with an RII of 0.753. From this, it could be seen that although many people know the existence of Rainwater Harvesting Systems, they may not know how Rainwater Harvesting Systems work. This may affect their intention to purchase as it is human nature to be afraid of the unknown.

Table 4.10: Relative Importance Index of Awareness Factor

AWARENESS FACTOR	∑W	AN	RII	RANKING
I am aware of the existence of Rainwater Harvesting Systems	416	510	0.816	1
I am aware of how Rainwater Harvesting System works	384	510	0.753	3
I know people who have installed Rainwater Harvesting Systems in their homes	387	510	0.759	2

4.3.3 Incentives Factor

Table 4.11: Relative Importance Index of Incentives Factor

INCENTIVES FACTOR	∑W	AN	RII	RANKING
Rainwater Harvesting Systems can help us save the environment	381	510	0.747	3
Rainwater Harvesting Systems can help cut down on water utility bills	405	510	0.794	2
Rainwater Harvesting Systems can help us in times of drought	408	510	0.800	1

According to Chart 10, the respondents mostly agree that Rainwater Harvesting Systems are a lifesaver during the drought, this is proven by an RII of 0.8. Next, they also believe that the Rainwater Harvesting System can help them save on water utility bills, this has an RII of 0.794. As for the last one, the respondents are least agreeable that the Rainwater Harvesting System can help save the environment. From the results, it can be interpreted that homeowners are likely to install a Rainwater Harvesting System if drought was an eminent danger in Malaysia. It is also likely that they will

install a system if it helps them cut down on their water bills. Finally, they are least agreeable with the fact that Rainwater Harvesting Systems can save the environment. This is understandable as it can be quite farfetched that the system can help save the environment. Yes, it helps save water, but it does not directly save the environment.

4.3.4 Water Demand Factor

Based on Chart 11, the respondents gave the highest RII of 0.888 at differentiating freshwater and saltwater. They also agree that they know the Malaysia's National Water Services Commission are trying to lower down the population's water consumption at 0.841 RII, and they are least agreeable that water is a finite resource, with an RII score of 0.784. It can be seen that the respondents understand that freshwater is the consumption water and saltwater is not directly consumable. However, they are the least agreeable that water is a finite resource. This means that although they know that water is not infinite, they don't think it will run out, at least in their lifetime.

Table 4.12: Relative Importance Index of Water Demand Factor

WATER DEMAND FACTOR	∑W	AN	RII	RANKING
I know the difference between freshwater and saltwater	453	510	0.888	1
I know that water is a finite resource	400	510	0.784	3
I know that Malaysia's National Water Services Commission are taking initiatives to lower down Malaysian's water consumption	429	510	0.841	2

4.3.5 Government Policies Factor

From Chart 12, it can be seen that this factor has very low RII values, with the highest being 0.720, they know that the government is actively

promoting Rainwater Harvesting Systems. This is followed by them knowing that the government has introduced guidelines on implementing the system, at 0.7 RII. Thirdly with 0.663 RII is that they know the government has made it mandatory to install Rainwater Harvesting System in some large buildings. Lastly, the respondents are least agreeable when they are asked if they knew that all government buildings have installed Rainwater Harvesting Systems at an RII of 0.651. From the results, it seems that the government has not done a great job in spreading their policies. As most of them recorded a low RII.

Table 4.13: Relative Importance Index of Government Policies Factor

GOVERNMENT POLICIES FACTOR	∑W	AN	RII	RANKING
I know that the government has introduced guidelines on implementing Rainwater Harvesting Systems	357	510	0.700	2
I know that all government buildings have installed Rainwater Harvesting Systems	332	510	0.651	4
I know that the government is actively promoting Rainwater Harvesting Systems	367	510	0.720	1
I know that the government has made Rainwater Harvesting Systems mandatory in large buildings such as bungalows, factories, and schools	338	510	0.663	3

4.4 Conclusion

To conclude Chapter 4, it seems that the cost factor is not a huge factor to be considered. On the other hand, the incentives factor would be more important as the homeowners are more concerned whether installing the Rainwater Harvesting System would bring them benefits, rather than the cost of the system. Furthermore, it is also found that the homeowners are more willing to purchase the system if they have a need for it, and if they know more about the Rainwater Harvesting System.

Lastly, it is also found that the government policies factor recorded the lowest values, which means that the respondents do not often see the government spreading awareness for Rainwater Harvesting Systems. Chapter 5 will have another summary of the findings, the discussion on major findings, implications of the study, and finally, the limitations and recommendations of the study.

