THE IMPLEMENTATION OF A SOCIAL MARKETING APPROACH FOR RAINWATER HARVESTING AND PRESERVATION

by

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 This thesis is submitted in partial fulfillment of the requirements for the degree of Doctor of Business Administration, Swiss School of Business and Management, Geneva.

Dedication

I dedicate this work to God Almighty for His endless grace and strength.

I dedicate this thesis to my beloved parents, whose unwavering love, encouragement, and sacrifices have been the foundation of my journey.

To my mentors and teachers, who guided me with patience and wisdom.

To my family and friends, thank you for being my constant source of support and love. And to all those who believed in me, even when I doubted myself. Without your prayers and encouragement, this journey.

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To my family, thank you for your unconditional love, patience, and support. Your belief in me has been my greatest strength.

Finally, I extend my appreciation to all those who directly or indirectly contributed to this work. This thesis would not have been possible without your support.

Abstract

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Dissertation Chair: Dr. Anna Provodnikova

Water crisis is identified as one of the biggest global threats due to its potential impacts on the environment and the ecosystem. Global warming, shifting climatic conditions, and rising populations, poses a substantial risk to urban water supply in developing countries. As a fundamental resource for human survival amidst changing climate conditions, water serves as a vital elixir that sustains life and ecosystems. Rainwater harvesting has been identified to be an optimal solution for water crisis all over the world. India, being a sub-tropical country, receives an ample amount of rain. However, most of the Indian states are recently facing severe challenges of water scarcity. This scenario is likely to worsen in the impending years, due to the anticipated severity of climate change. Therefore, it is it is necessary to understand the determinants that influence residents' adoption of rainwater harvesting and enhance awareness about its usage. Moreover, previous studies indicate that while awareness programs and campaigns motivate users to express an intention to adopt RWH, the actual installation of such systems remains limited. Therefore, an exploration of extensive studies on perceptions of Indian users is required to comprehend the behavioral nuances surrounding the use of rainwater harvesting structures. Following a thorough review of present literature, a conceptual framework has been constructed for the present study based on the research gaps found. The theoretical basis of this study is an integrated Motivation-Opportunity-Ability (MOA) framework which incorporates the Theory of Planned Behavior (TPB) to investigate the determinants of RWH behavior. The study adopted a positivistic research philosophy along with a descriptive and explanatory research purpose. A quantitative research approach with cross-sectional nature was chosen where close-ended structured questionnaire was used for data collection with a stratified sampling method. The target population for the study was the urban residents from one of the fastest growing cities in India, Bengaluru. After going through a pilot analysis, the final questionnaires were sent to 600 residents in Bengaluru and out of these 400 were selected as study participants. The study revealed that majority of the residents in the study were male and belonged to the age group between 25-45 years old. Most of them were graduates. They mostly lived in individual house or multi-storied flat, however it was dominantly rented accommodations. Independent t-test and ANOVA results showed that belief, attitude, subjective norms, motivation, barriers, ability and opportunity were significantly different for various sociodemographic factors. Linear regression analysis showed that belief, attitude and subjective norms significantly influenced the behavioral intention of the participants. Furthermore, the study showed that behavioral intention, motivation, opportunity, ability and barriers significantly influenced actual usage of RWH in their houses. In addition, PLS-SEM demonstrated that motivation, opportunity, ability and barriers significantly moderated the relationships between behavioral intention and actual adoption of RWH. While motivation, opportunity, ability positively moderated the association between behavioral intention and actual adoption of RWH, barriers negatively moderated the association. The study potentially provides several theoretical, managerial, and societal implications on social marketing theme and provides extensive comprehension on urban residents' perception regarding rainwater harvesting. The study further provides several recommendations for policymakers and administrators on constructing strategies for increased acceptance of rainwater harvesting in other developing countries.

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INTRODUCTION

1.1 Background of the Study

One of the prominent contemporary challenges pertains to the accessibility issues of freshwater resources (Kuzma et al., 2023) (Figure 1.1). Over 750 million people lack access to proper drinking water and almost 2.6 billion lack basic sanitation facilities (United Nations, 2021). Research predicts that globally, almost 1 in 4 children will live in extremely high water stress areas by 2040 (UNICEF, no date). Water stress is considered to occur due to two prime reasons, namely, physical scarcity and economic scarcity (Caretta *et al.*, 2022).

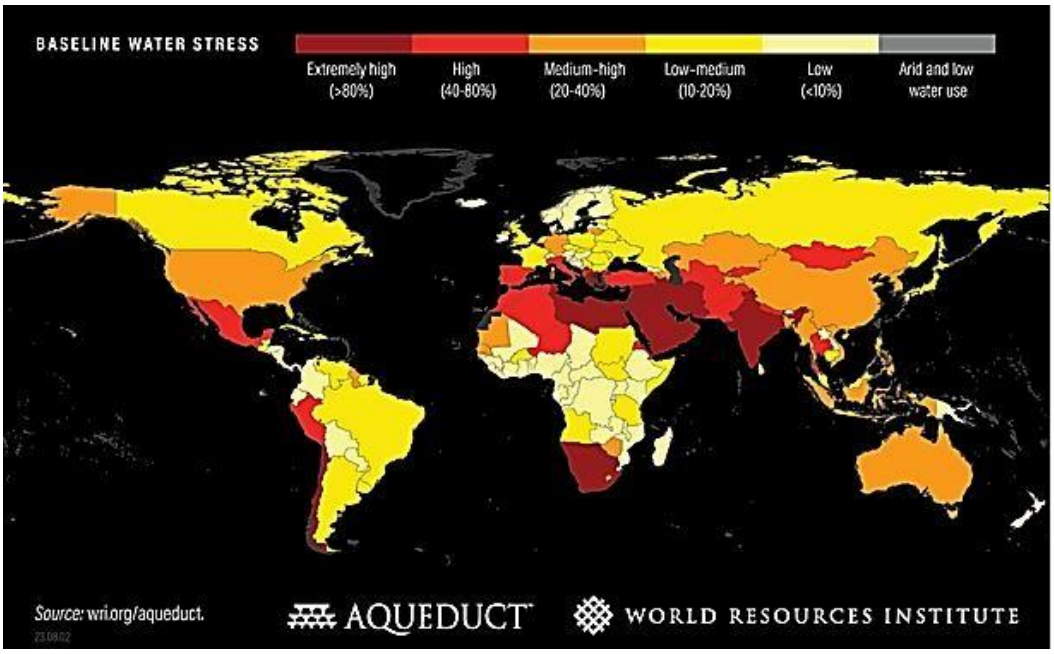

Figure 1.1

Global scenario for water stress

Source: Kuzma et al. (2023)

In instances of physical scarcity, a shortage of water can be caused due to local ecological conditions, while economic scarcity can arise due to lack of proper water infrastructure. However, experts suggest that physical water scarcity cannot solely cause drinking water problems in an area; rather, political and financial factors can expedite the situation (Klobucista and Robinson, 2023). Furthermore, some areas, such as Oman and the south-western part of the USA, experience scarcity due to lack of precipitation or alternative freshwater sources, yet possess the requisite infrastructure required for sustained functionality. In such contexts, governments and policymakers struggle with the formidable task of devising strategies to address water scarcity amidst the backdrop of climate change (Jha, 2022).

Various potential remedies have been proposed for ensuring water security over an extended period. The strategies include increased water storage in reservoirs, improved water efficiency, seawater desalinization, groundwater utilization, inter-basin water transfer, and urban landscape management (McDonald *et al.*, 2011, 2014; Larsen *et al.*, 2016). Among these solutions, the ancient technique of rainwater harvesting (RWH) is outstanding as it involves the preservation of rainwater/stormwater in structures for future use. RWH systems serve as an alternative water source that is distinct from the centralized water systems. RWH systems have been intricately linked to heightened climate fluctuations, including aridity and drought, and it has the potential of addressing the anticipated water scarcity across nations (Aladenola and Adeboye, 2010; Amos, Rahman and Gathenya, 2016; Krishna, Mishra and Ighalo, 2020; H Bhat and Abraham, 2021; Alam *et al.*, 2022).

The efficacy of rainwater harvesting extends beyond mere historical significance, presenting a multifaceted solution to contemporary water challenges. Some of the advantages include groundwater recharging, mitigation of water crises, fulfilment of water demands, and conservation of water for future needs (Amos et al., 2016; Mishra et al., 2020). The escalating number of global research on water scarcity has prompted various countries, such as Australia, Kenya, Sub-Saharan Africa, Ethiopia, the United States, India, China and the Netherlands, to adopt RWH as a pivotal strategy to meet their increasing water needs (Velasco-Muñoz *et al.*, 2019). Consequently, the market for RWH is experiencing substantial growth, positioning RWH as a source of supplemental water (Figure 1.2).

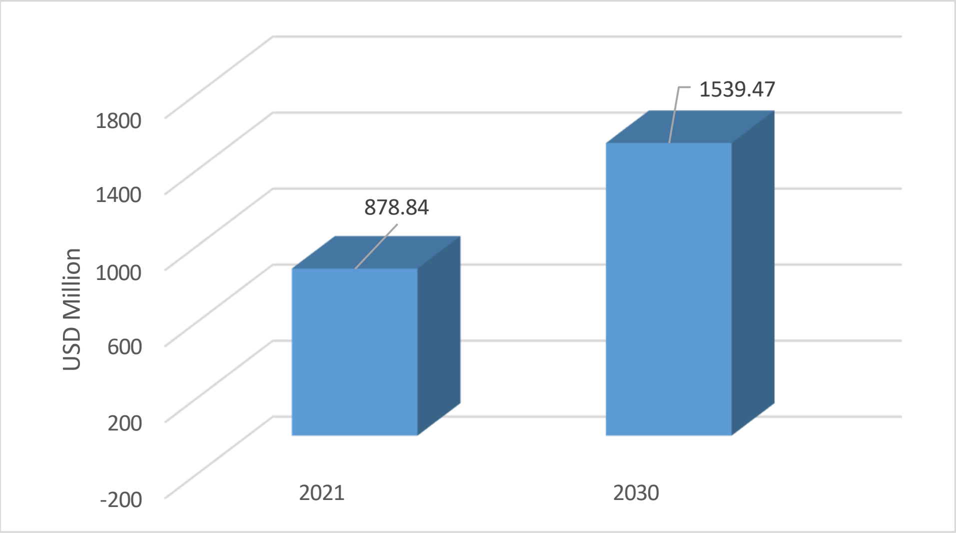

Figure 1.2

Global market growth in rainwater harvesting

Source: Verified Market Research (2022)

According to a report published by the National Institution for Transforming India (NITI) Aayog, India is facing extreme challenges related to water scarcity, with approximately 600 million people encountering acute water stress conditions and an alarming death rate of almost 200,000 people attributed to inadequate access to water (NITI Aayog, 2019; Figure 1.3). The report projected that the country's water demand would be doubled in the future and it will eventually hit the country's GDP (Khuller, 2022). In the wake of this looming crisis, governments and other regulating bodies are taking steps to spread awareness among people and formulate certain regulations pertaining to water preservation (World Bank, 2023). As the intricacies of rainwater harvesting are being examined, it is evident that fostering its adoption is not merely an environmental imperative but a crucial step towards mitigation of the looming water crisis in India. Consequently, the present study focuses on a comprehensive exploration of the adoption of rainwater harvesting as a pivotal strategy for a sustainable future.

