#AhonMalabon: Exploring the Awareness, Community Perceptions, and Current Practices of Rainwater Harvesting in Selected Barangays in Malabon City

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ABSTRACT

This paper explores the awareness, perceptions, and practices related to Rainwater Harvesting Systems (RWHS) in selected barangays of Malabon City—one of the most flood-prone areas in the Philippines. Despite the existence of Republic Act (RA) No. 6716, which mandates the implementation of RWHS across the country, the practice remains underutilized and poorly implemented at the community level. The study employed a qualitative research design, combining a thematic analysis of semi-structured interviews with Malabon residents and a document analysis of relevant government-issued materials to triangulate the residents' lived experiences with the local government's documented initiatives.

The findings show that, while there is a general understanding of rainwater harvesting (RWH) among Malabon residents, there is a low awareness of the specific term "rainwater harvesting system" and of Republic Act No. 6716. The positive perceptions towards RWHS were influenced by its potential for flood mitigation, emergency use, cost-effectiveness, and social influence. However, the nature of the residents' environment, inaccessibility to resources needed, and perceived technical complexity remain barriers for adoption. Furthermore, the study reveals that there are limited efforts and an overall lack of initiatives from the local government units (LGU) to promote and implement RWHS. The study concludes that increased public awareness, education on RWHS implementation, and more proactive LGU efforts are crucial for the effective RWHS adoption in Malabon City.

TABLE OF CONTENTS

CHAPTER 1 - INTRODUCTION

Few countries have been shaped by water as much as the Philippines. The country bears both water's weight and its absence: despite being a nation regularly tormented by storms, water scarcity remains a perennial problem as 9 million out of 101 million Filipinos still suffer from subpar and unsafe sources of water. This affects not only rural and low-income areas but also the capital region, Metro Manila (Palanca-Tan, 2020). Furthermore, the Philippines is predicted to become "water-stressed" by 2040 if no new mitigation policies are to be implemented beyond what is already present (World Resources Institute, 2013, as cited in Baclig, 2022). With this, the country's susceptibility to heavy rainfall and flooding could be harnessed in order to alleviate this persistent and growing issue.

Rainwater Harvesting (RWH) is defined as the practice of collecting rainwater and storing it for future use (Kumar & Thakur, 2024). On a global scale, RWH is seen as a reliable means of supplying water to households, with studies indicating its effectiveness in maintaining water security even in the most arid of regions across various climate conditions (Musayev et al., 2018). Furthermore, the implementation of rainwater harvesting systems (RWHS) is also associated with reducing greenhouse gas emissions and mitigating the effects of floods, among others (De Sá Silva et al., 2021).

With its susceptibility to both storm-induced flooding and protracted droughts, the Philippines is one of the countries that stands to benefit the most from the proper implementation of RWHS. This likely became the basis for Republic Act 6716, otherwise known as the Rainwater Collector and Springs Development Act of 1989, which mandates the construction of RWHS in all barangays across the country (Government of the Republic of the Philippines, 1989,

Section 2). Despite being passed into law more than thirty years ago, RA 6716 never fully came into fruition: the project's funding remained unaccounted for in the Department of Public Works and Highways' (DPWH) annual budget, and very few—if any—were the government's initiatives to strictly implement the law and see it through (Buban, 2023). Had the law been properly implemented, there could have been 100,000 rainwater collectors scattered across the country from as early as 1991. Instead, RA 6716 is now mostly forgotten, while the Philippines as a whole remains highly vulnerable to the worsening effects of climate change.

One of the regions most affected by flooding in particular is CAMANAVA—an informal term used to refer to the cities of Caloocan, Malabon, Navotas, and Valenzuela in Metro Manila. CAMANAVA is notably flood-prone due to its low elevation, inadequate drainage system, and close proximity to bodies of water such as the Manila Bay, Tullahan River, and Malabon-Navotas River. Because the region already receives a high amount of rainfall each year, the proper implementation of RWHS in households as a means of minimizing the effects of floods appears to be a sustainable solution, though little documentation or research exists on the implementation of RWHS in CAMANAVA specifically.

Malabon, being one of the four cities that make up CAMANAVA, is—much like its sister cities—particularly prone to flooding due to its low-lying terrain and proximity to major bodies of water. Within its boundaries is the Artex Compound, a residential area which, despite being permanently flooded, lacks access to clean, potable water. The rest of the city tells a similar story, with regular interruptions and frequent flooding being a part of daily life for its residents. These issues highlight the need for systems that effectively deal with excesses in rainwater, with RWHS possibly being a practical solution to address both the issue of water scarcity and flooding. Though most known RWH projects in the Philippines are initiatives either by private

businesses or local governments, the potential of RWHS developed and installed in households and other similarly-sized institutions remains mostly unexplored.

Currently, RWH remains a rare practice in a country marred by water scarcity, and the debilitating effects of climate change continue to be a pressing but widely unaddressed issue in the Philippines—not just in poor areas, but also in extremely flood-prone, highly-urbanized cities like Malabon City. This lack of awareness, implementation, and documentation hinders the country's ability to effectively respond to the effects of climate change. Key barriers such as insufficient funding, weak enforcement, lack of design standards, and minimal public education on water management highlight a research gap regarding the real-world experiences, perceptions, and practices of Filipino communities concerning RWHS.

This study seeks to evaluate the awareness, perceptions, and community practices of RWH in one of the Philippines' most flood-prone cities, Malabon. By identifying the above-mentioned, the outcomes of this research may be used as the foundation for homeowners, businesses, institutions, non-government organizations (NGOs), and local government units (LGUs) to design RWHS-related projects and awareness campaigns.

This study is guided by the following research questions:

1. What is the level of awareness and understanding of RWHS among the residents of selected barangays in Malabon City?
2. How do the residents of selected barangays in Malabon City perceive the implementation of RWHS in their community?
3. What are the current practices in RWH in selected barangays in Malabon City?

This study explored how RWHS are understood, perceived, and practiced by residents in selected barangays in Malabon City. As such, the following sectors will benefit from the findings of this study:

Residents and Homeowners. The study directly benefits Malabon residents by exploring their awareness, perceptions, and current practices surrounding RWH. Insights drawn from the study can help encourage communities to maximize rainwater as an alternative water source, reduce water bills, and contribute to flood prevention efforts.

Local Government Units (LGUs). Findings from this research can support LGUs in improving their strategies for implementing RA 6716. By highlighting both the strengths and shortcomings of current initiatives, city officials and environmental planners may identify more effective and efficient approaches to implement RWH.

Environmental and Policy Advocates. This study may also serve organizations and advocates working towards climate resilience, environmental sustainability, and water security. By finding out the barriers to the implementation of RWH, the study can contribute to the development of targeted policies and programs that provide access to alternative water systems and solutions for flood mitigation, especially in flood-prone and underprivileged urban areas.

Given these potential benefits and challenges, it is essential to understand how rainwater harvesting is currently perceived and practiced at the community level. Primarily, the study seeks

to generate insights that can support more sustainable water resource management and flood mitigation strategies in urban communities like Malabon City.

Definition of Terms

- **Rainwater Harvesting (RWH).** The practice of collecting rainwater and storing it for future use.
- **Rainwater Harvesting System (RWHS)**. Systems and facilities created to catch, collect, store, and sometimes treat rainwater.
- **Rainwater Catchment/Collection.** The practice of collecting and storing rainwater, not necessarily for future use.
- **RA 6716.** The Rainwater Collector and Springs Development Act of 1989, which mandates the construction of RWHS in all barangays across the country.
- **Water scarcity.** A condition where the demand for water exceeds the available supply of fresh, hygienic water in a region.
- **Water-stressed.** A condition where the demand for water is high relative to whatever water is available in an area, leading to pressure on freshwater resources.

CHAPTER 2 - REVIEW OF RELATED LITERATURE

The practice of harvesting rainwater has emerged as a practical and sustainable solution to address both water scarcity and flooding in recent years. In the Philippines, where RWHS remains underutilized despite the country's susceptibility to prolonged droughts and intense rainfall, reviewing existing related literature is essential in understanding the implementation of RWHS in similar settings and, by extension, its potential when implemented in the Philippines.

The purpose of this review is to synthesize current research on RWHS and governance in urban flood-prone areas. It serves to uncover gaps in implementation, especially in relation to RA 6716, and to examine how community awareness, government action, and environmental conditions interact in the discourse. The review is presented thematically in order to address the different areas that this study covers, such as: the Philippines' current water situation, emphasizing the dual issues of flooding and water scarcity across the country and in Malabon; RWHS and its perception among different stakeholders; the practical benefits of RWHS at both household and community levels; and lastly, the policy landscape surrounding RWHS in the Philippines.