CHAPTER 5: DISCUSSION, CONCLUSION, AND IMPLICATIONS

5.0 Introduction

The final chapter of the research will consist of the short summary of the analysis done in Chapter 4 and discuss on the findings of the analysis. Next would be implications of the study, how the study impacts the audience of the research. The limitations, and recommendations of the study, which will highlight the shortcomings of the research, and recommendations to for future research. Lastly, a conclusion will be in order to conclude the whole report.

5.1 Summary of Statistical Analysis

From the research done in Chapter 4, the Relative Importance Index (RII) for each question was calculated and compared within each factor to determine which questions were most impactful to the homeowners. For the cost factor, it seemed that most homeowners think that they can afford a Rainwater Harvesting System. This is understandable as the price of Rainwater Harvesting Systems are not sky-high, just that most people are not willing to bear the financial burden of paying and maintaining it. For the awareness factor, most respondents agreed that they are aware of the existence of Rainwater Harvesting Systems but are unaware of the workings of a Rainwater Harvesting System, most people would hesitate to purchase an item they are unfamiliar with. For the incentives factor, most respondents agree that Rainwater Harvesting Systems could be useful of there was a drought, or if it helped them save money, and if it helps save the environment, ranked from most important to least important. Apparently, saving the environment seemed to be the least prioritised out of the 3. As for the water demand factor, most respondents think that they understand the difference between salt water and freshwater, but there are less people who know that water is a finite resource. This

could mean that although they understand the difference, they don't think that water will ever run out, at least not in their generation. Finally, for the government policies factor, most respondents understood that the government is taking measures to promote the Rainwater Harvesting System, but they don't know that the government has taken the initiative to implement the Rainwater Harvesting System in all their buildings. It seems that not a lot of publicity has been done by the government to promote the Rainwater Harvesting System.

5.1 Summary and Discussion of Major Findings

Table 5.1: Relative Importance Index of All Factors

Main Factors	RII (Average)	Ranking
Cost	0.632	5
Awareness	0.776	3
Incentives	0.823	2
Water Demand	0.837	1
Government Policies	0.684	4

Table 13 records the average Relative Importance Index (RII) of the questions in each factor. It can be observed that water demand factor would be the most important factor with an RII of 0.837, if homeowners begin to understand that water is a finite resource, even if it may not run out in their lifetime, it may be detrimental to the future generation. Once the people recognise and understand this, Rainwater Harvesting System would be more welcomed. Following closely behind is the incentives factor, which recorded an RII of 0.823. This means that homeowners are more likely to install a Rainwater Harvesting System if it can bring them benefits, for example, if drought was happening often in Malaysia, or if the system could help them save money. Thirdly is the awareness factor with an RII of 0.776, this means that the respondents are already quite aware of Rainwater Harvesting Systems, but they are still not familiar enough with Rainwater Harvesting Systems because it is usually not discussed in their daily lives, as compared to the other systems such as smart home systems, or just normal machineries such as washing machines, refrigerators and so on. Fourthly is government policies factor which recorded a low RII of 0.684. This means that the government is lacking in promoting the Rainwater Harvesting System, and it would be better if the

government could campaign more on the system and enforce their policies more strictly. Finally, the cost factor which surprisingly recorded the lowest RII of 0.632. This means that cost is not an important factor to be considered, as the respondents understand that they can afford the system, but are still against purchasing it, either because they think it is a hassle, or it is not worth the investment.

5.2 Implications of the Study

This research is aiming to influencing the government, the developers, other potential researchers, the manufacturers, and also the general public. The results have clearly shown that although the government has taken action in subtly promoting Rainwater Harvesting System in our learning programs, and that they have installed the system in all their buildings, they have not done enough publicity to the public which greatly reduces their efficiency in promoting Rainwater Harvesting Systems to the general public. Next, the study is also aimed at the developers, so that they understand more about Rainwater Harvesting Systems, thus implementing them in their landed projects, rather than in strata projects only. Other than that, the study can also be referred to by other researchers on this topic, as it would also help bring awareness to everyone when they read their papers. Fourthly, this research has already surveyed what the homeowners think about Rainwater Harvesting Systems, this is so that they can analyse which parts of their system that they can improve on. Finally, this paper should be available to the general public, so that everyone can have the information on Rainwater Harvesting Systems and why they are helpful to us.

5.3 Limitations of the Study

For this research, there has been a limitation since the survey's ethical clearance was approved later than previously speculated. The chosen sampling location was in the Greater Kuala Lumpur, which is the densest populated area in Malaysia. Using the Taro Yamane formula, the calculated sample size reached the maximum of 400. With the late ethical clearance, the survey was unable to gather as many respondents as mentioned.