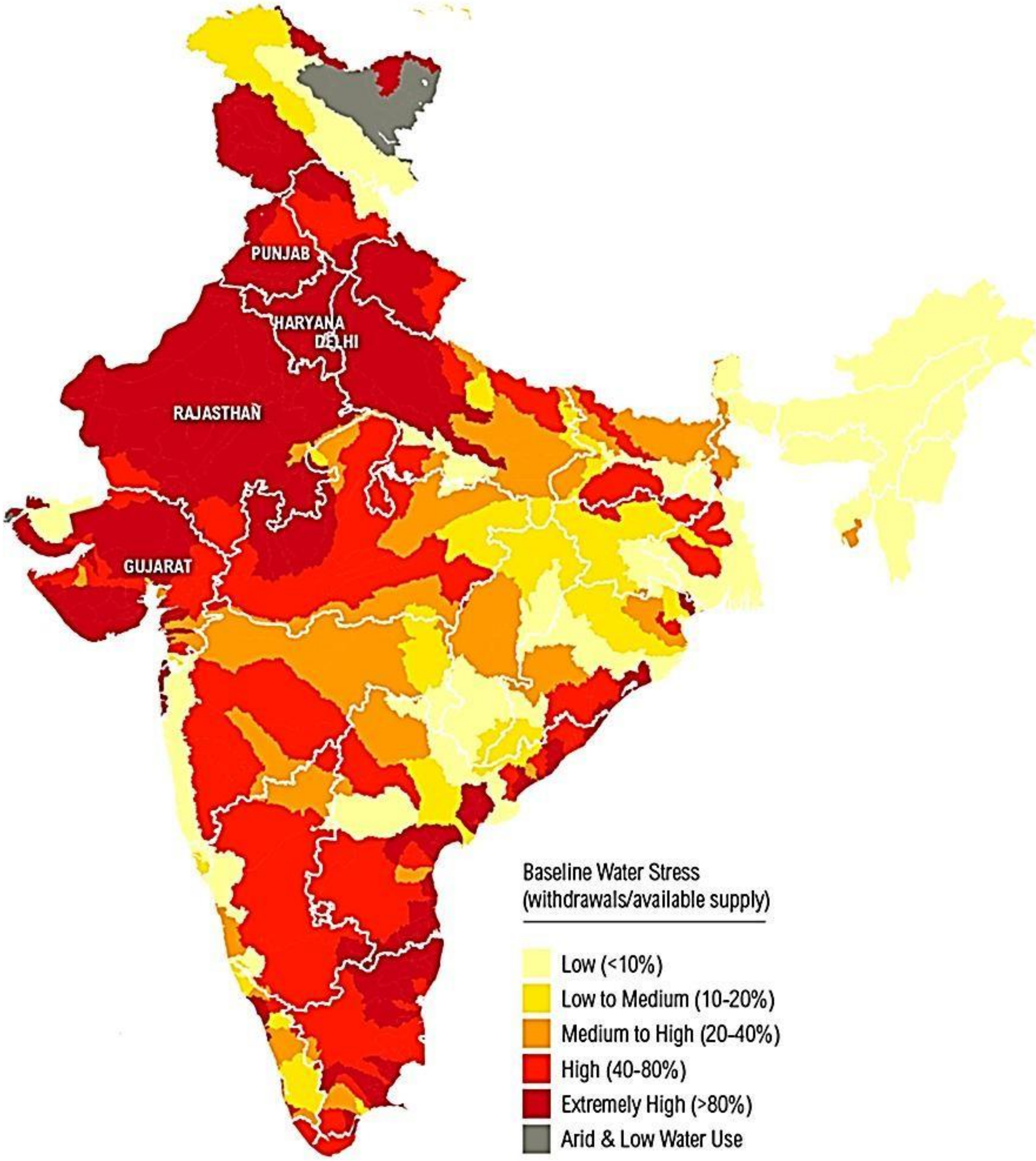

Figure 1.3

Water stress in India

Source: NITI Aayog (2019)

1.2 Different Methods of Water Harvesting

Water harvesting can be defined as the collection and storage of water, with a deliberate effort to restrict and minimize the loss of water through evaporation or seepage (Mekuria & Tegegne, 2023). The water accumulated through such procedures could be stored in sub-surface reservoirs, above-ground lakes, or ponds. Such storage practices comprise various techniques, namely, groundwater harvesting, rainwater harvesting, and floodwater harvesting.

Groundwater harvesting: It utilizes the underground pore space for water storage and usage. Traditional methods, such as Qanats and groundwater dams, are employed for groundwater harvesting (Paramaguru and Kar, 2020). Qanat systems consists of simple tunnels with multiple shafts designed for cleaning, repairing, and ventilating, thereby facilitating the extraction of water from underground sources. On the other hand, groundwater dams are used widely in East Africa, Brazil, and Kenya. Such dams obstruct the flow of underground water and preserve it for replenishing wells upstream of the dam. Such dams can take the form of subsurface dams, sand dams, percolation dams, or a combination of all these structures (Arwa, Heinz and Marwan, 2017).

Floodwater harvesting: It pertains to the storage of floodwater or creek flow for agricultural irrigation. Such harvesting can be of two types: within streambed and outside streambed. Within streambed harvesting involves the construction of dams and dykes in the mild-slope riverbed to retain water (Mekdaschi and Liniger, 2013). Off-streambed systems involve the diversion of flood water from the river course to adjacent floodplains or channels (Hashemi *et al.*, 2017).

Rainwater harvesting: It revolves around the collection and storage of precipitation for future use. Rainwater harvesting is primarily conducted through one of the three approaches, namely, rooftop water harvesting, micro-catchment water harvesting, and macro-catchment water harvesting (Prinz, no date). A vital component of rainwater harvesting is the storage tank in which water is stored, and if necessary, treated (Figures 1.4 and 1.5). Impervious surfaces, such as building rooftops serve as catchment areas (Campisano *et al.*, 2017). Gutters and downpipes channel the excess run-off water into the collection system (tank). Complementary devices, such as debris cleaners, flush diverters, or screeners, enhance the efficiency of the system (Abbasi and Abbasi, 2011). Recent projects have introduced innovation in the traditional system. Dual storage facilities of both detention and retention of water are considered wherein water will be slowly drained out in the detention portion and water will be temporarily stored in the retention area (Gee and Hunt, 2016). Surface run-off caused due to heavy rainfall is stored in the ponds or foot of the slopes for micro-catchment and macro-catchment rainwater harvesting, respectively (Prinz, no date). Water harvesting, through its various methods, serves as a crucial strategy for sustainable water management, ensuring the efficient utilization and conservation of this invaluable resource.

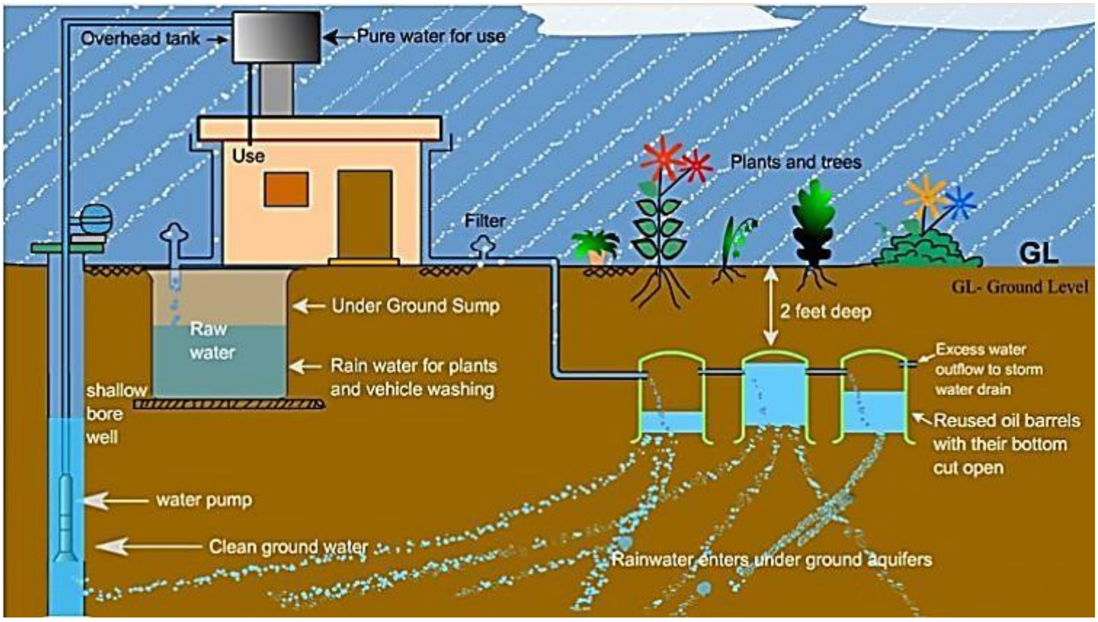

Figure 1.4

Schematic diagram showing rainwater harvesting techniques for urban areas

Source: (Karnataka State Council for Science and Technology, no date)

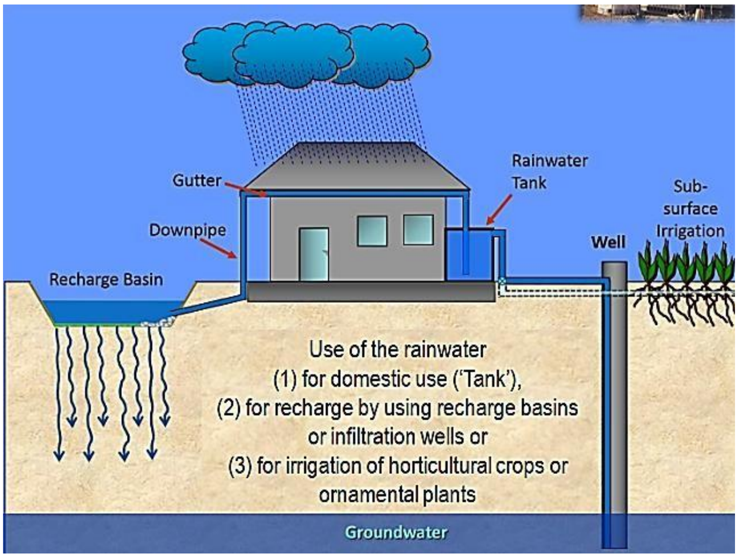

Figure 1.5

Schematic diagram showing rainwater harvesting techniques for rural areas

Source: Prinz (n.d.)

1.3 Effects of Rainwater Harvesting

The incorporation of rainwater harvesting (RWH) systems in households has been demonstrated to yield benefits at both public and private levels. The following section discusses the multifaceted impacts of RWH, encompassing its alignment with Sustainable Development Goals (SDGs), water conservation, rainfall and drainage management, decentralized water supply, contributions to agriculture, and environmental conservation.

Sustainable development goals: RWH system is considered as a promising technology to contribute to achieve various sustainable development goals (SDGs) which is the 2030 agenda adopted by United Nations Member for a sustainable future. Adopting RWH can help in achieving various goals such as the reduction of climate change impact (Goal 12), making sustainable cities and communities (Goal 11), enabling to have affordable and clean energy (Goal 7) and accessing clean water (Goal 6) (de Sá Silva *et al.*, 2022).

Water conservation: With RWH structures, water conservation can be achieved in residential buildings. Rainwater collected through RWH can be used in toilet flushing, garden watering, and house cleaning which does not need to be at drinking water standard (Şahin and Manioğlu, 2019). Studies showed that a single-story building can result in 33-35% of water savings, whereas an office building with a bigger roof-top can result in almost 60% of water conservation (Ghisi, Bressan and Martini, 2007; Ward, Memon and Butler, 2012).

Rainfall management: Storm-water preservation in urban households reduces inundation and flooding risk (Kim and Chen, 2018; Nguyen *et al.*, 2019; Şahin and Manioğlu, 2019). After some simple treatment processes, preserved rainwater also can be used for all domestic uses in households and thus help in water conservation (Şahin and Manioğlu, 2019).

Drainage management: The RWH system significantly improves the drainage system during stormwater discharge. Studies have shown the water flow and peak volume were reduced by almost 18% -33% (Zhang *et al.*, 2012; Kim *et al.*, 2015; Palla, Gnecco and La Barbera, 2017). Studies from the USA showed that RWH can reduce the drained volume by up to 17% (Steffen *et al.*, 2013; Teston *et al.*, 2018).

Decentralized supply of water in households: Rooftop RWH system can store rainwater for long-term use (Goonrey *et al.*, 2009; Kim and Chen, 2018). Also, it provides supplemental water to the household during rainy seasons (Van Mechelen, Dutoit and Hermy, 2015; Sepehri *et al.*, 2018; da Silva *et al.*, 2019). In addition, it helps to reduce the water bill of household (Sheikh, 2020).