The Philippines' Water Situation

Located in the Pacific Typhoon Belt and subject to the El Niño–Southern Oscillation (ENSO), the Philippines' water situation is nothing short of complex. It is equal parts characterized by the deprivation of water as it is the excess of it. While the country receives abundant rainfall and its freshwater resources are in generally good condition with a 0.392 score on the Freshwater Vulnerability Index (FVI), it faces increasing scarcity due to rapid population

growth, economic activities, and ecological degradation (Sanchez et al., 2024). The same study implies that the availability of water is becoming a major economic and human well-being constraint in some of the country's most populated regions—namely, CALABARZON, NCR, and Central Visayas—based on the metrics for freshwater scarcity by Gleick and Cooley (2021). Furthermore, the Philippines is listed among the countries likely to be "water-stressed" come 2040, with its high water stress level score of 3.01 translating to 40% to 80% of the nation's total water supply being withdrawn in next decade and a half (World Resources Institute, 2013, as cited in Baclig, 2022). At the same time, the Philippines is characterized by its abundant rainfall. With an average of twenty tropical cyclones—often referred to simply as "typhoons"—entering the Philippine Area of Responsibility (PAR) annually, the region is visited by more typhoons each year than any other part of the world (PAGASA, 2025). Moreover, the country is identified across several reports as among the countries most at risk of coastal flooding and the possibility of becoming "water worlds" in 2030 due to extreme weather events (Baclig, 2022).

Simply put, the Philippines possesses the unique—albeit unfortunate—quality of being simultaneously water-rich and water-stressed. The duality of the Philippines' water situation manifests itself in several ways across the country. Through face-to-face interviews and focus group discussions (FGDs), Delina et al. (2023) found that floods have been a major contributor to stress in communities residing near the Cotabato River Basin in Mindanao. While the stress is primarily attributed to economic loss due to what the residents described as "year-round flooding," which, in turn, results in the obstruction of agricultural activities and the death of animals in a region recognized as the country's supposed "breadbasket," drought-induced price inflations also emerged as a notable source of stress for Cotabato Basin residents. Many residents recounted how food insecurity in Mindanao has become a catalyst for civil unrest, with price

inflations caused by droughts historically linked to violent protests and other similar conflicts in the already politically volatile region. The link between droughts and social unrest persists even in other regions: Hussain (2021) found that the lack of access to water not only resulted in palpable discontentment among urban poor communities in Metro Manila, but also became the cornerstone for the creation of "water syndicates" and other illegal cooperatives. Extreme weather events—recurrent flooding, in particular—are also associated with major well-being losses and may even result in middle-class households being pushed below the subsistence level (Sauer et al., 2025).

These effects are felt not only in rural areas of the Philippines, but also in highly-urbanized regions like its capital, Metro Manila. Much like the rest of the country, the water crisis in Metro Manila is defined by torrential floods and dry spells brought about by the La Niña and El Niño phenomena, respectively (Rocina, 2023). Of the capital's sixteen cities and one municipality, Malabon, a flood-prone city in the northern part of Metro Manila, provides one of the most interesting case studies for the Philippines' complex water situation. Characterized by its low-lying terrain and its proximity to the Tullahan River and the Malabon-Navotas River, Malabon has been dubbed the Philippines' "Local Venice"—not just due to the frequency of flooding in the city, but also due to the existence of the Artex Compound, a permanently flooded residential area in Barangay Panghulo, Malabon. However, life in flood-prone Malabon is nowhere near as grandiose as it is in the Italian city that inspired its moniker: livelihoods and potable drinking water are scarce in Artex, while the rest of Malabon continues to bear the brunt of regular water shortages and perennial flooding (Suralta, 2022; Linardy & Sepe, 2022). Historically, Malabon's urban resilience has been marred by the national government's neglect and lack of transparency during the martial law period, which snowballed into poor planning, the

misappropriation of funds originally set aside for flood control projects, political insecurity, and the development of a "culture of disaster" wherein environmental threats have become part of daily life (Esteban & Edelenbos, 2023). With Malabon's high social capital, there exists ample potential to explore how water and the city's culture of disaster have shaped its residents' way of life and how they have adapted through independent measures.

Perceptions Toward Rainwater Harvesting

Rainwater Harvesting (RWH), particularly in urban areas, entails the collection, storage, and treatment of rainwater gathered from impermeable surfaces such as rooftops, terraces, courtyards, and the like (de Sá Silva et al. 2021). Collected rainwater can be used domestically for various purposes such as gardening, washing, and toilet flushing. If access to chemical treatments and filtration is available, it may also be used for potable purposes such as for drinking and cooking (Nandi & Gonela, 2022). Adoption of said practices will reduce a household's expenses on water utilities and positively affect their finances, especially in locales where rainfall and flooding is a common occurrence.

Rainwater Harvesting Systems (RWHS) have gained a notable amount of support worldwide for its benefits and accessibility. Countries such as Australia, Brazil, China, and India have made it mandatory to account for a RWHS during the planning stage of cities (García-Ávila, 2023). The European Union's recent Water Resilience Strategy (2025) encourages member states to adopt measures to increase water resilience across the region in response to climate change and increasing water scarcity—part of which is to adopt rainwater harvesting as a way for the construction sector to conserve water. Beyond projects by local governing bodies,

initiatives and collectives have emerged to help tackle the issue, namely the United Nations' International Rainwater Harvesting Alliance (IRHA) and the Global Rainwater Management Program, both working towards sustainable development by encouraging communities to adopt rainwater harvesting systems.

In the Philippines, efforts are being made in the implementation of rainwater catchment systems. In Bonifacio Global City, a 12-meter deep detention tank meant to store floodwater is located beneath Burgos Circle. Floodwater collected this way is released to a creek that flows into the Pasig River, effectively eliminating any risk of the area being flooded (GMA Integrated News, 2024). This project has inspired similar initiatives to be implemented in other urban areas across Metro Manila. The DPWH has considered replicating BGC's flood water collection system, and the Metropolitan Manila Development Authority (MMDA) have developed designs for rainwater catchment systems to be distributed to local government units across Metro Manila. MMDA aims to encourage water-saving measures among said LGUs in preparation for possible water shortages during the El Niño phenomenon with this initiative, and many cities—San Juan and Malabon, among others—are making use of said designs and exploring ways to implement such systems into their own localities (Legaspi, 2024).

Perceptions towards RWHS are generally positive, showing high regard for the practice and recognition of its advantages. Despite this, knowledge and awareness of the practice was found to be lacking. In a study conducted by Snelling et al. (2023), among the 44 collected responses, almost 90% of respondents expressed a positive attitude about RWH, citing its environmental impact as one of the reasons why. Some responses also show hesitation with its adoption, mentioning possible issues that may or have arisen with the practice despite generally positive comments. Prior negative experiences towards RWH may be the reason a small

percentage of the respondents preferred tap water over the use of collected rainwater. A similar survey conducted in Dhaka, Bangladesh found that the respondents were generally open to the implementation of RWH despite a relatively low percentage of awareness among the 256 respondents (Huq et al., 2024). In a survey of 238 households from four provinces in Cagayan Valley, it was found that the respondents were aware of RWH as a practice and prefer it over tap water, but perceived the collected rainwater as strictly non-potable—only to be used for cleaning, washing and watering plants, among others. Said study recommends education of the local community on rainwater management and treatment to maximize its use (Paguigan and Del Rosario, 2020).

Uses and Benefits of Rainwater Harvesting

The benefits of implementing RWHS are not limited to alleviating the inaccessibility to clean, potable water. According to Khan (2023), RWHS has been identified to be more cost-effective than conventional, centralized water sources, though the usage of collected rainwater must be coupled with the government supply line to meet demands for non-potable use. A case study in Jakarta found that their implementation of RWH in a boarding house resulted in a 58% reduction in clean water bills (Gulo & Mustafa, 2025). Another study conducted in native communities in northeastern Peru reported that the costs associated with the installation and upkeep of RWHS were outweighed by savings in foregoing traditional water haulage methods (Rojas et al. 2021). On the other hand, de Sá Silva et al. (2022) emphasized that there exists cases in which RWHS may not be economically viable, with its operational and investment costs possibly serving as a barrier to further development.

Given the Philippines' abundance of water during the rainy season and lack of it during droughts, the nation would stand to greatly benefit from a wide-scale implementation of RWHS. During rainy seasons, RWHS may be able to mitigate floods in urbanized areas by collecting water that would otherwise have been surface runoff. Furthermore, the potential of RWHS to reduce stormwater runoff is greater in areas with higher housing densities. Though highly urbanized areas are more susceptible to flooding, said areas are likely to have more people benefiting from collected rainwater (Custodio & Ghisi, 2023). For example, Malate et al. (2022) found that a building with a 500 sqm roof area can harvest enough rainwater to cover hundreds of toilet flushes during rainy seasons, heavily reducing reliance on piped water, saving a sizable amount of money, while possibly helping mitigate flooding in their communities at the same time.