5.4 Recommendations for Future Research

For future research, other researchers can consider redoing the survey, and try to gather as many as 400 respondents. If this survey can be done on a larger scale over the whole of Malaysia, then the results would be more accurate to represent the Malaysian's preference in Rainwater Harvesting Systems.

Other than that, other researchers can also consider using the results of this research and try to find out what can be done to improve on the Rainwater Harvesting Systems, whether there is a way to make the system more appealable to the homeowners in Malaysia. The preliminary factors would be in improving the Rainwater Harvesting System's efficiency, reducing the cost, and spreading awareness.

5.5 Conclusion

In conclusion, the first research objective of identifying the main factors influencing the landed homeowners from installing Rainwater Harvesting System has been achieved, as the research has identified 5 factors, including cost factor, awareness factor, incentives factor, water demand factor, and government policies factor as the 5 main driving forces in influencing the landed homeowners. Furthermore, the research's second objective in determining which are the factors most influencing the landed homeowners in installing the Rainwater Harvesting System has also been achieved. This was done using the Relative Importance Index (RII) in the analysis, to rank which factors were given the highest scores on the likert scale. It is found that water demand is the most impactful factor, if water source (cost or supply) were a problem in Malaysia, then the landed homeowners would be very likely to install the system in their homes. The next finding was unexpectedly the incentives factor instead of cost factor, if the return of installing the Rainwater Harvesting System was high, then it would also encourage homeowners from installing the system. This means that the price of the system is not a big issue, the homeowners are more concerned whether they will get their money back. Next is government policies, if the government implemented stricter policies for Rainwater Harvesting Systems and also enforced them, then the general population would have to follow the policy in implementing the Rainwater Harvesting System.

REFERENCES

Air Selangor Will Implement Water Supply Tariff Adjustment For Non Domestic and Special Categories In Line With KASA's Announcement. (2022). Retrieved from Air Selangor website: https://www.airselangor.com/air-selangor-will-implement-water-supply-tariff-adjustment-for-non-domestic-and-special-categories-in-line-with-kasas-announcement/

Ansu-Mensah, P. (2021). Green product awareness effect on green purchase intentions of university students': an emerging market's perspective. *Future Business Journal*, *7*(1), 1–13.

Asmawi, M. Z., Mustofa, N. S., Abd Aziz, A. R., & Rahim, A. A. (2020). The Rainwater Harvesting (RWH) as A Flash Flood Mitigation Measure in Ken Rimba Shah Alam, Selangor. *Journal of Social Science and Humanities*, *3*(1), 14–22.

Ayoun, S., Cheikh, A. Ben, Abdellatif, T., & Ghallab, N. (2015). Purchase intention of green product: an approach based customer orientation. *SSRN Electronic Journal*. Retrieved from https://doi.org/10.2139/ssrn.2583517

Bernama. (2020). Govt targets to reduce Malaysians' daily water consumption by 2025. Retrieved from The Malay Mail website: https://www.malaymail.com/news/malaysia/2020/08/03/govt-targets-to-reduce-malaysians-daily-water-consumption-by-2025/1890715

Buslima, F. S., Omar, R. C., Jamaluddin, T. A., & Taha, H. (2018). Flood and flash flood geo-hazards in Malaysia. *International Journal of Engineering and Technology (UAE)*, *7*(4), 760–764.

Che-Ani, A. I., Shaari, N., Sairi, A., Zain, M. F. M., & Tahir, M. M. (2009). Rainwater harvesting as an alternative water supply in the future. *European Journal of Scientific Research*, *34*(1), 132–140.

Cheng, I. (2022). Nearly 90 HDB blocks in Yishun and Jurong to be installed with rainwater harvesting system. Retrieved from Channel New Asia website: https://www.channelnewsasia.com/singapore/hdb-rainwater-harvesting-system-yishun-jurong-green-towns-programme-solar-panels-2590301

Das, P. (2021). What Is A Green Product? – Examples, Advantages, and Challenges. Retrieved from Feedough website: https://www.feedough.com/green-product/

Department, L. G. (n.d.). *Rainwater Harvesting*. Retrieved from https://jkt.kpkt.gov.my/jkt/resources/user_30/2016_OKU/Chapter_6_-_Rainwater_Harvesting.pdf

Department, P. M. (2022). *Current Population Estimates, Malaysia, 2022*. Retrieved from https://www.dosm.gov.my/v1/index.php?r=column/pdfPrev&id=dTZXanV6

UUdyUEQ0SHNWOVhpSXNMUT09#:~:text=The total population of Malaysia,to 2.4 million (2022).