Boosting agriculture: RWH has been considered useful in low agricultural productivity. Particularly, in drought prone areas, RWH play significant role in providing water throughout the years and enhance agricultural productivity (Hagos *et al.*, 2007; Yosef and Asmamaw, 2015). Further, studies showed that RWH increased annual income of the farmers by 35%. It also enhanced their calorie intake by 15% per adult person (Mekuria, Amede and Mekonnen, 2020).

Environmental conservation: RWH structures have been designed to address the soil as well as water conservation issues and improve crop yield, plant growth, and forage production (Gupta, 1994; Jia *et al.*, 2006; Singh *et al.*, 2013). It also protects the ecosystem (da Silva *et al.*, 2019), saves energy (Tavakol-Davani *et al.*, 2016), reduce pressure on existing natural resources (da Silva *et al.*, 2019), reduce the greenhouse effect by decreasing water wastage (Horan *et al.*, 2019).

Adoption of Rainwater Harvesting (RWH) systems emerges not only as a pragmatic solution for addressing water-related challenges but also as a transformative force with the potential to catalyze progress towards broader sustainability objectives. As evidenced by the comprehensive exploration of its diverse impacts, RWH stands poised as a crucial ally in the pursuit of a more resilient, efficient, and ecologically mindful future.

1.4 Global Utilization and Adoption of Rainwater Harvesting

Africa

Africa possesses an adequate water supply to fulfill the requirements of its population; however, several countries within the African continent have been identified as water stressed. The primary causes of this water scarcity are the economic challenges, including insufficient funding and inadequate infrastructure (UNEP, 2006). South Africa adheres to the Water Services Act (Act 108 of 1997) to regulate the supply of water to households. However, strict legislation for RWH is found to be lacking in the country. In addition, the government initiatives lack emphasis on proper cleaning and purification of stored rainwater. A national coordinating body for RWH is absent, hindering effective co-ordination with various stakeholders. In recent times, the Department of Water and Sanitation conducted "national rainwater harvesting program", which focused on building above- and below-ground rainwater storage tanks for rural households and productive uses, wherein clinics, schools, and hospitals were included as beneficiaries. Furthermore, some municipalities adopted and installed roof RWH system in households for domestic purpose (Water Research Commission, 2018).

Asia

In Asian countries, RWH is practiced from ancient times and RWH installations have substantially advanced in some countries (Yannopoulos, Giannopoulou and Kaiafa-Saropoulou, 2019). Following the earthquake and tsunami in Japan in March 2011, an increase was witnessed in the number of household RWH installations, which were facilitated by municipal subsidies for water storage and filtration (JFS, 2014). A survey revealed that municipalities subsidized half the cost of a 1,000-liter rainwater tank and its installation (Association for Rainwater Storage and Infiltration Technology, 2011). Japan introduced the Rainwater Act in 2015, making RWH systems compulsory in newly constructed buildings (JFS, 2017). China, with initiatives like the RWH irrigation project in 1996 and subsequent projects like the "Sponge city" and "1-2-1 catchment," has significantly increased agricultural production. However, challenges persist, including a shortage of water storage sites and inadequate maintenance (*Rainwater harvesting around the world-China*, 2023).

United States of America

RWH is an increasingly common practice in the United States for the last 70 years. Studies on RWH systems in USA revealed a prevalent use of harvested water for irrigation and other potable purposes. In addition, water treatment methods, such as using ultraviolet light, are widely used. Users commonly opt for polyethylene storage tanks, while composite asphalt shingles or metal are used as roofing materials (Thomas *et al.*, 2014). Individual states in the USA regulate RWH, providing manuals detailing processing systems, water quality objectives, and permitting requirements (USEPA, 2013).

Europe

Germany has attained a substantial advancement and stands out as a global leader in RWH, boasting over 1.5 million RWH systems. Rainwater serves various purposes, including car washing, toilet use, and garden irrigation (Herrmann and Schmida, 2000). Almost every third new building in Germany has rainwater storage tanks and such a massive adoption of RWH commenced from the 1980s (Nolde, 2007). Germany has a record of installing approximately 80,000 RWH systems per year with the total industry value incurs being nearly 340 million Euros (Partzsch, 2009). In the United Kingdom, modern RWH implementation is underway, with a focus on research and technology development (Ward and Butler, 2016). A review made by three leading RWH providers in the UK demonstrated that products are licensed from different European manufactures. Limited government initiatives, low subsidies, and insufficient support hinder RWH adoption in the UK (Yannopoulos, Giannopoulou and Kaiafa-Saropoulou, 2019).

Australia

RWH is quite popular in both urban and rural areas of Australia. RWH serves as a supplementary water source in urban areas, while it is a predominant water source in rural areas (30%). Approximately 13% of Australian households, totaling 2.6 million people, use RWH as the source of their drinking water (Coombes, no date; Yannopoulos, Giannopoulou and Kaiafa-Saropoulou, 2019). Local governments assumed massive responsibilities to encourage citizens for managing stormwater run-off and arranging supplementary water systems through RWH. Adequate subsidies and grants along with government policies facilitate a better adoption of RWH in households. Almost 50% of the Australian population resides in houses equipped with RWH systems (CHMS, 2013).

International organizations working on rainwater harvesting

Several government-aided and non-government organizations are extensively involved in spreading awareness and contributing to policymaking for enhancing the global adoption of RWH. Non-Governmental Organizations (NGOs) play a vital role by overseeing multiple projects that comprise sanitation, hygiene, and crop production management. International Rainwater Harvesting Alliance (IRHA) is one such non-governmental organization headquartered in Geneva. Commencing its operation in 2002, IRHA focuses on rainwater conservation and waste water management, with a particular emphasis on addressing these challenges in developing countries (IRHA, no date).

Another international NGO serving in the same cause is the American Rainwater Catchment Systems Association (ARCSA), which is an international US-based NGO dedicated to provide resources and information on rainwater management and its collection. In addition, ARCSA promotes the advanced technique of rainwater conservation and stormwater management. In a noteworthy initiative, the organization initiated a White House petition in 2014 to galvanize support for increased utilization of rainwater.

1.5 Adoption Levels of Rainwater Harvesting in the Indian Context

Policies for rainwater harvesting

The central government of India initiated rainwater harvesting by formulating the National Water Policy 2012 (Government of India, 2012). Subsequently, the Indian government has taken several vital steps to encourage RWH. The initiative called ‘Jal-Shakti Abhiyan-I’, launched in 2019 across 256 water-distressed districts, evolved into ‘Jal Shakti Abhiyan: Catch the Rain’ in 2021, with a thematic focus on "Catch the Rain Where it Falls When it Falls". This campaign was launched for all districts across the country in 2022 (Ministry of Rural Development, 2022). According to data from “Jal Shakti Abhiyan: Catch the Rain-2023”, 12,28,553 water conservation and rainwater harvesting structures were constructed and 2,67,472 traditional water bodies were renovated. Additionally, Pradhan Mantri Krishi Sinchayee Yojana (WDC-PMKSY) incorporated rainwater harvesting as a key activity under its natural resource management domain. Furthermore, the Model Building

Bye Laws (MBBL), 2016, under the Ministry of Housing and Urban Affairs, outlines provisions for rainwater harvesting, disseminated to all states. The Central Ground Water Authority (CGWA) has initiated the issuance of no-objection certificates for groundwater extraction (Ministry of Jal Shakti, 2023a).

Since water is a state subject, individual states have implemented various initiatives for rainwater harvesting.

Kerala

The Kerala government has initiated the implementation of RWH structures through different agencies, such as the Kerala Water Authority and Jalnidhi. RWH was introduced as a technological solution to address drinking water challenges in gram panchayats. In addition, the government subsidized the construction of 6000 RWH units in 2007, with the Kerala Water Authority providing nearly 90% of the subsidy on the construction of RWH structures (*Kerala Rural Water Supply and Sanitation Agency*, 2023).

New Delhi

The Delhi Jal Board (DJB) has enforced RWH measures and it monitors and assesses their implementation. The state government mandates the installation of RWH structures on plots exceeding 100 square meters. Despite strict regulation, several households have not complied with RWH installation (Pushkarna, 2022).

Indore (Madhya Pradesh)

RWH has been mandated in all new buildings with an area of 1,500 square meters or more. The Indore Municipal Corporation has instituted penalties for violating the rules for implementing RWH. Residential buildings with RWH installation certification are eligible for a 10% rebate (Choukse, 2022).

Telangana

The Secunderabad Cantonment Board (SCB) has mandated the construction of RWH pits in every residential building. SCB approval is obtained only after RWH systems are included in building plans (Mungara, 2022). In addition, the Hyderabad Metropolitan Water

Supply and Sewerage Board (HMWS&SB) has initiated the restoration of nearly 3000 existing RWH pits to improve the groundwater table (Mungara, 2021).

Tamil Nadu

In 2001, the RWH movement was launched in Tamil Nadu to combat severe water scarcity. The state government issued orders mandating the installation of RWH for all types of buildings. Further, collaborations among the government, private companies, and NGOs resulted in the restoration of lakes and other RWH structures (Gautham, 2019).

Karnataka

The Bangalore Water Supply and Sewerage Board (BWSSB) has mandated RWH adoption in buildings with a site area exceeding 2400 square feet and in new buildings with a site area not less than 1200 square feet. Minimum rainwater storage or groundwater recharge of 20 liters per square meter of roof area and 10 liters for paved open space is a basic requirement for buildings (*Rain Water Harvesting*, no date). In addition, mass awareness programs and training programs are conducted for improving the knowledge about RWH installation. Such awareness and training programs are conducted for contractors, plumbers, and technicians for the execution of RWH in a scientific way.

Campaigns and programs carried out for rainwater harvesting

Har Ghar Jal

The Government of India has undertaken concerted campaigns aimed at achieving the ambitious goal of providing piped water supply to all rural households by the year 2024 (Ministry of Jal Shakti, 2019). In collaboration with urban local bodies, the central government has planned to establish a dedicated cell for the meticulous monitoring of RWH initiatives and for the revival of water bodies.

Atal Mission for Rejuvenation and Urban Transformation (AMRUT)

This mission was conceptualized for the development of basic infrastructure in urban areas of India. The revised mission called AMRUT 2.0 specially focuses on the rejuvenation of water bodies and wells, as well as the efficient recycling of wastewater and the implementation of rainwater harvesting (Ministry of Housing & Urban Affairs, 2022).

Jalpherbharan Abhiyan

Gram Vikas Sanstha (GVS) has initiated several campaigns for spreading awareness about RWH in Maharashtra. This comprehensive campaign strategically targets rural areas to spread awareness about the prudent utilization of natural resources. Workshops are systematically organized, wherein various stakeholders, such as students, professionals and social workers, are engaged. Furthermore, awareness programs are diligently conducted, accompanied by the distribution of informative materials, such as free books and pamphlets, on water management. Such awareness campaigns serve to apprise the community about various government schemes, such as the Maharashtra Rural Employment Guarantee Scheme, for addressing water scarcity (Gram Vikas Sanstha, no date).

Abhiyana Program

Specialized awareness programs for early morning walkers are being organized in renowned parks in Bangalore. The Abhiyana program, spanning a period of 60 days, was conducted in prominent parks, namely, Cubbon Park and Lalbagh. In addition, street plays were organized by the Bangalore Water Supply and Sewerage Board. This program facilitated meaningful interactions among experts and officers, fostering discussions on the effective implementation of rainwater harvesting practices (BWSSB, 2022).

1.6 Barriers in Adopting Rainwater Harvesting

Several risk factors limit the adoption of RWH services among potential users. Some of the barriers to RWH adoption are discussed in this section (Figure 1.6).

High installation cost: The initial cost for constructing the RWH structure is high. The estimated cost for constructing a RWH structure in Tughlakabad Institutional Area, Delhi, is nearly 30,000 INR. The cost in the model projects can range between 70,000 INR to 1 lakh INR (PTI, 2020). The lack of government subsidies often inhibits residents from investing to construct such infrastructure (Leidl, Farahbakhsh and Fitzgibbon, 2010). Additionally, the necessity to import certain components of RWH technology contributes to its overall expense. Consequently, many people opt for the relatively economical water provided by municipalities instead of constructing RWH structures on their sites (Akuffobea-Essilfie *et al.*, 2020).