RWH has also been identified to lower electricity use and greenhouse gas emissions by lessening the demand for energy and resource-intensive water treatment and distribution (de Sá Silva et al. 2021). Collected rainwater could also be used for a myriad of purposes outside of a domestic setting. Some examples include, among many others, crop irrigation, where it can consistently maintain and increase crop production (Islam, 2022), groundwater recharge (Alam et al., 2022), and fire suppression, which—despite needing further research to prove its feasibility in fire departments—is expected to decrease environmental impacts and save money given their heavy use of water (Vaz et al., 2023). Furthermore, the implementation of RWHS may also positively contribute to issues with water scarcity, providing usable water for local urban or rural communities during dry spells, shortages, or in areas without secure groundwater sources. The implementation of RWHS is also found to improve sanitary conditions in said communities, subsequently improving public health (de Sá Silva et al., 2021). Overall, RWH serves as a cost

effective, environmentally friendly, and sustainable option at home, in industries that heavily make use of water, as well as in communities that are battling issues with water quality or scarcity.

Rainwater Harvesting Practices in the Philippines

The implementation of RWHS in the Philippines could be significant in addressing the country's water scarcity and urban flooding problems. As mentioned previously in other sections of this study, a law—RA 6716—was filed to adopt the system throughout the country. However, the actual implementation and public awareness of both this law and the concept of RWHS remain limited.

RA 6716, also known as the Rainwater Collector and Springs Development Act of 1989, mandates the construction of rainwater collection facilities in every barangay across the country. This law was designed to promote alternative water sources and strengthen disaster resilience in local communities; as stated by then-Senator Sonny Angara, rainwater harvesting has been implemented and effective in the countries of India, Malaysia, Thailand and Singapore (Inquirer, 2019). In support of this law, the Department of the Interior and Local Government (DILG) released Memorandum Circular 2017-76, which called on local government units (LGUs) to integrate rainwater harvesting into public infrastructure plans (DILG, 2017).

Despite these legislative measures, actual implementation remains limited to only some notable areas such as Bonifacio Global City and Davao City. More than three decades after RA 6716 was passed, many LGUs have yet to fully comply. A study by Ciriaco et al. (2022) emphasized that while the law provides clear direction, the absence of consistent funding,

monitoring, and technical guidance has hindered progress. Furthermore, public knowledge of the law remains low, especially in marginalized or flood-prone communities. In many cases, residents use rainwater harvesting informally for non-potable purposes, without being aware that such practices are actually supported and encouraged by law.

According to a study by Lumbera et al. (2023), the Philippines receives substantial rainfall annually, yet water scarcity remains a threat due to poor utilization of this natural resource. The study found that the key barriers to rainwater harvesting include the lack of national design standards, limited data, low public awareness, and weak consideration of social and economic factors. The study recommended public education campaigns to raise awareness, provision of subsidies, tax incentives for private sector participation, and stricter enforcement and updating of RA 6716—also emphasizing the potential use of Global Information System (GIS)-based tools to improve planning and implementation.

Nevertheless, some parts of the country make small steps towards the implementation of rainwater collection systems. This takes the form of initiatives by private companies such as Maynilad's donation of rainwater collection facilities to the cities of Malabon, Manila, Pasay, Bacoor, and the municipalities of Teresa and Morong in Rizal (Maynilad, 2024) and the construction of a rainwater harvesting system in Brgy. Potrero, Malabon City—an initiative of the barangay government and the City Environment and Natural Resources Office (CENRO). The system collects and filters rainwater from rooftops for non-potable uses such as watering plants and maintaining green spaces. It serves as a proactive response to the El Niño threat while also promoting environmental sustainability, reducing pressure on the city's water supply, and lowering costs for residents (Lim, 2024). These efforts indicate that proper funding and LGU-led

implementation supported by public-private partnerships are significant in the efficacy of implementing RA 6716.

Theoretical Framework Underpinning the Study

To better understand the factors influencing the awareness, motivations, and community practices related to RWHS, this study draws upon two theoretical perspectives: Ajzen's Theory of Planned Behavior (TPB) and Rogers' Diffusion of Innovation (DOI) Theory.

This study is primarily grounded in the TPB, developed by Icek Ajzen (1991). TPB is a psychological theory that explains how individuals come to perform certain behaviors based on their intentions, which are influenced by three core components: *attitude*, *subjective norms*, and *perceived behavioral control*.

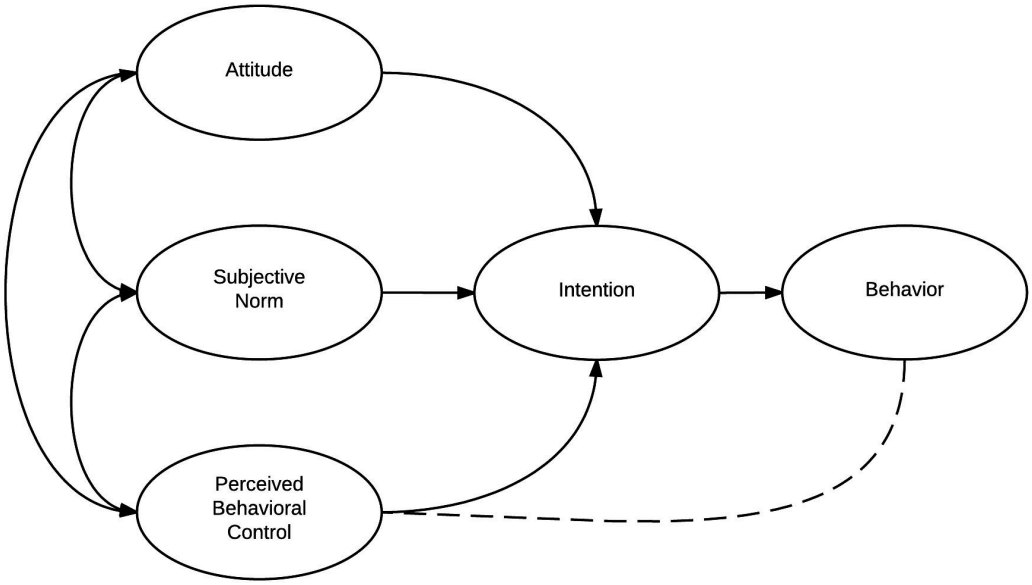

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Figure 1. Components and Flow of the Theory of Planned Behavior

In the context of this study, the TPB provides a filtered set of reasons for understanding why individuals residing in Malabon may decide to adopt or reject RWHS, even in the face of financial benefits, environmental challenges, and the legal mandate of RA 6716, etc. by looking at a resident's motivations, pressures, and limitations affecting RWHS adoption. Hence, the application of its core components to the research questions is as follows:

First, *attitude* toward the behavior is referred to how residents evaluate RWHS, whether they perceive it as beneficial or not. This includes their views on its practical use in everyday life, its cost-effectiveness, and its perceived ability to address weather-related problems such as flooding and droughts. Thus, a positive *attitude* toward RWHS may increase their intention to adopt it, while skepticism or unfamiliarity may reduce it.

Second, *subjective norms* consider the social influences that may impact a resident's decision to adopt RWHS. These include existing traditions within the family, neighbors, and the actions of local leaders, and government institutions. This also ties into the current water sourcing practices that are often seen as the standard, such as relying solely on piped water from paid services, which can discourage residents from considering alternatives.

Lastly, *perceived behavioral control* addresses whether individuals feel capable of installing and maintaining RWHS, regardless of their intentions. This includes their confidence in having the time, technical skills, and resources necessary to carry out the behavior. A lack of perceived control, even in the presence of positive attitudes and supportive social norms, may still hinder adoption.

While TPB focuses on individual decision-making, it also leaves room to observe how collective behaviors emerge from a sum of personal intentions. Hence, the application of DOI, a theory that complements TPB's individualistic nature by looking at the social aspect of the study.

DOI Theory, developed by Everett M. Rogers (1962), serves as a supplementary framework for the study. This foundational theory provides a framework for understanding the process by which new ideas or practices, termed 'innovations', are communicated and adopted within a social system. The core premise is that for an innovation to be adopted, individuals must perceive it as novel and a departure from old behaviors.

At its core, the DOI Theory assumes that the diffusion process is influenced by four core elements: the (1) *innovation* itself, referring to the new idea being diffused; (2) *communication channels*, which are the various means by which information about the innovation is transmitted; (3) *time*, representing the speed and rate of adoption; and the (4) *social system*, which is the group of interconnected units among whom the innovation spreads. Together, these elements describe the dynamic environment and pathway through which new ideas gain acceptance within a community (Rogers, 1962).

Additionally, Meyers (2004) and Rogers (2003) identified five perceived attributes of an innovation that significantly influence its rate of diffusion, as these characteristics collectively shape how potential adopters view and respond to the innovation. These include: (1) *relative advantage*, the degree to which an innovation is seen as better than existing alternatives; (2) *compatibility*, its consistency with prevailing values and experiences; (3) *complexity*, the perceived difficulty in understanding or using it; (4) *trialability*, the ability to experiment with it on a limited basis; and (5) *observability*, the visibility of its results to others.