Domestic metered water consumption in Malaysia. (2022). Retrieved from Statista Research Department website: https://www.statista.com/statistics/796354/domestic-metered-water-consumption-malaysia/

Evans, M. (2019). How We Use Water and Why We Should Conserve More. Retrieved from Live About Dot Com website: https://www.liveabout.com/how-do-we-use-water-and-why-conserve-3157863

Freshwater. (n.d.). Retrieved from WWF Malaysia website: https://www.wwf.org.my/our_work/freshwater/#:~:text=About 97%25 of our raw,and flow from the highlands.

Gimino, G. (2022). Saving from a rainy day. Retrieved from The Star website: https://www.thestar.com.my/news/nation/2022/08/27/saving-from-a-rainy-day

Haaban, A. J., & Huang, Y. F. (2007). Malaysian Experience Research in Rainwater Harvesting.

Hafizi Md Lani, N., Yusop, Z., & Syafiuddin, A. (2018). A Review of Rainwater Harvesting in Malaysia: Prospects and Challenges. *Water*, Vol. 10, pp. 1–21. https://doi.org/10.3390/w10040506

High-rise dwellers can also benefit from rainwater harvesting. (2019). Retrieved from The Star Online website: https://www.thestar.com.my/metro/metro-news/2017/10/23/highrise-dwellers-can-also-benefit-from-rainwater-harvesting

How We Use Water. (2022). Retrieved from EPA U.S. Environmental Protection Agency website: https://www.epa.gov/watersense/how-we-use-water

Kailasam, K. (2021). Valuing Water through Community Empowerment in Malaysia.

Martins, A. (2022). Most Consumers Want Sustainable Products and Packaging. Retrieved from Business News Daily website: https://www.businessnewsdaily.com/15087-consumers-want-sustainable-products.html

Nadason, M. (2021). FOMCA, WECAM, FAM: Celebrating World Water Day 2021 – Valuing Water. Retrieved from FOMCA website: https://www.fomca.org.my/v1/index.php/fomca-di-pentas-media/fomca-di-pentas-media-2021-21/1295-fomca-wecam-fam-celebrating-world-water-day-2021-valuing-water

Rahman, S., Khan, M. T. R., Akib, S., Din, N. B. C., Biswas, S. K., & Shirazi, S. M. (2014). Sustainability of Rainwater Harvesting System in terms of Water Quality. *The Scientific World Journal*, *2014*, 1–10. https://doi.org/10.1155/2014/721357

Rainwater harvesting. (n.d.). Retrieved from SuDS Wales Sustainable Drainage Systems website: https://www.sudswales.com/types/source-control/rainwater-harvesting/

Rainwater Harvesting in Malaysia. (n.d.). Retrieved from Voda Rainwater Harvesting System website: https://www.vodarainwaterharvesting.com/rainwater-harvesting-in-malaysia/

Rainwater Harvesting in Malaysia. (2022). Retrieved from Voda Rainwater Harvesting System website: https://www.vodarainwaterharvesting.com/rainwater-harvesting-in-malaysia/#:~:text=The price of an average,on ground) to the WCs

Rainwater Harvesting Solutions: Which Countries Lead the Way? (2015). Retrieved from Cleanawater website: https://cleanawater.com.au/information-centre/rainwater-harvesting-solutions-which-countries-lead-the-way#:~:text=Known as Rooftop Rainwater Harvesting,be safe for human consumption."

Siwar, C., & Ahmed, F. (2014). Concepts, dimensions and elements of water security. *Pakistan Journal of Nutrition*, *13*(5), 281–286. https://doi.org/10.3923/pjn.2014.281.286

Suhaimi, A. R., Rasyikah, M. K., Jamaluddin, S. A., Huang, Y. F., & Farah, M. S. (2007). Policies and incentives for rainwater harvesting in Malaysia. *Rainwater Utilization Colloquium On*, *19*, 1–15.

Syuibah Mohamad, Mohd Reeza Yusof, Muhamad Faiz Musa, Mohammad Fadil (2014, March 8). The Awareness Among Developers on Rainwater Harvesting System (RWHS). *The Awareness Among Developers on Rainwater Harvesting System (RWHS)*.