Quality of rainwater harvesting water: Rainwater quality varies according to pollution levels and industrial activities in specific areas. Pigeon fecal discharges also pose a significant risk of contamination to stored rainwater on building rooftops (Chidamba and Korsten, 2015). People often feel insecure to use rainwater due to its degraded quality (Fortier, 2010). However, employing appropriate design and management techniques can effectively eliminate impurities of rainwater and minimize the associated health risks.

Limited information on rainwater harvesting system and installation: Common people frequently lack the necessary information for sustainable water use. A notable lack of understanding regarding RWH techniques and their practical applications is identified among people (Fortier, 2010).

Inadequate communication among policy institutions, ministries and the private sector: Clear policies play a vital role in establishing RWH systems and government subsidies for additional machinery significantly facilitate higher adoption rates (Zia and Hasnain, 2000; Temesgen *et al.*, 2016). Moreover, the absence of complementary localized policies in many areas hampers the promotion of RWH adoption (Zimmermann *et al.*, 2012; Beirne *et al.*, 2021).

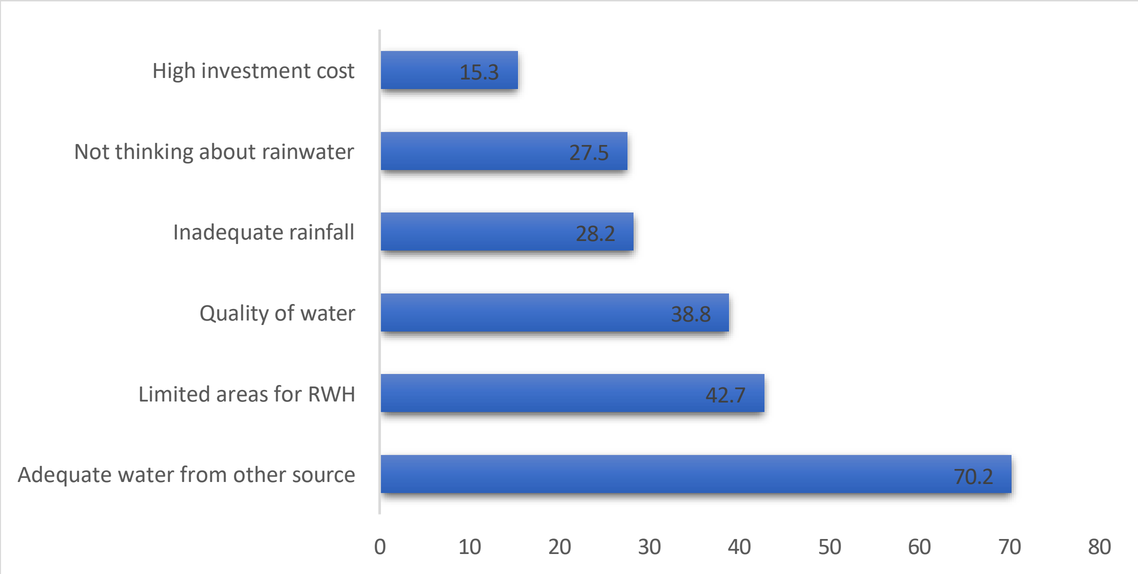

Figure 1.6

Barriers and risks in implementing rainwater harvesting

Source: Hang and Huong (2019)

1.7 Statement of the Research Problem

Water crisis is identified as one of the biggest global threats due to its potential impacts on the environment and the ecosystem (Aladenola and Adeboye, 2010; Aliabadi, Gholamrezai and Ataei, 2020). The convergence of factors, such as global warming, shifting climatic conditions, and rising populations, poses a substantial risk to urban water supply in developing countries (Aladenola and Adeboye, 2010). As a fundamental resource for human survival amidst changing climate conditions, water serves as a vital elixir that sustains life and ecosystems. Rainwater harvesting has been identified to be an optimal solution for water crisis all over the world (Campisano *et al.*, 2017). RWH has been used in many forms from ancient times to supply water during dry periods. Governments and policymakers are trying to establish RWH technology as a supplementary water source to enhance water conservation and minimize water scarcity. However, despite the formulation of several regulations and laws governing RWH, its adoption among common people is still lacking. A primary factor behind the reluctance to adopt RWH is the lack of knowledge and awareness about the system's benefits (Staddon *et al.*, 2018; H Bhat and Abraham, 2021). India, being a sub-tropical country, receives an ample amount of rain. However, most of the Indian states are recently facing severe challenges of water scarcity (NITI Aayog, 2019). This scenario is likely to worsen in the impending years, due to the anticipated severity of climate change (UNICEF, 2021).

In such a critical time, it is necessary to understand the determinants that influence residents' adoption of rainwater harvesting and enhance awareness about its usage. Moreover, studies indicate that while awareness programs and campaigns motivate users to express an intention to adopt RWH, the actual installation of such systems remains limited. Therefore, an exploration of extensive studies on perceptions of Indian users is required to comprehend the behavioral nuances surrounding the use of rainwater harvesting structures.

1.8 Research Questions

Given the problem statement, the present study intends to answer the following questions:

RQ1 What factors influence the intention of residents to adopt RWH?

RQ2 What factors influence the actual adoption of RWH by residents?

RQ3 What are the barriers and facilitators for adopting RWH?

RQ4 What are the abilities and opportunities that influence residents' intentions to adopt RWH and the actual adoption of RWH?

1.9 Objectives of the Study

Based on the research questions, the present study formulates the following objectives:

1. To understand the factors that influence residents' intentions to adopt RWH.

2. To understand the influence of barriers and facilitators on residents' actual adoption of RWH.

3. To determine the influence of abilities and opportunities on residents' actual adoption of RWH.

4. To determine the relationship between residents' intentions to adopt RWH and the actual adoption of RWH.

5. To determine how behavioral intentions together with barriers and facilitators influence residents' actual adoption of RWH

6. To determine how behavioral intentions together with abilities and opportunities influence residents' actual adoption of RWH

1.10 Hypotheses of the Study

H1: Residents' beliefs about RWH influence behavioral intention to adopt RWH

H2: Residents' attitudes about RWH influence behavioral intention to adopt RWH

H3: Residents' subjective norms about RWH influence behavioral intention to adopt RWH

H4: Behavioral intention to adopt RWH influence the actual behavioral change to adopt RWH

H5: Motivation moderates the relationship between behavioral intention to adopt RWH and the actual behavioral change

H6: Barriers moderate the behavioral intention to adopt RWH and the actual behavioral change

H7: Ability moderate the behavioral intention to adopt RWH and the actual behavioral change

H8: Opportunity moderate the behavioral intention to adopt RWH and the actual behavioral change

1.11 Significance of the Study

In contemporary times, the world is facing a significant challenge of water scarcity. RWH emerges as an optimal solution for utilizing rainwater for various domestic purposes. Many countries all over the world have attempted to mandate RWH for residential purposes.

However, it is observed that the adoption level of RWH varies extensively. A critical exploration of residents' awareness levels and behavioral intentions towards RWH is imperative for comprehending the factors that shape their intentions. Further, such studies can delineate barriers hindering the implementation of RWH. An extensive examination of the perception about RWH adoption is instrumental for policymakers and governments to comprehend the drawbacks prevailing in existing policies. Further, it helps in identifying the motivating factors that encourage residents to adopt RWH in their daily lives. Moreover, a discernible difference exists between the intention to use and the actual implementation of various practices. This study will help to understand the factors that influence citizens to incorporate RWH for residential usage. Widespread adoption of RWH can provide a solution for the long-standing water crisis at both national and global levels.

1.12 Scope of the Research

The scope of this study encompasses the parameters under which the present study has been conducted. The primary parameter is the sampling population, with a specific focus on users of RWH systems. In recent times, India has witnessed the introduction of several policies and laws mandating the installation of RWH systems. However, the adoption rate has not increased significantly among users. Therefore, the present study attempts to glean insights into the perceptions of RWH users in Indian cities, shedding light on the facilitating factors and barriers that influence the actual usage of RWH systems. Consequently, the study renders scope for opening avenues of knowledge on the non-adoption of RWH and the factors that drive the actual usage of RWH systems.

1.13 Organization of the Thesis

The thesis has been organized into different chapters, namely, Introduction, Literature Review, Research Methodology, Data Analysis and Interpretation, and Discussion, Conclusions and Recommendations. The following is a brief description of each of the chapters.

Chapter 1: Introduction: This chapter represents the introductory section of the present thesis. Different aspects associated with rainwater harvesting, globally and within

India, have been discussed. The chapter encompasses the background of the study, statement of the research problem, research questions, research objectives, significance of the study, scope of study, and thesis structure.

Chapter 2: Literature Review: In this chapter, literature related to the factors influencing users' intention to adopt RWH has been discussed along with barriers and facilitators for the adoption of RWH. Research gaps existing in the literature have been identified and a conceptual framework has been recommended along with the formation of hypotheses.

Chapter 3: Research Methodology: The research design and the research methods used to perform the study have been discoursed in this chapter. The approach of research work, i.e., the quantitative method of research, the methods of data collection, and the formation of questionnaire and methods of data analysis have been described.

Chapter 4: Data Analysis and Interpretation: In this chapter, data analysis and results are discussed in detail. Data collected through questionnaires are analyzed through various statistical tools. Different statistical analyses, such as One-way ANOVA, Correlation Analysis, and Chi-Square Test, are used to understand relationships among variables.

Chapter 5: Discussions, Conclusions and Recommendations: In this chapter, the major findings of the thesis are discussed. All findings are correlated with the published literature on adoption of FinTech payment services. Conclusions and limitations of the study are discussed along with the future area of research.

CHAPTER II
REVIEW OF LITERATURE

1.14 Overview

With rapid urbanization, increasing population and changing climate raise the issue of water scarcity in urban areas is which become a matter of concern for developing nations (Aladenola and Adeboye, 2010). In recent times many developed processes and advanced techniques have come up to address water scarcity across the globe. Rainwater harvesting (RWH) is one of the key solutions to address the increased water demands due to climatic, environmental and societal changes (Amos, Rahman and Gathenya, 2016).

The term "Rainwater Harvesting" is used for the storing and using the collected precipitation/rainwater with the help of tanks, storage containers and pipelines in a structured manner which was among the most ancient practices used to meet water demands with compilation of many components and processes (Debusk & Hunt, 2014). The RWH approach is majorly classified into two types 1) Surface water storage and 2) Groundwater Recharging. In surface water storing approach, the rainwater is collected at the rooftop and with the help of water pipes transferred to storage tanks. This stored water was used for different purposes such as drinking, bathing etc. (Mishra, B.K. and Rao, 2020).

Whereas, groundwater recharging, the storage rainwater transferred to open wells using the downward pipes. This technique of storing rainwater known as artificial recharging of groundwater (Umamani and Manasi, 2013). RWH is also used to conserve water for future purposes which was being promoted and actively practiced in different countries like Kenya, Iran, South Africa and Australia on larger scale (Aladenola and Adeboye, 2010; Recha, Mukopi and Otieno, 2015; Amos, Rahman and Gathenya, 2016; Shalamzari *et al.,* 2016). Later, the research on RWH systems were being adopted by many African countries, especially the countries that faced a high water shortage (Amos, Rahman and Gathenya, 2016). The developed countries like Germany and Japan were meeting the water needs by building centralized water systems and encouraging household level water harvesting

(Bulteau, Laffitte and Marchand, 2011; Mankad and Tapsuwan, 2011; Staddon *et al.*, 2018; Savari, Mombeni and Izadi, 2022; Sunkemo and Essa, 2022). Even in developing countries like India, RWH practices were followed from an ancient period, water and rain were associated to various cultural practices and religious beliefs (Cochran & Ray, 2009; Krishna et al., 2020).

1.15 Rainwater Harvesting Practices

The rainwater harvesting practices were followed in various developed and developing nations for domestic and irrigation purposes (Villarreal & Dixon, 2005; Cowden et al., 2006; Kumar et al., 2006; He et al., 2007). Initially, RWH strategies were followed by Thailand government and promote jar tank water storage systems with different capacities (0.1 to 3 m^3) (Wirojanagud and Vanvarothorn, 1990), implementing new policies related to effective water management to boost the domestic RWH system throughout the Taiwan and increase the tank capacity up to 30 m^3 with better building designs to meet the domestic water demands (Luong & Luckmuang, 2002; Liaw & Tsai, 2004; Monjaiang et al., 2018). Similarly, South Korea emphasized on large-scale RWH practices with innovative solutions by educating people, address social issues, offered subsidies to household owners for installing rooftop RWH system and promote the community based RWH practices which were lacking in African and Asian countries (Han & Mun, 2011; Han, 2013; Kim et al., 2016).