This framework is crucial for the study as it provides a lens for analyzing why RWHS have not been widely adopted in Malabon City at a community level. The application of its concepts to the research questions is as follows:

First, the area of application concerns how the DOI framework informs the analysis of residents' knowledge about RWHS and RA 6716 since its implementation since 1989, particularly through its *communication channels* and *time*, which helps understand how information has disseminated within the communities over the years.

Second, the investigation into what motivates individuals to adopt or ignore RWHS is informed by the five perceived attributes of innovation namely: *relative advantage*, *compatibility*, *triability*, *observability,* and *complexity*. These attributes help the research in understanding what drives or hinders residents in implementing RWHS, and how perceptions of RWHS in their environment relate to these characteristics.

The final application focuses on analyzing existing RWHS initiatives and practices at both resident and LGU levels to understand the dynamics of the *social system*. This helps examine how community initiatives and institutional support shape the acceptance or dismissal of RWHS, and how the absence of visible social modeling may hinder its integration into local norms.

Overall, these theories offer a comprehensive lens through which the awareness, perceptions, and community practices surrounding rainwater harvesting in Malabon City can be systematically understood and analyzed.

CHAPTER 3 - METHODOLOGY

This chapter outlines the data gathering methods and analysis procedures that the study employed in its exploration of the awareness, perceptions, and practices related to RWHS in selected barangays in Malabon City.

Research Design

The study adopted a qualitative research design, aiming to gather in-depth insights on lived experiences, community perceptions, and local practices surrounding RWHS among residents in selected barangays in Malabon. By utilizing a qualitative research design, the study examined the Malabon residents' awareness, perceptions, experiences, motivations, and contextual factors related to RWHS. According to Tenny et.al. (2022), utilizing a qualitative research design allows for the study to investigate the themes and patterns of human behaviors that quantitative research would not be able to gather.

The study employed a combination of two qualitative research methods: semi-structured interviews and document analysis. Open-ended, semi-structured interviews with residents sought to gather personal narratives that show the sociopolitical factors influencing the implementation and adoption of RWHS. To contextualize the interview findings, a document analysis of relevant government-issued materials and other related documents was conducted to examine how RWHS is implemented at the barangay and city levels. Reviewing these documents helped identify both gaps and alignments between patterns that emerged from the residents' lived experiences and the local government's documented initiatives.

Research Setting and Participants

This study focused on the residents of Malabon City, the demographic most suited to supply relevant insights to the study's inquiry into RWH-related awareness, perceptions, and practices in selected barangays in Malabon.

The proponents utilized purposive sampling to select participants who met specific criteria relevant to the study. Eligible participants were 20 to 60 years old and currently residing in Malabon City. This selection intended to provide the study with a well-rounded and context-specific understanding of RWH within Malabon City. Following initial interviews, the proponents utilized snowball sampling, where participants recommended other qualified individuals within their community or network.

A total of eight (8) residents from three (3) different barangays participated in the study. Due to the limitations imposed by the select number of barangays encompassed by the study, the results cannot be considered representative of the population of Malabon and its 21 barangays. Lastly, the study's findings are shaped by the availability and willingness of participants, which, similarly, may introduce limitations in representativeness.

Data Collection Methods

The study primarily gathered data through onsite and online semi-structured interviews with residents from selected barangays in Malabon City. Onsite interviews were conducted at the participants' preferred location, both inside and outside of their respective barangays in Malabon, whereas the online interviews were conducted through the virtual meeting platform *Zoom*.

These interviews centered on Malabon residents' lived experiences. As such, the semi-structured interview questionnaire was separated into three main sections: the first section focused on the participants' awareness of RWH; the second section shifted its focus towards the participants' perspectives on the adoption and implementation of RWHS and related practices in their respective communities; and the third and last section focused primarily on participants' current practices in relation to rainwater collection. Through such inquiries, the results of the semi-structured interviews were able to supply the study with relevant insights into how both individual and collective experiences shape the adoption, or lack thereof, of RWHS in Malabon City, particularly in the context of ongoing climate vulnerabilities. The information gathered was instrumental in identifying existing gaps in knowledge, implementation, and support systems at both the household and barangay levels. All interviews were recorded with the participants' informed consent. To ensure accuracy and depth of analysis, interviews were manually transcribed. The verified transcriptions were then used for thematic analysis.

The study also employed document analysis as a secondary method of data collection. This method is typically employed alongside other qualitative research methods as a means of corroborating and converging information (Bowen, 2009). It was used in this exact manner throughout the study. Publicly available documents—including local ordinances, social media announcements from government-managed accounts, press releases, and other relevant materials—were thoroughly examined to assess the formal presence of RWHS and the effectivity of related policies in the city. This method allowed for the triangulation of findings from the semi-structured interviews by comparing official communications with the lived realities of the residents.

The research focused exclusively on the community-level understanding, attitudes, and practices surrounding rainwater harvesting systems in Malabon City. It did not aim to evaluate the technical performance or engineering specifications of existing RWHS infrastructure. It also did not cover other water management systems unrelated to rainwater collection, nor did it quantitatively assess the cost-efficiency or hydrological impact of RWHS. While the findings may offer insights applicable to other urban flood-prone areas, they may not be generalizable to rural communities or other regions with significantly different socio-political and environmental contexts.

Data Analysis Procedures

A thematic analysis was employed to identify recurring patterns and key insights related to awareness, perceptions, and practices surrounding RWHS in selected barangays in Malabon City. In this approach, coding—generally understood as the process of labelling or organizing data based on thematic similarities—was both *deductive* and *inductive*. Deductive coding (theory-driven) is guided by predetermined concepts drawn from the existing literature, whereas inductive coding (data-driven) involves new themes emerging organically from the participants' responses, allowing for the discovery of unanticipated insights unique to the participants' lived experiences and the context of Malabon City (Braun & Clarke, 2013, as cited in Bryne, 2022).

In conducting the document analysis, the researchers followed the three-step process of skimming (superficial examination), reading (thorough examination), and interpretation (Bowen, 2009). Throughout this iterative process, the researchers sought to evaluate the following: (1) the relevance of the documents to the topic of the study, (2) the credibility of the materials and its

authors, (3) the original purpose of the documents, and (4) the implications of the information contained therein. With the mentioned considerations, the documents were interpreted and, in turn, produced empirical knowledge that could be cross-referenced with the residents' narratives.

Ultimately, using thematic and document analysis in concert with one another allowed for a deeper understanding of the implementation of RWHS in selected barangays in Malabon—an understanding that is grounded in both experiential and structural evidence.

Ethical Considerations

Informed consent was sought from all participants before the data collection procedure began; they were provided with a briefer on the scope of the study, a digital copy of the interview questions, and a consent form prior to data collection, all of which were assessed by the research adviser to be in alignment with the study's objectives. Only upon gaining the participants' explicit consent via the above-mentioned form did the researchers commence data collection. Furthermore, participation in the study was entirely voluntary, with individuals free to withdraw at any point during the process without consequence. All collected data was then stored securely.

CHAPTER 4 - DISCUSSION AND CONCLUSION

This chapter discusses the study's findings in regards to the awareness, perceptions, and community practices related to RWHS in selected barangays of Malabon City. Its findings are based on semi-structured interviews conducted with residents from the selected barangays of Longos, San Agustin, and Concepcion, with analyses of public documents containing relevant insights acting as supplemental sources of information. While not indicated in the study's sampling criteria, the three barangays wherein the respondents reside are all considered "highly susceptible to floods" per the Malabon City Development Plan from 2014 to 2016, supplying the study with rich insights from lived experiences related to flooding and water management.

For a more thorough understanding of the adoption of RWHS in the selected barangays, the information was interpreted using Ajzen's Theory of Planned Behavior (TPB) and Rogers' Diffusion of Innovation (DOI) Theory.

I. Residents' Awareness and Understanding of RWHS

Terminological Unfamiliarity of "RWHS"

While all respondents demonstrated a general understanding of the idea of collecting rainwater for non-potable household uses, there was also a notable unfamiliarity with the term "Rainwater Harvesting System" itself. Several respondents only recognized the practice once it was described to them. As Respondent 1 shared, *"Actually yes, pero 'di ko alam ganon pala 'yung tawag."* Even those whose households had previously collected rainwater admitted they did not associate it with a formal system. Respondent 2, a resident who had previously learned

about rainwater collection from their grandma during childhood, initially responded with, *"To be honest, I'm not knowledgeable about that."* Similarly, Respondent 5 mentioned that their household had practiced rainwater collection in the past but were unfamiliar with the concept being referred to as a formal "system." This confusion around the term was evident even before conducting the interviews, with a few respondents asking for further clarification after reading the research's project brief.

Unawareness of RWHS as a Nationwide Mandate (RA 6716)

A significant finding from the interviews is the respondents' near-total unawareness of Republic Act No. 6716 or the Rainwater Collector and Springs Development Act of 1989. Out of the eight respondents, seven had no prior knowledge of the law, with some even stating that it was their first time hearing about it during the interview itself. Respondent 7 even emphasized never having come across any coverage of it, noting, *"Kasi wala pa naman silang pinababalita eh…"* Among the eight respondents, no one mentioned having heard or observed any barangay or city-level initiatives to promote or implement this law.