Teo, E. Q. (2019). Singapore's Solution to Water Scarcity: NEWater. Retrieved from Save The Water website: https://savethewater.org/singapores-solution-to-water-scarcity-newater/

The Edge. (2009). Water tariff hike of up to 12% under consideration. Retrieved from The Edge Markets website: https://www.theedgemarkets.com/article/water-tariff-hike-12-under-consideration

Wait A Minute, How Many Properties Are There In Malaysia? (2022). Retrieved from Property Guru website: https://www.propertyguru.com.my/property-guides/how-many-properties-are-there-in-malaysia-38675

Worst water shortage occurred in 1998 with 150 days of rationing. (2014). Retrieved from The Star Online website: https://www.thestar.com.my/news/nation/2014/02/26/worst-water-shortage-occurred-in-1998-with-150-days-of-rationing/#:~:text=PETALING JAYA%3A The country's worst,residents in the Klang Valley.

Yendo, A., Ahmad Puad, M. S., Normadiah, D., & Nor Adeena, R. (2018). Consumer Awareness Towards Rainwater Harvesting System in Selangor, Malaysia. *International Journal of Engineering and Technology (UAE)*, *7*(4), 33–36.

APPENDIX

Wholly owned by UTAR Education Foundation
(Co. No. 578227-M)
DU012(A)

Universiti Tunku Abdul Rahman

Name: Ian Low Ming Hans

Student ID: 2000572

Introduction

This survey is aimed to identify some of the factors that are influencing terrace homeowners in Malaysia from implementing Rainwater Harvesting Systems in their homes. This survey will take up to 10 – 15 minutes, I would really appreciate it if you could answer our questions.

Your response will be kept confidential, and we will only share the compiled information that we collected from all the respondents. Information collected from the questionnaire will be shared, however, respondents' name and details will be kept confidential. Please contact Ian Low Ming Hans at 01110518840 or minghans@1utar.my for any further suggestion or inquiry.

Thank you for your time and input in this research.

I hereby consent on my voluntary participation in this survey which will be conducted anonymously. (As proposed accordingly by Personal Data Protection Statement-UTAR)

☐ Yes- proceed the questionnaire.

☐ No- thank you for your time

Section A: Respondent's Background

Instructions: Please tick (/) the rows which applies to you.

1. Gender

Male	
Female	

2. Age

18 - 24	
25 - 34	
35 - 44	
45 - 54	
Above 54	

3. Employment

Government sector	
Private sector	
Self-employed	
Unemployed	
Retired	

4. Family Income (Monthly)

RM10,960 and above	
RM4,850 to RM10,959	
RM4,849 and below	

5. Education

SPM	
Foundation/Diploma/STPM	
Bachelor's Degree	
Master's Degree	
PhD	

6. Marital Status

Single	
Married	
Separated	
Widowed	
Prefer not to say	

7. State

Selangor	
Kuala Lumpur	
Putrajaya	

Section B: Main factors affecting terraced homeowners from installing Rainwater Harvesting System

Instructions: Please read the first column and tick (/) the box which relates to you the most, whether you disagree, somewhat disagree, neutral, somewhat agree or agree with the statements.

i) Cost Factor

	Disagree (1)	Somewhat Disagree (2)	Neutral (3)	Somewhat Agree (4)	Agree (5)
I know the cost of Rainwater Harvesting Systems					
I can afford to install a Rainwater Harvesting System					
I would install a Rainwater Harvesting System					

ii) Awareness Factor

	Disagree (1)	Somewhat Disagree (2)	Neutral (3)	Somewhat Agree (4)	Agree (5)
I am aware of the existence of Rainwater Harvesting Systems					
I am aware of how Rainwater Harvesting System works					
I know people who implements Rainwater Harvesting Systems in their homes					

iii) Incentives Factor

	Disagree (1)	Somewhat Disagree (2)	Neutral (3)	Somewhat Agree (4)	Agree (5)
Rainwater Harvesting Systems can help us save the environment					
Rainwater Harvesting Systems can help cut down on water utility bills					
Rainwater Harvesting Systems can help us in times of drought					

iv) Water Demand

	Disagree (1)	Somewhat Disagree (2)	Neutral (3)	Somewhat Agree (4)	Agree (5)
I know the difference between freshwater and saltwater					
I know that water is a finite resource					
I know that Malaysia's National Water Services Commission are taking initiatives to lower down Malaysian's water consumption					

v) Government Policies

	Disagree (1)	Somewhat Disagree (2)	Neutral (3)	Somewhat Agree (4)	Agree (5)
I know that the government has introduced guidelines on implementing Rainwater Harvesting Systems					
I know that all government buildings have installed Rainwater Harvesting Systems					

I know that the government is actively promoting Rainwater Harvesting Systems					
I know that the government has made Rainwater Harvesting Systems mandatory in large buildings such as bungalows, factories, and schools					

vi) Other Factors (Please state your opinon)