Even, China faced severe drought in semi-arid areas, started RWH practices to minimize the ground water depletion and Chinese government installed more than 2 mn RWH tanks with a capacity of 73 mn m^3 that fulfil the demand of drinking water for Chinese population and simultaneously helped in irrigation projects which got positive outcomes with higher soil-water efficiency up to 87.5%, minimized irrigation water demand up to 750–1125m^3/ha, increase grain productivity (1.9%), cost reduction (50%) and increase farmers overall income by 718 Yuan/ha (Gould, Zhu and Yuanhong, 2014; Wei *et al.*, 2018; Zheng *et al.*, 2018). However, in past several decades Australia also faced various drought conditions which encouraged government to shift sustainable RWH practices by installing 5 m^3 RWH tanks domestically to mitigate the issues related to water scarcity, water quality and reliability (Burns *et al.*, 2014; Preeti, Haddad and Rahman, 2022).

Traditionally, the local people of UK use RWH only for domestic purposes (drinking, washing, etc.), nowadays, RWH systems were utilized for commercial purposes such as supermarkets, universities, office buildings etc. in UK with proper regulations and innovative RWH infrastructure (Melville-Shreeve, Ward and Butler, 2016; Ward and Butler, 2016; Yannopoulos, Giannopoulou and Kaiafa-Saropoulou, 2019). In Spain, the RWH practices on multi-family buildings help to meet more than 70% of the water demands but RWH systems had prolonged pay-back time and Spanish government provides subsidies as well as tax exemption to encourage people for RWH practices for residential purposes by considering the economic (1.4 Euros/m^3) and environmental (tank storage capacity 33 m^3) aspects for better outcomes in apartment-buildings located in urban areas (Domènech and Saurí, 2011; Morales-Pinzón *et al.*, 2012, 2014) On contrary, Angrill et al. (2016) found that roof tank storage capacity depend on the rainfall rate and water demand in particular area to optimize the RWH practices.

Therefore, proper regulations for dense urban planning are one of the key solutions to conduct RWH practices optimally. Further, RWH practice gained popularity in different European countries such as Switzerland, Portugal, Denmark, Austria, Italy, Belgium and Sweden due to their economical installation and improving the water scarcity along with sustainable development (Godskesen *et al.*, 2013; Yannopoulos, Giannopoulou and Kaiafa-Saropoulou, 2019). However, the USA authorities also used roof RWH systems for island communities and residential purposes in which 5.3% water used for domestic purposes, 1.1% of houses entirely depend on roof RWH which fall under the risks associated with water contamination due to *Cryptosporidium spp.* which cause severe health issues, US authorities implement new policies to ensure the safety as well quality of the drinking water (Crosset et al., 2008; Meehan & Moore, 2014; Kirs et al., 2017). Similarly, Brazil and China also encounter the risks associated with the water quality of roof RWH and establish standards for

RWH practices to ensure the public health safety while consumption for domestic purposes (Marcynuk et al., 2013; Liu et al., 2016).

Although, countries understand the importance of RWH practices to address water scarcity and launched different RWH programs to boost RWH practices like *"Isla Urbana"* of Mexico, *"Rainshare"* of UK and *"Akash Ganga"* & *"Jal Shakti"* of India (Sustainable Innovations, 2014; Campisano et al., 2017; Ministry of Jal Shakti, 2023). In India, community based RWH systems were popular in Rajasthan namely *Johads* to meet the water demands and RWH practices significantly improve the ground water depletion of Rajasthan (Cochran & Ray, 2009; Krishna et al., 2020). The RWH practices were followed widely in different areas of India such as Nagaland, Himachal Pradesh, Himalayan regions, Mumbai, Bengaluru etc. to meet high water demands in households and agricultural purposes (Borthakur, 2009; Sharma and Kanwar, 2009; Bhattacharya, 2015; Clark *et al.*, 2017; Mishra, B.K. and Rao, 2020; Harshita Bhat and Abraham, 2021).

Specifically, in Bangaluru water supply and sewerage board had made RWH practices mandatory as per RWH regulations, 2009 which helps the urban population to meet their addition water demands and 94% household have adopted RWH practices out of compulsion and 81% did not follow proper technical procedures (Umamani & Manasi, 2013; Bhat & Abraham, 2021; Soundarya et al., 2021). Therefore, it is important to understand the reasons and drawback associated with the adoption of RWH practices across the globe.

1.16 Adoption of Rainwater Harvesting Practices

Some studies focused on the adoption of rainfed model in agricultural sector mainly for developing nations which mainly examined the socio-economic aspects such as age, income, experience, government participation, education, family size of farmers (Recha et al., 2015; Rozaki et al., 2017). On contrary, Mango et al., (2017) emphasized on the different categories of the farmers based on socio-economic status as well as land and critical role of awareness, social capital, knowledge among adopter and non-adopters.

However, RWH practices were mainly adopted in rural areas of Kenya due to water scarcity and several other factors such as gender, literacy, social & economic status, building capacity, training, poverty and community groups for domestic purposes (Kimani et al., 2015; Amos et al., 2016). On contrary, Mutschinski and Coles (2023) found that ineffective policy implementation and insufficient investments cause low rate of RWH adoption in Kenya which needs appropriate reforms in policy framework to achieve sustainable RWH practices.

Initially, several studies preferred dichotomous models like logit and probit to analyze the factors responsible for the adoption RWH practices or technologies in the agricultural sector (Aneani *et al.*, 2012; Ayuya, Kenneth and Eric, 2012; Asfaw and Neka, 2017) whereas, some studies employed various kinds of censoring & truncated models like Tobit and Heckman to investigate the impact of irrigation technology adoption on farmers' livelihood, crop productivity, socio-economic conditions etc. (Foti, Gadzirayi and Mutandwa, 2008; Wang, Pandey and Velarde, 2012; Hailu, Abrha and Weldegiorgis, 2014).

Further, a binary logistic regression model was employed to understand the farmers decision ability towards the adoption of RWH practices, results showed that gender as well as education of family head significantly impact the adoption of RWH in rural areas of China and Ethiopia while occupation, community groups and support of NGOs significantly impact the adoption of RWH technologies in Pakistan (He et al., 2007; Asfaw & Neka, 2017; Jan, 2020).

Similarly, a binary logistic regression model was employed to analyze the adoption of RWH technology in South African households and the findings revealed that gender, income, age, social capital, education, homemade gutters, tank capacity, water quality and attitude significantly increase the adoption of RWH practices (Baiyegunhi, 2015; Lebek and Krueger, 2023). On the contrary, family size impact negatively on RWH adoption while regular training and timely drought alert increase the rate of RWH adoption (Dzvene *et al.*, 2021). However, the adoption of RWH practices in households and irrigation purposes in Ethiopia depend on distinct aspects of logit model such as prior experience, education, technology, family size, income (farmer & farm) and attitude of the consumers while socio-economic as well as psychological features improve the rate of adoption of RWH systems (Siraj & Beyene, 2017; Kelemewerk Mekuria et al., 2020). On the contrary, probit model was employed to examined the perception of farmers regarding the adoption of RWH practices in Ethiopia and Nepal, outcomes showed that apart from education, family size and income; the sense of belongingness, occupation, physical assets, weather conditions, distance of training center and farmland as well as gender (female) significantly impact the adoption of RWH technologies (Adhikari et al, 2018; Mengistu, 2021).

The Tobit model helps researchers to determine the crucial aspects of RWH adoption and the findings revealed that farm size, quality of soil, credit assess, farmer's education, age, selling output significantly impact the farmers' willingness to adopt RWH technologies (Masuki *et al.*, 2014; Wakeyo and Gardebroek, 2017; Mangisoni, Chigowo and Katengeza, 2019). Further, some studies focused on water allocation and designed a model to improve water supplies to meet the farmers' demand by considering the financial as well as social aspects that encourage farmers to adopt water management and mitigate issues regarding river pollution and optimal water distribution through the bankruptcy approach (Madani, Zarezadeh and Morid, 2014; Hatamkhani and Moridi, 2021).

However, the adoption of RWH technologies for irrigation purposes offers opportunity to farmers to survive unfavorable environmental conditions (storm flooding, drought etc.) and utilize the water resources effectively to meet their agricultural and socio cultural requirements (Gadanakis *et al.*, 2015; Timothy *et al.*, 2022). Furthermore, studies focused on the RWH system adoption for households to improve the water sources and utilization for different purposes like drinking, washing, cleaning, gardening, storing which potentially helps urban and rural people to meet the water requirements (Shalamzari *et al.*, 2016; Campisano *et al.*, 2017; Harshita Bhat and Abraham, 2021; Thakur *et al.*, 2022).

1.17 Theoretical Framework

It is essential to understand human behavior towards the adoption of RWH technologies based on different theories, such as Theory of Reasoned Action (TRA), Theory of Planned Behavior, Norm Activation Theory (NAT), Human Belief Model (HBM), Technology Acceptance Model (TAM), Social-technical Theory, and Social Cognitive Theory (SCT), which include psychological, technological, motivational, abilities, barriers, opportunities, subjective norms and social behavior of people to assess the actual adoption of the rainwater management behavior (Ward et al., 2012; Yazdanpanah et al., 2015; Arunrat et al., 2017; Aliabadi et al., 2020; Ataei et al., 2022; Savari et al., 2022; Shanmugavel & Rajendran, 2022).

However, the TPB is the modified form of TRA which focus on the behavioral changes of an individual based on the normative opinions, behavioral and control beliefs and TPB model has been widely used to understand the psychosocial behavior of an individual as it provides a deep understanding regarding the perception of human behavior (Aliabadi, Gholamrezai and Ataei, 2020; Savari, Mombeni and Izadi, 2022). The TPB model have been applied to understand water management practices in different developed and developing nations (Shojaei-Miandoragh, Bijani and Abbasi, 2020; Thakur *et al.*, 2022). The TPB model can be used to understand the psychological determinants of the RWH adoption for domestic purposes in rural as well as urban areas which helps to identify the factors responsible for the behavioral change (Fielding *et al.*, 2012; Untaru *et al.*, 2016). In contrast, TPB in association with social- psychosocial factors (attitude, subjective norms, self-identity, belief, moral and social norms) facilities to understand the reason behind the actual behavior change towards the RWH adoption which leads to sustainable reforms by altering the opinion of people (Aliabadi et al., 2020; Shojaei-Miandoragh et al., 2020; Shanmugavel & Rajendran, 2022).

However, TPB is utilized in several studies by focusing on the water conversation, recycle, recuse systems and highlighted the crucial role of the person's attitude, subjective norm, belief, knowledge, and perceived behavioral change which restrict the farmers to adopt the water management projects (Yazdanpanah et al., 2014; Tohidyan Far & Rezaei Moghaddam, 2015). In contrast, TPB was significantly employed to understand behavior intention of farmer towards irrigation (Lynne *et al.*, 1995), reuse and recycling of water (Lam, 1999; Nancarrow et al., 2008; Dolnicar & Hurlimann, 2010), water preservation & conservation water conservation (Gilg & Barr, 2006; Clark & Finley, 2007), water consumption (Cary, 2008), water tariffs (Mugabi *et al.*, 2010), predicting behavioral intention (Kaiser, 2006; Nigbur, Lyons and Uzzell, 2010) and behavior intention to adopt RWH (Aliabadi, Gholamrezai and Ataei, 2020).

Based on TRA, TAM were developed by Davis which helps to examine the user's behavioral intention to adopt new technology which were influenced by their perceived utility & ease of use (Davis, 1985) However, TAM states that perceived utility and ease of use significantly influence a user's attitude towards the technology, defined as favorable or unfavorable attitudes towards it (Davis, 1989). In other words, perceived ease of use is defined as the extent to which an individual feels that using the technology is easy to manage and desire to use the system is determined by the connection between attitude and perceived usefulness. Behavioral intention then controls actual use behavior (Davis, 1985, 1989). In 2000, Venkatesh and Davis integrated social and organizational aspects, including subjective norms, impression, quality of output, and job relevance within TAM, proposing the expanded TAM model, often known as TAM2 (Venkatesh and Davis, 2000).