Rainwater Collection Knowledge Rooted in Old Practices

Among the eight respondents, five were able to recall rainwater collection as traditions influenced by older members of the community. These practices were as simple as using drums and buckets to be placed outside during rainfalls. Respondent 1 recalled this practice, stating, "*Way back siguro mga 2019, may gumagawa pa niyan. Ang ginagawa nila 'pag umuulan, naglalabas na (...) 'yung mga old people doon sa amin ng drum, ta's nilalagay nila doon sa labas para maka-collect ng water."* Respondent 7, who practices RWH and has been residing in

Malabon since the 80s, even shared, *"Sa school namin non, sa elementary pa lang at 'saka sa high school [tinuturo na sa amin] kung paano mag-conserve ng water."*

Additionally, two respondents credited these practices to the influence of older family members. Respondent 2 explained, "*One time [I asked], 'Lola para saan po ba 'yon? Bakit ka nag-iipon?'... So sabi niya sa akin, 'apo, malaking tulong 'yung tubig ulan.'"* Similarly, Respondent 7 noted, *"...'yung tita ko, ah, bale sa kanya kasi ako natuto eh."* Despite this generational influence, three out of the five respondents who recall these traditions no longer adopt RWHS in their own households due to external reasons over time such as a lack of motivation and the increased cost of materials.

II. Residents' Perceptions of the Implementation of RWHS

Motivations and Perceived Benefits of RWHS

The implementation of RWHS was viewed by the respondents in a significantly positive light. Through the thematic analysis of their responses, four potential motivations emerged. In line with Roger's DOI Theory, specifically the attribute of Relative Advantage, these insights show that implementing RWHS is a better practice than simply fixing the roads or cleaning the drainage systems. These perceived benefits enhance the system's likelihood of adoption especially as it is clearly perceived to be beneficial in the residents' daily living.

a. **Flood Mitigation**

A recurring perception among respondents was the role of RWHS to reduce flooding. Most respondents expressed that harvesting rainwater would help in minimizing

the flood by storing rainwater that would otherwise flow into the streets and drainage systems. As emphasized by Respondent 3, *"Kasi, kumbaga, 'di na ako nagdadagdag ng tubig na tinatapon sa kalsada. But it's not enough. It's not enough. But at least it helps. (...) Again, it should be a process, it's not just one person. 'Pag marami kami, maaari. Maaaring mabawasan ang baha."* The sentiment of having RWH as a practice that would be of significant impact once practiced collectively was echoed among most of the respondents. The practice and implementation of RWHS is viewed not just as a personal benefit, but also as a community-oriented solution.

This supports already existing literature which indicates the potential for flood mitigation, particularly in urban areas, through the implementation of RWHS via stormwater runoff reduction (Custodio & Ghisi, 2023; de Sá Silva et al., 2022).

b. **Emergency use**

Respondents have also highlighted the value in having stored rainwater in times of water scarcity, which has been found to be a common issue among Malabon residents. Respondent 6 shared, *"...Siguro malaki yung magiging benefit sa amin ng rainwater harvesting system tuwing may water interruptions during dry season."* Having an emergency supply of water during particularly critical periods will, to an extent, ensure that they are still able to go through the motions of daily life without difficulty.

Multiple respondents have also mentioned the efforts LGUs have undertaken to tackle interruptions, such as supplying water via large trucks or distributing water via a rotational system. Despite this, residents still feel the stress of having a limited water supply, and some respondents recounted times in which collected water was used to make

up for government efforts that were seen to be lacking, evident in Respondent 1's account: *"Parang nagre-ready na ['yung mga kapit-bahay] para [...] mag-imbak ng water kasi limited lang ['yung] binibigay ni city hall."*

Community use was also a benefit some respondents mentioned during times of drought, interruption, or emergency. While discussing a RWHS one of their neighbors once had, Respondent 1 shared: *"...ang nangyayari doon sa* community *namin, kung sino may imbak, naghihingian lang sila ng* water." This highlights that—like its benefits towards flood mitigation—the implementation of RWH has the potential to be a solution that can help entire communities become more resilient when faced with the seemingly perennial problem of water scarcity.

c. **Cost-effectiveness**

Another perceived benefit that emerged was the potential for cost reduction upon adopting RWHS. All the respondents acknowledged that the implementation of RWHS could significantly help reduce their monthly water bills, hence, easing the burden of household expenses. By repurposing the collected rainwater for cleaning, gardening, and other non-potable uses, the household's water bill is reduced. Respondent 1 reflected on their household's water bill, *"...'Yung water bill namin is [umaabot] siya ng 2k [pesos]. Before, siguro no'ng way back, [...]nasa 900 pesos 'e. May nag iimbak kasi no'n dati—'yung si papa ko."* The significant difference in their water bill from when they were practicing rainwater harvesting to now having none shows a drastic increase in water bills.

In addition, although adopting RWHS requires some initial investment for materials and installment labor, the resulting long-term savings were emphasized as being worth more than the initial cost. Respondent 3, who has been maintaining their own RWHS for 10 years, estimated the annual maintenance cost, *"Kung kasama labor, isang tao, one person… based on our economic… ang labor is around 700 pesos, let's say 700 pesos. Pintura, 300 pesos. Isang libo, maintenance. Gano'n lang kamura siya."* They emphasized that, while the installation and maintenance of RWHS requires a specific cost, when the bill comes, it would show that they managed to save more than they spent.

This aligns with findings from previous studies that highlight the cost-effectiveness of RWHS over centralized water sources, emphasize its potential to reduce water bills, and indicate that the long-term savings typically outweighing the initial investment cost (Khan, 2023; Gulo & Mustafa, 2025; Rojas et al., 2021).

d. **Social influence**

Most of the respondents viewed that peer influence and visibility of successful adoption has a significant role in their perception towards the implementation of RWHS. Seeing neighbors successfully implementing RWHS would help demonstrate its effectiveness and worth. As Respondent 8 expressed, *"If ever maging successful man 'yung [neighbors] namin na gawin 'yung rainwater system na 'to, I think magiging curious kami as a family and 'yung other neighbors namin, and siguro matatry din namin."*

Social media was also brought up as a way where the visibility of RWHS affected the respondents' perception of it. As shared by Respondent 7, *"At saka sa iba rin, siguro*

malaki rin tulong sa kanila pero hindi ko rin kasi nakikita sa social media. 'Yung iba kasi, nagpo-post ng ganun eh. Iilan lang siguro ang nag-a-apply ng ganyan." When people are exposed to other people successfully adopting RWHS or by simply seeing it online, they could see the system as advantageous, hence, reducing their uncertainty to adopt RWHS.

Perceived Challenges of Implementing RWHS

The respondents have also recounted factors that may discourage, impede, or even prevent the implementation of RWHS in their households. Through the lens of the DOI Theory, while said systems' relative advantage is perceived to be high, attributes such as compatibility, trialability, and complexity—if found to be lacking or unfavorable—may contribute to the respondents' hesitancy with its implementation.

a. **Environment**

A number of the accounts state their homes being in close proximity to one another, with limited space to house large reservoir tanks or drums. Said tanks may also be an inconvenience towards neighbors and passersby with the little walking space some neighborhoods reportedly have. Many have also doubted the safety of the collected rainwater considering the cleanliness of their residential environment, especially when it comes to its consumption. As shared by Respondent 7, "*...kasi hindi natin maiwasan 'yung may mga alaga nating hayop, (...) minsan nagdudumian sa taas ng bubong.*"

While residents agree that on a general level, solutions like RWHS do fit with the typical life of a Malabon resident, the aforementioned concerns may stand in the way for

it to be fully compatible with some residents' living conditions. This, in turn, may be a possible reason for its low adoption despite acknowledgment of its benefits.

b. **Inaccessibility**

Another major concern shared by nearly all respondents is the cost of installing RWHS in their homes, which is perceived to be expensive and unaffordable. Although they recognize that such systems may reduce water bills and will eventually offset implementation costs, residents may still not be able to afford the short term financial investment that is required of it. Respondents also shared that they may not have a concrete understanding of which materials are needed and where to purchase them. Furthermore, these materials may have become less common over time, as per Respondent 1's account, *"'yung blue drum, dati kasi, marami nagbebenta no'n eh, ngayon, (...) di ko na nakikita 'yung mga blue drum."* Trialability is limited as residents do not have the chance to properly explore RWH or similar systems before fully committing to it, given perceived costs and difficulties acquiring materials.

c. **Complexity**

Some accounts also mention the manual labor that comes with installation and upkeep, which may also be a demotivating factor among residents. Lack of information regarding RWHS was also found to be a factor, contributing to its perceived complexity. Respondent 5 expresses their community's likely willingness to adapt RWHS, as long as the information conveyed to them is correct, and that it is introduced to them properly. This goes to show that the respondents are generally open to its implementation, but feel as though information related to and promoting RWHS is lacking. As of now, the labor

required to implement said systems and the perceived lack of accessible information may instill among residents the idea that the practice is complex, leaving them unsure of where to start.