TAM is a straightforward and pragmatic theoretical paradigm which gained widespread acceptance in various domains such as E-learning (Masrom, 2007), ecological conservation (Rezaei, Safa and Ganjkhanloo, 2020), water conservation (Rasoulkhani *et al.*, 2018) and RWH technologies (Willy and Kuhn, 2016). Some studies highlighted the reason behind technology non-acceptances such as lack of education, poor infrastructure, privacy concerns, ease of use, complexity, cultural difference, age, perceived risks etc. (Gupta, Dasgupta and Gupta, 2008; Ejiaku, 2014; Tortorella *et al.*, 2020). Similarly, adoption of RWH technologies depend on various factors like gender of household head, age, water demand, neighborhood acceptance, education (Willy and Kuhn, 2016; Mangisoni, Chigowo and Katengeza, 2019). Therefore, acceptance and non-acceptance of RWH technology mainly depend on the behavioral intention of the farmers as well as household owners, benefits and usefulness of the technology also significantly impact the adoption practice (Senkondo *et al.*, 1998; Willy and Kuhn, 2016; Wakeyo and Gardebroek, 2017; Mangisoni, Chigowo and Katengeza, 2019).

Further, HBM theory emphasizes the role of an individual's perspective in generating motivation, facilitating action, and shaping behavior by considering two dimensions of health behavior which includes perceived risk and behavior evaluation (Vassallo *et al.,* 2009; Yazdanpanah *et al.*, 2015). In contrast, HBM theory mainly focused on the belief regarding the health or perceived behavior of an individual towards health protection from illness which can be occurred due to poor quality of rainwater consumption in domestic purposes (Aliabadi, Gholamrezai and Ataei, 2020).

In other words, the theory of HBM comprises seven categories related to behavioral persistence which mainly consist of perceived severity, benefits, self-efficacy, belief, barrier, susceptibility and cue to action (Tajeri Moghadam et al., 2020). The perceived severity focuses on the seriousness of the issue which can cause severe health problems. Further, perceived susceptibility is related to the health which encourage the people to ensure health safety by adopting the health sensitive behavior. The perceived barriers refer to the mental health and belief towards the recommended behavior. Perceived benefits and cue to action were associated with the belief related to the effectiveness of the performed actions. The perceived self-efficacy refers to the ability of an individual to adopt a certain behavior (Aliabadi et al., 2020; Yazdanpanah et al., 2015).

According to HBM theory, an individual is likely to engage in the recommended behavior when (i) understands the need of the water resources as critically compromised, (ii) considers the status of water resources a significant concern, (iii) believes to adopt sustainable water management practices, (iv) encounters minimal obstacles to performing the behavior, (v) anticipates receiving incentives for the behavior, and (vi) possesses a sense of self-efficacy, confidence and ability to perform the adoption behavior (Aliabadi et al., 2020; Straub & Leahy, 2014; Tajeri Moghadam et al., 2020). Further, HBM helps to examine the behavior change based on the perceived belief, benefits, challenges and susceptibility towards adoption of RWH (Bay & Heshmati, 2016; Aliabadi et al., 2020). On contrary, HBM showed that knowledge regarding quality of water and individual’s attitude significantly impact the adoption of RWH practices (Walekhwa *et al.,* 2022).

Further, researchers believe that the connections between norms and behaviors strengthen among individuals when they exhibit greater understanding of the outcomes and a sense of accountability for their actions (De Groot and Steg, 2009). The Norm Activation Theory (NAT) includes various aspects such as perceived behavioral control, awareness, responsibility, self-efficacy, moral and personal norms (belief, motivation, attitude) (Ataei *et al.*, 2022). In NAT was first developed in the context of altruistic behavior, later utilized for ethical and environmental studies such as tourism & localities behavior towards a responsible environment (Confente and Scarpi, 2021), pro-environment behavior of farmers (Hallaj *et al.*, 2021), Pest management by farmers (Rezaei *et al.*, 2019) and water crisis (Savari *et al.*, 2021).

The NAT has been supported by several empirical studies which focus on sense of ethical obligation towards environmental conservation or environmentally responsible behavior which include an individual's attitudes and beliefs (Rezaei *et al.*, 2019; Confente and Scarpi, 2021; Hallaj *et al.*, 2021; Savari *et al.*, 2021). Robust personal norms possess an intrinsic individual’s motivation to save the environment and have a significant role in environmental protection while moral norms directly influence the people engagement in environmental behaviors, while awareness also helps to improve the responsibility towards sustainable environmental behavior (Wan, Shen and Yu, 2014; Ataei *et al.*, 2022). However, an individual's awareness reflects their recognition of issues and their responsibility towards the pro-environmental behavior (De Groot and Steg, 2009; Confente and Scarpi, 2021; Savari *et al.*, 2021). Conversely, in NAT the social differentiation among individuals is analyzed based on responsibility while denial of responsibility denotes the tendency of people to reject their responsibilities and outcomes their actions like water conservation for the well-being of farmers (Savari *et al.*, 2021).

Although, Social cognitive Theory (SCT) includes dynamic behavior of the people which is uncertain or changes over a period of time, SCT also helps to examine the socio-psychological behavioral changes within an individual and possible reason for the behavioral change (Ratten and Ratten, 2007; Yazdanpanah *et al.*, 2015). Initially, the SCT was developed by Bandura to explore the health behavior of an individual to promote health education(Bandura, 2004), later SCT employed for different domains such as drug advertising (Young, Lipowski and Cline, 2005), technological innovation (Ratten and Ratten, 2007), saving electricity in domestic purposes (Thøgersen and Grønhøj, 2010), sustainable consumption (Phipps *et al.*, 2013), e-government acceptance (Rana and Dwivedi, 2015), pro-environmental behavior (Sawitri, Hadiyanto and Hadi, 2015) and water conservation behavior (Valizadeh *et al.*, 2019) to understand the psycho-social characteristics (behavior, effect and action). However, SCT consist of several components such as self-efficacy, behavioral intention, outcome expectancy, socio-structural aspects and perception of other behavior (Shahangian, Tabesh and Yazdanpanah, 2021). In contrast, self-efficacy is most significant aspect of behavior intention and SCT showed 61% variation in behavior intention and 41% variation in perception of other's behavior (Shahangian, Tabesh and Yazdanpanah, 2021). Further, SCT for water conservation behavior gain significant popularity due to water shortage problems in urban and rural areas of developing countries which promote the water recycling projects to meet the urban water demands and save electricity tariffs in households (Thøgersen and Grønhøj, 2010; Hou *et al.*, 2021). In addition, some studies focused on the water efficiency to improve the water quality as well as additional water demands of farmers by constructing useful infrastructure for irrigation purposes and spread social awareness regarding the water conservation programs and associated benefits in urban households for their future generations (Hou *et al.*, 2021; Shahangian, Tabesh and Yazdanpanah, 2021). In contrast, SCT develop trust, positive belief and social awareness among the people to adopt water conservation technologies (Valizadeh *et al.*, 2019).

Similarly, Social-technical theory (STT) developed by considering the mutual effort of social and technological aspects in which humans are associated and use of technology based on human social behavior (Adler and Docherty, 1998) In contrast, this theory integrates the human social/psychological aspects as well as technological aspects to improve the quality of life along with organizational development by considering the SCT aspects in business practices(Appelbaum, 1997; Ellison, Pyle and Vitak, 2022). The SCT may employed in various domains such as business practices (Adler and Docherty, 1998), organizational development (Appelbaum, 1997), social intervention in market (Moor, 2012), social media for health (Munson *et al.*, 2013), retail banking (Durkin, Mulholland and McCartan, 2015), social marketing to solve the socio-cultural issues (Kennedy, 2016), social media adoption (Wan et al., 2017), social marketing to address obesity (Kemper and Ballantine, 2017) and well-being scholarship (Ellison, Pyle and Vitak, 2022). Therefore, STT also helps to determine the social as well as technical aspects related to social marketing which facilitates to understand the social, societal & individual perspective for their behavior change (Francis and Taylor, 2009; Withall, Jago and Fox, 2012; Kennedy, 2016; Kemper and Ballantine, 2017; Kassirer *et al.*, 2019)

1.18 Factors Influencing Rainwater Harvesting

In this section, various influencing factors have been discussed which impact the adoption of RWH. This section mainly focusses on the social marketing aspects, perceived barriers & challenges involved in the adoption of RWH systems for agriculture as well as households in rural and urban areas. In addition, motivating factors, technical or ability to use RWH systems and associated opportunities with the adoption of RWH practices

Social marketing factors

The term "Social marketing" (SM) initially introduced to address the social issues at administration level (Kotier and Zaltman, 1971). It was a holistic strategy to understand and resolve the problems related to health, social psychology, environmental etc. through community practices (Withall, Jago and Fox, 2012; Kassirer *et al.*, 2019). In other words, Social marketing is defined as "the use of marketing principles and techniques to influence a target audience to voluntarily accept, reject, modify, or abandon a behavior for the benefit of individuals, groups or society as a whole" (Speller, 2003). According to Francis and Taylor (2009), SM theory involves a cyclic procedure which includes people social opinion, societal & individual benefits and behavior change. Although, SM employed the fundamental principles of the "marketing mix", which includes four Ps, namely, promotion, place, product, and price, to gain social benefits (Chhabra et al., 2011; Mayasari, 2012). In contrast, SM improves the prior information of an individual and creating social influence to adopt the technology which is made for societal benefit and create awareness among the people which improve the RWH practices (Samaddar, Murase and Okada, 2014).

Even, SM offer opportunities, barriers and spreading the awareness among adopters regarding RWH technology which influence the people's behavior change to adopt RWH (Gilbertson, Hurlimann and Dolnicar, 2011; Samaddar, Murase and Okada, 2014). In addition, SM factors such as marketing mix, behavior objectives, social innovation, competition, audience segmentation, exchange and formative research regarded as prominent tools for assessing the behavior change among the population belongs to difference age groups (Carins and Rundle-Thiele, 2013; Alsharairi and Li, 2024). However, Social marketing is a strategy designed to promote welfare at the personal, societal, and communal levels. It encompasses the formulation and implementation of marketing ideas to affect people, communities, organizations, and society for sustainable social transformation and modern SM strategies include strategic policies, services, communities and personal levels to promote societal well-being (Dao Truong, 2014; Zainuddin and Russell-Bennett, 2017).

Further, SM approach significantly influence the individual's behavioral changes associated with social networks (SN) and existing studies were focused mainly on biofuels, financial activities, innovation, energy and effective water management (Schot and Geels, 2008; Ter Wal and Boschma, 2009; Wen *et al.*, 2015). In contrast, SN includes the individual and community belief, decision, support, willingness towards social innovation within a social system which helps to adopt the RWH practices for the benefit of people to meet the water shortage in their households (Domènech & Saurí, 2011; Samaddar & Okada, 2008). According to (Domènech and Saurí, 2011) the social marketing helps to increase the rate of adoption of RWH practices by creating awareness, spreading useful knowledge, benefits, improving social learning, social experience and motivate the people to adopt RWH practices in households.

The social marketing approach is significantly effective in health domain in which social marketing facilitates the large scale promotional programs to improve the patients' health and also provide effective knowledge to prevent the spread of communicable & non-communicable diseases by creating awareness among the people (Williams *et al.*, 1998; Grier and Bryant, 2005; Christie and Venter De Villiers, 2023). In contrast, Christie & Venter De Villiers, (2023) found that social marketing significantly impact the quality of life of an individual where social (community perception, environment, friends, family, neighbors, society) as well as personal (attitude, belief, subjective norms) aspects help to shape the behavior change towards the sustainable consumption.