III. Current Practices in RWH in Selected Barangays in Malabon

Scarce Implementation of RWHS

The implementation of RWHS and the practice of RWH in general in Malabon is considered rare. Out of eight respondents, none observed the presence of a government-owned and maintained RWHS within their respective barangays. *"To be honest, wala akong idea. Pero kasi, upon observation, wala akong nakikita,"* Respondent 2 admitted.

These observations can be supported by a comprehensive review of publicly available documents, primarily the Malabon City Government's *Facebook* page. Although not a formal policy document, the page serves as the local government's main communication channel and is the only source that offers reliable insights into the visibility of RWHS-related initiatives in Malabon. Its posts reveal a limited rollout of RWHS units—only four in total, to be specific—and little evidence of sustained public engagement and government initiatives beyond one-time installations. Included in the limited rollout is the RWHS unit in Barangay Potrero, donated by Maynilad Water Services Inc., the primary water concessionaire for Malabon, in July of 2023, which marked the city's first government-owned and maintained RWHS unit. The other three RWHS units in Longos, Hulong Duhat, and Catmon are all recent additions, having only been installed in late February 2025.

Outside of a lack of government-led efforts, residents with at-home RWHS are also perceived to be uncommon. Of the study's eight respondents, only three have continued to practice RWH at present. Furthermore, six respondents—including the three who practiced RWH themselves—emphasized the scarcity of residents who practiced RWH independently. Both Respondent 2 and Respondent 4 used the Filipino word *"bihira"* to describe such residents. Respondent 3, who has been harvesting rainwater for 10 years, mentioned that they didn't know anyone other than themself who practiced RWH. They further expressed that community efforts related to the promotion and practice of RWH are practically non-existent: *"Right now, wala talaga. Even [the] information campaign is very very weak."*

Outside of RWHS, the respondents mentioned their engagement with other community practices. Most prominent among the study's respondents is strict waste management. While Respondent 6 mentioned doing this in compliance with Malabon's local ordinances, others appeared to have already grown accustomed to segregating their waste even without the local government's influence. Respondent 5 explained that their family did not carelessly dispose of trash, as they understood that it was the main cause of the flooding in their area. Respondent 7 had a similar mindset, *"Before kasi, aware na ako, lalong-lalo na sa kalikasan natin. (...) Naiiwasan 'yung mga basurang kinakalat natin araw-araw sa pagse-segregate ng garbage [at] yung mga [recyclables]."*

Other residents, like Respondent 4 and their neighbors, also practiced routine cleaning of the canals and roads in their area. Without this routine cleaning, Respondent 4 claimed that the floodwaters would reach their house.

Current LGU Initiatives

While RWHS appears to be scarcely implemented in selected barangays of Malabon, other projects exist in its absence. All but one respondent agreed that their respective LGUs have implemented initiatives to control the water situation in Malabon, with the one outlier believing it to be out of the local government's control due to the city's inherent geographical vulnerabilities. There are four main initiatives mentioned by the study's respondents:

a. **Elevating roads**

Mentioned by three out of seven respondents who acknowledged local government efforts to reduce flooding in Malabon, projects to elevate the roads in the city happen relatively frequently. Because Malabon is a topographically low-lying area, elevating the roads is seen as a means to lift the city above the expected flood level, preventing it from being submerged. Respondent 6 recounted, *"Kasi mababa po 'yung Malabon, so ang pinaka napansin ko po na nangyari is 'yung tinataas na po 'yung roads around the city, so 'yun po 'yung isa sa napansin ko na— na mas nakapag decrease ng chance ng higher floods."*

While two respondents, Respondent 6 and Respondent 8, viewed the elevation of roads in Malabon in a positive light, one respondent, Respondent 2, believed these efforts to be short-term solutions with potential long-term consequences. Respondent 2 explained that these projects typically only elevate the roads and do not take into account the houses surrounding them. They expounded that, without the proper implementation of drainage systems, the stormwater runoff from the elevated roads instead flows to the houses around the roads with lower elevation, therefore exacerbating the flooding. *"Ang*

na-notice ko kasi as a Malabon resident 'no, kapag nagtaas ang kalsada, dapat ang mga bahayan din magtaas. Kasi, ang tubig walang tatakbuhan, sa bahay mo. 'Yun 'yung nano-notice ko."

b. **Clean-up and declogging drives**

Respondent 2 and Respondent 7 recounted the reoccurrence of "clean-up drives" conducted by the local government in their barangays. According to the respondents, clean-up drives typically include declogging of the canals and similar drainage systems around the city. Furthermore, these drives happen regularly in preparation for the rainy season as a flood prevention measure. Respondent 7 explained, *"So bago magtag-ulan, ginagawa nila, pumupunta sila dito sa lugar namin, binubuksan 'yung manhole. Bale 'yung kanal, tinatanggal 'yung [basura], para 'pag magtag-ulan naman, hindi siya babaha."*

c. **Waste segregation and management schemes**

Respondent 6 mentioned the implementation of waste segregation schemes by the local government to avoid clogging of canals, which, in turn, frees up the city's waterways for stormwater runoff during the rainy season. This is corroborated by Malabon's enforcement of City Ordinance No. 14-2011 and Ordinance No. 27-2020. The former is the Malabon Anti-Littering Ordinance, which apprehends both residents and non-residents found guilty of improper waste disposal within the city, whereas the latter is Malabon's Ordinance on Proper Segregation, which is carried out in accordance with Republic Act No. 9003 or the Philippine Ecological Solid Waste Management Act of 2000 and its Implementing Rules and Regulations (IRR).

While copies of the above-mentioned city ordinances are not readily available for review, both are cited in the public copy of the main document for the 25-Year Metro Manila Solid Waste Management (SWM) Plan by the Metropolitan Manila Development Authority (MMDA) published in March of 2022. According to the document, guidelines for implementation in Malabon include but are not limited to "segregation of waste into biodegradable, non-biodegradable residual or non-biodegradable recyclables," "domestic non-biodegradable recyclables shall not be collected by the City dump trucks," and "for residential units with five (5) or more lessees, the owner of the unit is required to provide proper garbage storage area for the segregated wastes." Furthermore, per an October 2024 report from the Philippine Information Agency (PIA), violators of City Ordinance No. 14-2011 may be charged up to ₱3,000 in fines and may even cost business owners their permits for repeated offenses. In the same report, the Malabon LGU allegedly apprehended 371 individuals caught disposing of trash in public spaces and waterways in 2024. The implementation of these regulations aims to instill residents with a sense of discipline, particularly in regards to their role in preventing flood-related hazards through proper waste management.

d. **Pumping stations**

Respondent 4 acknowledged the important role of pumping stations—facilities that move water from one place to another—in reducing the effects of flooding in Malabon. Pumping stations are designed to drain floodwater from low-lying localities and discharge it into the city's surrounding river systems. As of May 2025, Malabon has at least 48 fully operational pumping stations and 120 floodgates (Eguia, 2025).

According to the 2018 Malabon Annual Report, around half of the city's pumping stations are managed by the local government, whereas the remaining pumping stations are managed by national agencies like the Department of Public Works and Highways (DPWH) or the MMDA. The document states that the local government, in coordination with the DPWH and MMDA, "continues to implement projects that would help minimize if not totally eradicate the flooding occurrences in Malabon. Flood control facilities such as pumping stations and flood gates are maintained." This cements the construction, repair, and maintenance of pumping stations across Malabon as a cornerstone of the city's flood mitigation efforts.

Perceived Lack of LGU Initiatives

None of the study's eight respondents noted seeing any government-maintained RWHS in their barangays nor did they know of any initiatives by their respective LGUs to install RWHS units or encourage similar practices to RWH. Although seven respondents acknowledged the existence of the local government's efforts to reduce the occurrence of flooding in Malabon, the same seven respondents believed that the LGU is still lacking in initiatives or that the ones currently being implemented are ineffective. When asked if they believed the Malabon LGU's initiatives to be lacking, Respondent 8 admitted, *"I think oo, kasi sobrang tagal nang problem ng baha sa Malabon and (...) tinawag na ngang "Malubog" 'yung lugar namin kasi every time na umuulan, baha dito and nagcacancel lagi ng classes dahil nga lang sa onting baha, gano'n. So, I think wala nagagawa masyado 'yung government dito."*

a. **Lack of effective strategies**

Two respondents communicated a desire for the local government to conduct a more proactive investigation into the root cause of Malabon's flood problem, pushing for the implementation of more effective long-term strategies rather than short-term solutions. Respondent 1 mentioned their dissatisfaction with the local government's inaction and lack of proper strategy development, stating, *"Actually, kahit paglinis ng mga kanal wala na rin akong nakikita. So hindi nila alam or hindi nila inaalam paano ba nagkakaroon ng baha."*

Respondent 2, who lived in a neighboring barangay, shared similar sentiments, *"Ang thinking lagi ng mga Pilipino, [mga] government workers, is i-clean 'yung mga drainage, 'yung mga kanal. But, hindi kasi nila ina-analyze properly kung ano ba 'yung nagiging cause. It's not all about the clogging lang 'e, 'di ba."* They continued, *"Magkaroon sila (...) ng (...) investigation, analyze kung ano 'yung mga nagiging cause and effects kasi sometimes, taas lang sila nang taas ng mga kalsada, pero 'yung kanal, mababa, (...) kumikitid lang siya. (...) So dapat, check din nila kung ano 'yung magiging prevention nung mga 'yon. Gano'n lang."*

Meanwhile, Respondent 3 urged the local government to rethink its current waste management strategies, particularly in regards to plastic: *"In Malabon, (...) 'yung mga department stores 'dun, 'yung mga tindahan 'dun, are only allowed (...) to use paper bags on Fridays. Not every day. Just on Friday. But why's it not every day? (...) 'Yung paper bag system kasi, I don't think it works. 'Yun ang napansin ko."* The "paper bag system" referred to by Respondent 3 is part of Malabon's "Plastic-Free Days" every Friday, as required by City Ordinance No. 01-2013. Much like Malabon's other local ordinances, a copy of the document itself cannot be obtained via their official website or

any other public sources. However, secondary sources mentioning the ordinance remain accessible. According to Melican (2013), beyond imposing a paper bag only rule on Fridays, Ordinance No. 01-2013 also bars businesses from using plastic packaging—with the exception of wet goods' primary packaging—and the improper disposal of plastic waste. The ordinance was reportedly enacted as a result of the flooding caused by plastic-clogged drainage systems. Despite this, Malabon has yet to impose a complete ban on plastic similar in nature to Muntinlupa's Ordinance No. 10-109 (2010) or Quezon City's Ordinance No. SP-2868 (2019); at present, Malabon's imposition of plastic-specific restrictions is limited to the above-mentioned policies and their plastic-free Fridays.

b. **Lack of government support**

Several respondents conveyed the need for more extensive support from the LGU in addressing Malabon's persistent flood problem, particularly in the form of relief aid, materials, and programs that could make residents more self-sufficient in the face of calamities.

One respondent mentioned the inaccessibility of clean drinking water due to flooding. Seven out of eight respondents admitted to frequently encountering issues with water, particularly during the dry seasons when access to water is limited in Malabon. However, according to Respondent 3, water interruptions also occur during the rainy season: *"'Pag sobrang daming tubig, sobrang laki ng baha, wala rin pong tubig na lumalabas sa gripo namin (...) because of contamination, because of the baha."* This account is corroborated by several public announcements by Maynilad. In three separate

reports from August 2018, October 2018, and November 2020 published on Maynilad's official website, the water concessionaire cited the high turbidity of the raw water in Ipo Dam as the reason behind water interruptions in Malabon and other affected areas. Turbidity refers to the murkiness of water, and a high level of turbidity in Ipo Dam can be attributed to sediments being stirred into the water by strong rain brought by the southwest monsoon (Maynilad, 2018). Respondent 3 wished for more consistent support from the local government during these interruptions: *"Although I have heard of fire trucks going around and distributing to certain areas (...) 'pag walang tubig talaga. But it's not a regular thing. And (....) in my area, sa barangay ko, wala kaming natatanggap."*

On the other hand, Respondent 5 wished for more programs and initiatives to educate the public about flood prevention measures, including RWH. Similarly, Respondent 6 hoped for more support during water interruptions in the form of both aid and materials for water collection: *"So, I think 'yung sana nakapagprovide sila ng water for the families in the area. Or, ano sana, if nagkaroon ng chance [na] may own water tanks kami sa bahay namin."*

IV. Conclusion of Findings

The Philippines is vulnerable to water-related challenges, including water scarcity during droughts and severe flooding during rainy seasons. RA 6716 has long mandated the establishment of RWHS in every barangay. Yet, decades later, most Filipinos remain unaware of this law, and RWH remains a rare practice. To better understand this gap, the study explored the awareness, perceptions, and practices surrounding RWHS among residents in Malabon City utilizing Ajzen's (1991) TPB and Rogers' (1962) DOI Theory.

Through interviews with eight respondents from the barangays of Concepcion, Longos, and San Agustin in Malabon City, the findings revealed that many are indeed familiar with the general practice of collecting rainwater for non-potable use. However, the formal term "Rainwater Harvesting Systems" was unfamiliar amongst the respondents, with even less knowledge of its legal mandate under RA 6716, as all reported having no observation to any community programs or local policies that promoted or helped raise awareness regarding RWHS. This highlights a gap in *communication channel* and *time*, two of DOI's four core elements, as institutional information on RWHS has not effectively reached residents over time despite the law's existence since 1989. Many respondents commented that if it became more visible among peers or online, it would help generate curiosity in the community.

Notably, a few respondents cited their understanding of RWH and its effectiveness from family members and schools during their childhood, as it was once practiced and encouraged by older members of the community, pointing to the role of TPB's *subjective Norm*. However, while rainwater collection was once a common household practice, a few respondents observed it is no longer widely adopted today largely due to shifting circumstances over time such as a lack of motivation and the increased cost of materials, leaving little to no social norms in today's time.

As for the Innovation itself, a core element of DOI, Meyer's (2004) and Rogers' (2003) five perceived attributes help define the residents' perceptions of RWHS. Starting off with (1) *relative advantage*, all of the respondents perceived RWHS to be a useful and practical system with many sharing their beliefs in its importance during water interruptions, in lowering water bills, and its potential to reduce flooding in Malabon City. However, these positive perceptions were ultimately constrained by various concerns regarding feasibility. For (2) *compatibility,* many shared that RWHS may not suit urban living conditions, especially given the limited space

available in their homes. Additionally, respondents expressed their concerns in the inaccessibility and high cost of materials, limiting (3) *trialability* before fully committing to a full adoption. As previously mentioned, (4) *observability* remains low in community members successfully adopting RWHS, affecting their interest in the innovation. Lastly, (5) *complexity* was noted by a few respondents who were unfamiliar with the system and believed it might require technical knowledge or labor to install RWHS. Moreover, their positive perception of RWHS reflects TPB's *Attitude*, supporting intentions to adopt the system; though this is limited by *perceived behavioral control*, given the constraints already discussed, and *subjective norms*, due to the continued absence of social reinforcement within the community today.

In the case of current practices, on top of the perceived absence of any RWHS units in their barangays, majority of respondents have noted that they still continue to rely on Maynilad as their water provider, even during interruptions. Moreover, a few respondents noted that environmental efforts in barangays mostly revolve around waste management and canal clean-ups, with little mention of sustainable water management systems, with some respondents even taking personal initiatives to address the effects of flooding, such as domestic clean-up efforts that consume significant amounts of water. This reflects another gap in one of DOI's core elements, *social system*. Without support or modeling from local institutions for residents to take notice and engage, RWHS remains outside of the community's priority, limiting its diffusion and leaving residents to rely on established but short-term responses to recurring water-related challenges.

In light of these findings, the proponents of the study propose a public information campaign composed of a non-fiction docuseries, a printed brochure, and a series of vertical short-form informational videos. The campaign hopes to address the clear lack of awareness

surrounding RWHS and encourage Malabon residents and the local government to integrate the practice of harvesting rainwater into their daily lives. While the non-fiction docuseries serves to highlight narratives surrounding Malabon residents' relationship with water and related issues, the printed brochure and short-form videos seek to educate the public about the benefits of RWHS and the various means through which the system can be installed in their homes and integrated into their lifestyles. The digital materials will be circulated using social media, which the proponents observed to be the primary communication channel for residents of Malabon, whereas the printed brochure hopes to be disseminated physically with the assistance of the city's local government.

In addition to the public information campaign mentioned above, the study's proponents believe there are potential solutions that only the local government of Malabon is capable of providing. Based on the study's findings, it would be beneficial if RWHS were to be integrated into public institutions, particularly in schools and government facilities, to increase the innovation's *observability* among residents. Private businesses, especially those that heavily rely on water in their daily operations, may also find the cost-effectivity of RWHS to be economically beneficial. Given the discussed lack of material accessibility, it would be helpful as well if there were services that focused on offering affordable installation, maintenance, or even bundled materials in hopes of addressing RWHS's gaps in *trialability* and *complexity* in Malabon City.

For a deeper understanding of RWHS in the specific context of Malabon City, the study's proponents recommend that future research integrate personal input from LGU officials in order to obtain valuable institutional perspectives surrounding the feasibility of RWHS integration in policies, programs, and initiatives. To broaden the understanding of RWHS not just in Malabon but in the Philippines as a whole, the proponents recommend the exploration of the feasibility of

using filtered rainwater for drinking in Filipino households, particularly in areas with unreliable access to potable water.

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APPENDICES

I. Consent Forms

[Redacted in consideration of interviewee data privacy]

II. Data Gathering Questions

Research Question 1

What is the level of awareness and understanding of RWHS among the residents of selected barangays in Malabon City?

a. What factors affect the level of awareness of RWHS among the residents of selected barangays in Malabon City?