However, social marketing is also used for macro businesses to improve the social awareness among the people and change the social behavior of the people towards the obesity (Kennedy, 2016; Kemper and Ballantine, 2017). Particularly, the SN helps the large scale population (neighbors, society, friends, spatial groups etc.) to understand the social benefits of water infrastructure like RWH and enable relevant knowledge/awareness regarding social issues, environmental impact, innovations which shape the adoption & non-adoption decisions of the audience by providing holistic understanding related to the revolutionary technologies similar to RWH (Samaddar, Murase and Okada, 2014; Ward and Butler, 2016).

Perceived barriers and challenges

Several studies were conducted in different countries to identify the key barriers and challenges associated with RWH installation in domestic purchases (Villarreal & Dixon, 2005; Cowden et al., 2006; Kumar et al., 2006). Further, He et al. (2007) found that age and technology knowledge regarded as major challenges in the adoption of RWH in irrigation purposes. Moreover, the perception of the people towards water quality, hygiene, safety and usability of stored rainwater was also identified as a questionable factor that creates a doubt among people in accepting any decentralized water system for the essential uses (Bulteau, Laffitte and Marchand, 2011; Mankad and Tapsuwan, 2011). Especially, in remote areas where people intention varies with the community interest, attitude, moral norms, family needs, education, appropriate knowledge of the technology, social and financial background which become a barrier for the acceptance of the RWH (Kimani, Gitau and Ndunge, 2015; Shalamzari *et al.*, 2016). Further, people also faced social barrier due to lack of awareness regarding the RWH systems and insufficient training to handle the technology (Campisano *et al.*, 2017), some studies found people faced economic barrier due to poor financial background and do not have sufficient funds to install RWH systems on their rooftop (Mankad and Tapsuwan, 2011; Amos, Rahman and Gathenya, 2016), some studies observed institutional barriers due to lack of governmental support and lack of appropriate promotion of the RWH practices, people remain unaware from the benefits of the technology and showed no interest in the RWH adoption (Campisano et al., 2017; Kumar et al., 2016; Shalamzari et al., 2016).

Some studies found that poor technology usage or implementation, lack of technology knowledge, lack of awareness, lack of confidence significantly restrict the adoption of RWH practices in rural areas (Borthakur, 2009; Shalamzari *et al.*, 2016; Harshita Bhat and Abraham, 2021). Some studies focused on the water quality issues, attitude, low-income and critical infrastructure as a major barrier to invest on RWH technologies which significantly reduce the rate of adoption (Kumar et al., 2016; Savari et al., 2022; Velasco-Muñoz et al., 2019). Further, studies found that lack of space in urban areas and periodic maintenance cost restrict the adopter to accept RWH systems and people with low-income group shown less interest in new technology implementation (Singh and Ravindranath, 2006; Shalamzari *et al.*, 2016; Hang and Huong, 2019).

However, the installation of RWH systems in households was found to be impacted by intermediary organizations, finance sponsors/financial availability, life course dynamics and land tenure (Staddon *et al.*, 2018). In contrast, RWH and reuse of water was helpful in domestic purposes as well as irrigation processes and adoption of RWH was influenced by several factors such as cost-benefit ratio, awareness, knowledge, maintenance & usability of RWH system, tenancy regime of farms, harvesting capacity, storage capacity, water productivity, infrastructure & technology support and availability of alternative water sources for the farm (Velasco-Muñoz et al., 2019; Aliabadi et al., 2020).

Further, factors like installation cost, maintenance efforts, lack of knowledge and lack of observation were identified as major barriers and challenges affecting consumer’s perception towards adopting RWH systems (Bhat & Abraham, 2021; Alam et al., 2022). López-Felices et al. (2023) found that farmer's age, income, education, perceived risk of technology usage become key barriers in the adoption of RWH systems in agricultural purposes. Further, social perception, awareness, usability and sustainability of the RWH systems significantly influenced the perception of the consumers while adopting the RWH in domestic purposes (Burszta-Adamiak and Przybylska, 2024; Huq, Rahman and Hasan, 2024; Zhou, Matsumoto and Sawaki, 2024).

Motivational factors

The education and high income facilitates the farmers to understand the modern RWH practices and also motivate them to adapt RWH practices for better productivity (Asfaw & Neka, 2017; Mango et al., 2017). In semi-arid areas, RWH practices help people to save water resources in households and reuse the water to fulfil their water requirements, people showed positive attitude towards the RWH technologies which motivate them to adopt the RWH systems (Recha, Mukopi and Otieno, 2015; Savari, Mombeni and Izadi, 2022; Thakur *et al.*, 2022). The local government use effective promotional programs to create awareness among the rural people regarding to environmental benefits of RWH and provide adequate knowledge related to RWH technologies which encourage the residents to adopt RWH practices in their households (Campisano *et al.*, 2017; Harshita Bhat and Abraham, 2021).

Government and NGOs offered subsidies to farmers and residents for installing RWH systems to meet the water shortage in rural and urban areas and utilize the water for drinking as well as other purposes which encourage the people to adopt RWH practices on larger scale (Campisano *et al.*, 2017; Harshita Bhat and Abraham, 2021). The low maintenance and easy installation of RWH systems on the rooftop of households help residents to mitigate the water scarcity issue which boost the confidence of the people to adopt water conservation practices (Debusk and Hunt, 2014; Shalamzari *et al.*, 2016; Qi *et al.*, 2019).

Some studies found that financial aids from government and employment opportunities to local people increase the interest in RWH projects which leads to greater adoption of RWH technologies (Krishna et al., 2020; Shalamzari et al., 2016; Subedi et al., 2020). Researchers also noticed that people belongs to stable income group showed more interest in the adoption of RWH, good financial background motivate people to invest in new technologies in rural and urban areas (Sivanappan, 2006; Cochran and Ray, 2009; Amos, Rahman and Gathenya, 2016). Although, the social and psychological aspects such as perceived belief, attitude and subjective norms shape the behavior intention of the people to adopt the water saving strategies which motivate other to adopt RWH practices for agriculture and domestic purposes (Cowden et al., 2006; Gilg & Barr, 2006; Kumar et al., 2006; Samaddar et al., 2014; Velasco-Muñoz et al., 2019).

Some studies found that proper education and training improve the understand of the people regarding RWH technologies, awareness programs in rural areas boost the confidence of the local people and sustainable benefits of RWH systems motivate the people to adopt RWH practices in their households (Kumar et al., 2016; Shalamzari et al., 2016; Sharma & Kanwar, 2009). The RWH technology significantly help to develop a sustainable approach for water saving, people feel motivated towards the adoption of RWH systems due to the solution of issues of flooding, droughts up to some extent and water shortage in urban and rural areas (Recha, Mukopi and Otieno, 2015; Velasco-Muñoz *et al.*, 2019).

An understanding of technology helps farmers and residents to utilize RWH projects optimally which encourage other people to adopt such technologies for the betterment of environment and meet their water demands without paying extra tariffs on water usage (Mankad and Tapsuwan, 2011; Debusk and Hunt, 2014; Amos, Rahman and Gathenya, 2016). Some studies found that people demographics, social behavior, infrastructure, belief and intention to use technology significantly motivate the people to adopt RWH practices in households (Lam, 1999; Fielding *et al.*, 2012; Sheikh, 2020). However, the financial support offered by the local authorities/government, reduction of electricity bills, age of RWH, tank capacity, water pricing were the influential factors that encourage the consumers to adopt the RWH systems for domestic usage (Dudkiewicz and Ludwińska, 2023; Islam, 2023).

Technical abilities

Sustainable RWH technology for urban areas helps to mitigate the issue of water scarcity in which technological abilities support the RWH practices through different rainwater collection systems such as photovoltaic, Soil & tree root, humidity and nano-sponge based systems (Javier et al., 2012; Song et al., 2018; Kim, 2020; Kamali et al., 2022). On contrary, the smart RWH systems improve the overall hydric stress and ground water depletion using IoT and artificial intelligence based real time tracking in Mexican cities (Alvarez, Flores-De-La-Mota and Anguiano, 2024). Considering the advancements in technologies to support the upcoming projects on RWH systems in India the expected number of households for adoption of RWH in urban Bengaluru is likely to increase due to on IoT and GIS based RWH technologies which provides real time monitoring of the water tank and other useful features (Bhanu & Ramaswwamyreddy, 2017; Reddy, 2020).

Similarly, rural households face the issue of water shortage in developing nations like India which need to adopt sustainable technology like RWH systems which would improve water resources without hindering the environmental balance (Bhattacharya, 2015; Van Mechelen, Dutoit and Hermy, 2015; Burszta-Adamiak and Przybylska, 2024). Some studies found that multi stakeholders keep the technology adoption process complicated but RWH technology provides ability to use sustainable solution for meeting the water demands in agriculture and households in rural as well as urban areas (Rezaei-Moghaddam, Karami and Gibson, 2005; Bhattacharya, 2015; Aliabadi, Gholamrezai and Ataei, 2020).

The RWH technology offers key solution for households (Beirne *et al.*, 2021; Puppala *et al.*, 2023) to meet the water scarcity issue (Kingsborough, Borgomeo and Hall, 2016; Nachshon, Netzer and Livshitz, 2016) by providing flexible infrastructure such as roof RWH, flood run-off collection, surface run-off harvesting, in-situ RWH and studies observed that most of the household preferred to install rooftop RWH systems due to ease of installation, low cost structure, low maintenance, effectively meet the additional water needs of households other than drinking (Mati, 2006; Puppala *et al.*, 2023).

People found that RWH systems were easy to install and operate at households due to sufficient training, knowledge and education provided by the local authorities to the residents for the optimal use of RWH practices in urban and rural areas (Sivanappan, 2006; Borthakur, 2009; Jasrotia, Majhi and Singh, 2009; Thakur *et al.*, 2022). In contrast, Puppala et al., (2023) found that various factors were involved such as technology awareness, knowledge, subsidies, financial support, attitude, intention to use, subjective norms, ecological responsibilities, perceived usefulness social trust on technology and ease of use/installation which encourage the residents to adopt RWH technologies and improve their abilities use to new technology.

Practical opportunities

RWH facilities farmers for crop diversification to meet the growing demands of consumers and generate high income (Subedi et al., 2020; Assefa et al., 2021). The construction of RWH infrastructure in rural and urban areas increase the employability and economic activities which provides financial opportunities to laborers to improve their income (Hatibu et al., 2006; Kirsten & Moldenhauer, 2006; Shively & Sununtnasuk, 2015). In contrast, employment and financial support in RWH projects is one the significant practical opportunities that attracts the small farm households to adopt RWH technology (Osei Danquah, 2019). Further, the technology improves the ease of RWH operations and offer real time monitoring of data which minimize the losses while working in the farms and also offer an opportunity to farmers to increase their profitability (Javier et al., 2012; Bhanu & Ramaswwamyreddy, 2017; Song et al., 2018).

However, RWH systems also help to mitigate the issue of urban flooding and preserves water for domestic purposes in urban and rural areas (Sivanappan, 2006; Raimondi & Becciu, 2014; Jamali et al., 2020). In contrast, RWH significantly reduce up to 28.66% of flooding and people consider RWH technologies as an opportunity to meet their additional water demands for agriculture and domestic purposes like an alternative source of water (Akter, Tanim and Islam, 2020). The implementation of effective policies significantly improve the utilization of RWH, wastewater recycling and reuse of water for domestic purposes which helps to save up to 30%-40% of water pricing in Indian urban households (Ramakrishnaiah, 2014; Gopalappa, 2015)

RWH technologies includes several practical opportunities for the stakeholders in terms of economic, social opportunities, environmental benefits, employability, education, socio-psychological (Aladenola & Adeboye, 2010; Amos et al., 2016; Binney et al., 2006; Campisano et al., 2017; Cochran & Ray, 2009; Kumar et al., 2016; Velasco-Muñoz et al., 2019). Further, the adoption of RWH practices also can reduce the dependency of residents on the availability of freshwater resources and helps to minimize the groundwater depletion (Krishna et al., 2020; Mankad & Tapsuwan, 2011; McDonald et al., 2014; Thakur et al., 2022). However, RWH practices on larger scale facilities in water conservation and also minimize the adverse effects associated with water scarcity like ground water depletion, environmental pollution, water pollution, water logging etc. (Burns et al., 2014; D. Kumar et al., 2006; Lynne et al., 1995; Villarreal & Dixon, 2005; Zhang et al., 2012).