Semi-structured Base Interview Questions
1. The factors and their level of awareness on Rainwater Harvesting Systems 1.1. Can you share a time when you faced problems with water — like not having enough during dry spells, or too much during floods? Looking back, what do you wish was available to help your household during that time? *(Maaari ka bang magbahagi ng isang panahon o pagkakataon kung kailan nakaranas ka ng problema sa tubig, tulad ng kakulangan tuwing tag-init o pagka labis-labis tuwing baha o tag-ulan? Kung babalikan ito, ano ang tulong na nais mo sana'y mayroon dati?)* 1.2. Do you know anything about how Rainwater Harvesting Systems (RWHS) work? This is the practice of collecting rainwater and storing it for future

household use.

(May pagkakaalam ka ba tungkol sa kung paano gumagana ang Rainwater Harvesting Systems (RWHS)? Ito ang kaugalian ng pag-iipon ng tubig-ulan at pag-iimbak nito para magamit sa ibang pagkakataon sa hinaharap.)

1.2.1. **If yes:** Before this conversation, had you ever thought about using rainwater in your own home? What made you curious or hesitant about it?

*(**Kung oo:** Bago ang pag-uusap na ito, naisip mo na bang gumamit ng tubig-ulan sa iyong sariling tahanan? Ano ang dahilan kung bakit ka na-curious o nag-alinlangan tungkol dito?)*

1.3. Have you ever come across any laws or programs that mention collecting or using rainwater such as the Republic Act 6716, otherwise known as the Rainwater Collector and Springs Development Act of 1989? This law mandates that all barangays nationwide should have a rainwater harvesting system.

(Nakatagpo ka na ba ng anumang mga batas o programa na nagbabanggit ng pagkolekta o paggamit ng tubig-ulan gaya ng Republic Act 6716, o kilala bilang Rainwater Collector and Springs Development Act of 1989? Ang batas na ito ay nag-uutos na lahat ng barangay sa buong bansa ay dapat magkaroon ng rainwater harvesting system.)

1.3.1. **If yes:** What can you recall about them?

*(**Kung oo:** Ano ang naaalala mo tungkol sa mga batas o programa na ito?)*

1.4. Has your barangay ever introduced any efforts related to water conservation or rainwater collection?

(Nagsimula na ba ang iyong barangay ng anumang pagsisikap na may kaugnayan sa pagtitipid ng tubig o pagkolekta ng tubig-ulan?)

1.4.1. **If yes:** How did people respond?

*(**Kung oo:** Ano ang naging reaksyon ng mga tao dito?)*

1.5. Have you seen or heard of anyone in Malabon using RWHS? Did this prompt you to learn something new about any water-saving or environmental solutions?

(Nakakita o nakarinig ka na ba ng sinuman sa Malabon na gumagamit ng RWHS? Nag-udyok ba ito sa iyo na matuto ng bago tungkol sa anumang mga solusyon sa pagtitipid ng tubig o pangkapaligiran?)

1.5.1. **If yes:** How did it catch your attention or leave an impression on you? What about it made you curious or interested?

*(**Kung oo:** Paano nito nakuha ang iyong atensyon o nag-iwan ng impresyon sa iyo? Ano ang nakakuha ng iyong curiosity o interes?)*

2. Factors affecting the adaptation of RWHS

2.1. What kinds of things—like seeing someone else do it, barangay support, or saving money—might make you want to learn more or try out rainwater harvesting?

(Anong mga uri ng bagay—tulad ng makitang may ibang gumagawa nito, suporta mula sa barangay, o ang pagkakataon na makatipid ng pera—ang maaaring mag-enganyo sa'yo na matuto o subukan ang rainwater harvesting?)

2.2. What kind of challenges (like budget, knowledge, or accessibility) do you think affect someone's ability to use RWHS in a place like Malabon? *(Anong uri ng mga pagsubok (tulad ng badyet, kaalaman, o accessibility) sa tingin mo ang nakakaapekto sa kakayahan ng isang tao na gumamit ng RWHS sa isang lugar tulad ng Malabon?)*

Research Question 2

How do the residents of selected barangays in Malabon City perceive the implementation of RWHS in their community?

a. What are the perceived benefits of implementing RWHS in selected barangays in Malabon City?
b. What are the perceived challenges of implementing RWHS in selected barangays in Malabon City?

Semi-structured Base Interview Questions
2.1. Can you think of a time when saving rainwater might have helped your household or neighbors? What would that look like? *(Maaari ka bang magbigay ng isang pagkakataon kung kailan ang pagtitipid ng tubig-ulan ay nakatulong sana sa iyong sambahayan o mga kapitbahay? Ano kaya ang hitsura niyan?* 2.2. If someone in your neighborhood started collecting rainwater regularly, what kinds of changes do you think people would notice? *(Kung may isang tao sa iyong komunidad na nagsimulang mangolekta ng tubig-ulan*

nang regular, anu-anong mga pagbabago sa palagay mo ang mapapansin ng mga tao?)

2.3. If someone offered to help set up a rainwater collector in your home, what questions or concerns might you have before agreeing?

(Kung may nag-alok na tumulong sa pag-set up ng RWHS sa iyong tahanan, anong mga katanungan o alalahanin ang maaaring mayroon ka bago sumang-ayon?)

2.4. Do you think using rainwater would change how your family uses or pays for water? How so?

(Sa palagay mo, mababago ba ng paggamit ng tubig-ulan kung paano ginagamit o binabayaran ng iyong pamilya ang tubig? Paano?)

2.5. What do you think makes it difficult for people in Malabon to try out new systems like this?

(Ano sa palagay mo ang nagpapahirap o nagiging sagabal sa mga tao sa Malabon na subukan ang mga bagong sistemang tulad nito?)

2.6. Have you seen any effort in your community to promote things like this? How did people respond?

(Nakakita ka na ba ng anumang pagsisikap sa iyong komunidad na i-promote ang mga bagay na tulad nito (RWHS)? Ano ang naging reaksyon ng mga tao?)

2.7. Do you think solutions like RWHS fit with the way most households in Malabon live? Why or why not?

(Sa palagay mo ba ay angkop ang mga solusyon tulad ng RWHS sa paraan ng pamumuhay ng karamihan sa mga sambahayan sa Malabon? Bakit o bakit hindi?)

Research Question 3

What are the current practices in RWH in selected barangays in Malabon City?

a. Are any RWHS-related initiatives implemented by the LGUs of selected barangays in Malabon City?
b. Is RWH or any similar activity being practiced by the residents of selected barangays in Malabon City at a homeowner level?

Semi-structured Base Interview Questions
2.3. What do you usually do to prevent floods in your own household? And are there any initiatives or lack of initiatives from the government that may have influenced it? *(Ano ang karaniwan mong ginagawa para maiwasan ang pagbaha sa iyong tahanan? At mayroong bang mga inisyatibo o kakulangan sa inisyatibo mula sa gobyerno na maaaring nakaapekto rito?)* 2.4. What do you usually do to minimize the damage that flood does in your household? After the flood, how does your family manage or restore your water supply and daily routines? *(Ano ang karaniwan mong ginagawa para mabawasan ang pinsalang dulot ng baha sa iyong tahanan? Pagkatapos ng baha, paano ninyo mina-manage o ibinabalik ang inyong suplay ng tubig at mga gawain sa araw-araw bilang isang pamilya?)* 2.5. What is your household's main source of water? *(Ano ang pangunahing pinagkukunan ng tubig ng iyong bahay?)*

2.6. Do you have similar systems to RWHS? Do you collect water in other ways wherever it rains?

(Mayroon ka bang mga similar na sistema? Nag-iipon ka ba ng tubig sa ibang paraan kung kailan umulan?)

If the household has RWHS: What do these systems entail? What is its:

*(**Kung ang pamilya ay may RWHS:** Ano ang nilalaman ng mga sistema na ito? Ano ang itong:)*

2.6.1. general effectivity;

2.6.2. number currently operational;

2.6.3. capacity of operational rainwater harvesting systems;

2.6.4. age of operational rainwater harvesting systems;

2.6.5. maintenance measures;

2.6.6. filtration system, if any;

2.6.7. difficulties or challenges in its installation, if any; and

2.6.8. usage. What do you use Rainwater Harvesting Systems for?

2.7. **If the local barangay has RWHS**: Do you use the water collected by the local rainwater harvesting system? Why or why not?

*(**Kung ang lokal na barangay ay may RWHS:** Ginagamit mo ba ang tubig na kinokolekta ng lokal na sistema ng pag-iipon ng tubig-ulan? Bakit o bakit hindi?)*

2.7.1. Do you notice other community members using the local rainwater harvesting system?

(Napansin mo ba ang ibang miyembro ng komunidad na gumagamit ng lokal na RWHS?)

III. Interview Transcripts

[Redacted in consideration of interviewee data privacy]