However, the use of roof RWH practices by installing rainwater storage tanks with high capacity solve the issue of soil erosion and also installing RWH systems in farm lands significantly resolve the issue of water shortage while land cultivation, crops with additional water requirements (He, Cao and Li, 2007; Lani, Yusop and Syafiuddin, 2018; Teston *et al.*, 2018; Sheikh, 2020; Preeti, Haddad and Rahman, 2022; Timothy *et al.*, 2022; Walekhwa *et al.*, 2022). For semi-arid as well as arid areas while droughts are highly prominent and people were facing the water scarcity issue, RWH practices emerge as potential solution to provide opportunity to residents to install roof RWH system to meet the water requirements and in urban areas RWH is best alternative to fulfil the additional water demands (Kumar, Ghosh and Ankit, 2006; Debusk and Hunt, 2014; Bhattacharya, 2015; Osei Danquah, 2019; Burszta-Adamiak and Przybylska, 2024). On contrary, some studies found that RWH is not effective in semi-arid as well as arid areas due to extremely low rainfall, low dependability on RWH systems due to lack of awareness, less supports for the local authorities, lack of financial assistance, lack of training, skill workers, perceived beliefs, intention to use new technology and proper knowledge and higher installation costs (Ammar et al., 2016; Qi et al., 2015)

1.19 Research Gaps

There is a lack of knowledge among the local people towards the benefits of RWH processes. This arises from the pre conceived lack of trust and observation about the storage, maintenance and health risks associated with the water obtained from a decentralized water system (Alam et al., 2022; Bhat & Abraham, 2021; Bulteau et al., 2011). The lack of knowledge creates a mental barrier in accepting the rainwater harvesting system as the primary water source for families/households in India (Bhat & Abraham, 2021). Research findings also revealed that majority of people have opted RWH system in their houses out of compulsion and not by choice (Bhat & Abraham, 2021; Umamani & Manasi, 2013).

The benefits of having a RWH system were studied by researchers which includes water expenditure and annual savings were found to increase after installation of RWH systems in t urban and rural households (Sivanappan, 2006; Fielding *et al.*, 2012; Aliabadi, Gholamrezai and Ataei, 2020) . Many studies covered the socioeconomic factors affecting the adoption of RWH systems in developed and developing (Kirsten and Moldenhauer, 2006; Kumar, Ghosh and Ankit, 2006; Meehan and Moore, 2014; Akter, Tanim and Islam, 2020). It was found from the literature review that the benefits of RWH programs need to be emphasized upon in order to make more people adopt the RWH systems to mitigate the water scarcity issues (Leidl, Farahbakhsh and Fitzgibbon, 2010; Steffen *et al.*, 2013; Thomas *et al.*, 2014; Lani, Yusop and Syafiuddin, 2018).

Most of the research on RWH were on implementation and assessment of factors that affect the adoption of RWH systems in urban Bengaluru is limited (Ramachandra, 2016). Even, studies on publicizing the benefits of RWH and improving awareness among people were also scarce (D’Souza and Nagendra, 2011). This conveys the urgent need of spreading information and awareness among the public. Using a modern technological tool like “social marketing” for improving the awareness among people for adoption of RWH system can be beneficial (Grier & Bryant, 2005; Speller, 2003; Zainuddin & Russell-Bennett, 2017). Increased awareness and increased publicity of the about the public and private benefits of RWH systems and social marketing approach was found to be used in several social issues like health education, awareness and many other social benefits (Bennett and Rundle-Thiele, 2002; Dao Truong, 2014; Christie and Venter De Villiers, 2023).

Considering the fact that social marketing approach has been successfully used in other studies to curb social issues and make significant improvements is an identified gap that can be incorporated in the present research. Social marketing approach has been used since decades with a goal of societal benefit. It has been used in the field of public health, environmental protection and political marketing and has showed remarkable success (Smith, 2006). Existing studies were mainly discussed the social benefits of the awareness related to the water conservation strategies (Yan, McManus and Duncan, 2019; Christie and Venter De Villiers, 2023). But most of the studies were lagging to explain the merits of actual behavioral changes due to social marketing in the Indian context.

Prior studies have investigated the role of social norms to understand the behavioral intentions of the people (Chen et al., 2019). A limited number of studies have focused on the benefits of the social marketing for the effective implementation of domestic RWH systems (Chhabra et al., 2011; Yan et al., 2019). Therefore, a study an empirical study is required to explore the critical aspects of social marketing (belief, attitude and subjective norms) for the behavioral intention to adopt rainwater harvesting practices in household. In addition, the moderating role of motivation, barriers, ability and opportunity between behavioral intention and actual behavioral change to adopt rainwater harvesting in Indian context.

1.20 Development of Hypotheses and Conceptual Framework

Behavioral change can be achieved with adequate education or knowledge related to the technology adoption. The education improves the understanding towards rational facts and encourage individuals to change their perceived perception towards technology which provides a new perspective to the adopters before the adoption of any new technology. (Rao, 2014). According to new trends the RWH systems are promoted by highlighting their social benefits. The awareness regarding subsidies on social platforms become effective to change the behavior. The incentive and financial assistance awareness related to RWH systems; people motivated to install of these systems. Local norms also an effective way to promote the advantageous of RWH systems among the people which is supported by awareness campaigns launched by the state authorities. These social campaigning motivate the residents to install RWH systems on their building (Liaw and Chiang, 2014). Despite the various merits of RWH systems, some municipalities reported that rainwater is hardly used for all the indoor activities like toilet flushing, laundry, cleaning etc. (Domènech & Saurí, 2011). In contrast, the Karnataka's state government launched RWH Application (RWH Advisor) at Water Festival 2016 which was developed in collaboration with UNESCO to create social awareness among the residents related to benefits of RWH (Rudrappa Shivakumar, 2018).

According to TPB, individuals' behavioral intentions mainly depend on the attitude, subjective norms, control behavior and beliefs system (Ajzen, 2001). However, normative belief pertain to the perceived behavioral intentions of a person or community and the integration of motivation along with an individual beliefs shape the subjective norms while subjective norm considered as the perceived social pressure on an individual to involve or not involve in a particular activity based on the perceived belief system (Ajzen, 2001; Aliabadi, Gholamrezai and Ataei, 2020). However, the actual behavioral change depend on the normative as well as control beliefs which includes different factors such as personal, conditional and cultural (Cary, 2008; Tohidyan Far and Rezaei Moghaddam, 2015). In addition, the perceived belief of local authorities as well as communities towards the water conservation technology helps the people to adopt RWH and increase the participation towards irrigation (Lam, 1999; Nigbur, Lyons and Uzzell, 2010; Gilbertson, Hurlimann and Dolnicar, 2011). Although the perceived trust and belief on the agricultural experts showed positive participation of the farmers towards the water management (Cary, 2008; Tohidyan Far and Rezaei Moghaddam, 2015; Wen *et al.*, 2015). Therefore, following hypothesis is formulated:

H1: Residents' beliefs about RWH influence behavioral intention to adopt RWH.

Attitude of an individual refers to a particular behavior which involves analysis of both positive and negative emotions which act as an excellent predicator for determining the real purpose behind the certain behavioral actions (Hyytiä and Kola, 2006; Min, Ji and Qu, 2008). Some studies showed that attitude is a latent concept or conditional which may vary based on the favorable circumstances, attitude of a person can encourage them to perform a specific behavior which shows the behavioral intention of an individual towards the adoption (Hyytiä and Kola, 2006; Malek-Saeidi, Rezaei-Moghaddam and Ajili, 2012) The adoption of agricultural technologies like RWH depends on the farmer's attitude and prior studies showed that positive or negative attitude of an individual towards a new technology, significantly effects the rate of adoption (Rezaei-Moghaddam, Karami and Gibson, 2005; Rezaei-Moghaddam and Salehi, 2010). According to TPB, the behavioral intention an individual significantly influenced by their attitude and encourage the person to perform a particular behavior (Kaiser, 2006; Nigbur, Lyons and Uzzell, 2010; Tohidyan Far and Rezaei Moghaddam, 2015). For example, the farmers showed negative attitude towards the RWH due to lack of technology and inequality of water supplies which negatively impact the adoption of RWH systems (Yazdanpanah *et al.*, 2014, 2015). Conversely, people showed positive attitude towards the adoption of RWH in households which significantly increase the participation of the community groups and residents (Aliabadi, Gholamrezai and Ataei, 2020; Savari, Mombeni and Izadi, 2022). Similarly, some studies found that adoption of water management projects depend on the behavior intention of the people which directly or indirectly involve the attitude of an individual towards the acceptance (Sivanappan, 2006; Malek-Saeidi, Rezaei-Moghaddam and Ajili, 2012; Ward *et al.*, 2012). Therefore, following hypothesis is formulated:

H2: Residents' attitudes about RWH influence behavioral intention to adopt RWH.

Subjective norm refers to an individual perception regarding what other people thinks while performing a particular behavior (Min, Ji and Qu, 2008) and actual behavioral change denotes the degree to which an individual has the appropriate abilities, resources, and other essential criteria to perform certain behaviors (Tohidyan Far and Rezaei Moghaddam, 2015; Untaru *et al.*, 2016). In contrast, successful change in behavior relies on positive intent as well as adequate level of behavioral control in which subjective norms involves an individual's person's belief towards a specific behavior (Aliabadi, Gholamrezai and Ataei, 2020).According to (Lam, 1999), subjective norms refer to guidance that encourage an individual to execute an action. The behavioral intention of an individual is significantly influenced by the subjective norms (Fishbein and Ajzen, 2011). Several studies highlighted the crucial impact of subjective norms on eco-friendly behaviors. Marcos et al. (2021) examined the critical role of subjective norms to perform water conservation. The findings revealed that individuals showed strong behavioral intention towards water conservation strategies. However, Kim and Seock (2019) found that social norm also shown significant on water conservation strategies. The social norms encourage the individual to increase participation in the sustainable activities which build up the social image of an individual. The social norm also influences the purchasing and investing behavior of an individual which encourage the people to invest on the sustainable projects like RWH (López-Mosquera, García and Barrena, 2014). Several evidence based studies found that subjective norms impact positively on individual's engagement towards sustainable behavior (Mair and Bergin-Seers, 2010; Reese, Loew and Steffgen, 2014). Therefore, following hypothesis is formulated:

H3: Residents' subjective norms about RWH influence behavioral intention to adopt RWH.

The behavioral intention of the adopters may influence through different factors which includes gender, education, attitude etc. (Berk et al., 1993; Campbell et al., 2004; Hamilton, 1983; Sidibé, 2005; Willis et al., 2011). Researchers found that environmental conditions also influence the perceived perception of an individual (Swim *et al.*, 2009). In addition, concerns related to rainfall and climate change impacts the behavioral intention of an individual (Semenza *et al.*, 2008). Clark and Finley (2007) examined the correlation among individual's awareness related to water conservation and adoption behavior. The finding revealed that people with adequate awareness related to water conservation and their benefits. They adopt the WMS and encourage others to adopt the technology for their future generations (Kaiser, Wölfing and Fuhrer, 1999). The water conservation strategies are highly significant for farmers. Kahsay et al., (2019) found that actual behavioral change of farmers happened due to perceived shortage of rainfall, whenever, farmers concerning about the crop damage due to low rainfall. They showed willingness to adopt the WMS / RWH systems to maintain their productivity (Slegers, 2008). According to Yu (2022) adoption expressed as a cognitive process in which an individual analyses the information and rationally considered the facts and decide the final adoption or rejection. In contrast, White (2010) explained the adoption process by classifying into five basic phases such as knowledge phase, persuasion phase, decision phase, implementation phase and confirmation phase. However, the individual's interaction with different social communities helps to build-up the social networks which motivate people to coordinate and share resources together. These social interactions improve the possibility of behavioral change and likelihood to adopt new technologies (Ali *et al.*, 2007; Hansen and Roll, 2017).

However, people in developed countries were motivated to adopt RWH system by establishing regulations in their local governments to support the sustainable solution for meeting the resilience in the water supplies (Campisano et al., 2017). The planned used of rainwater always provide benefit to the mankind and RWH is practiced in various developing nations to meet their primary and secondary water demands (Kim et al., 2016). Mostly, the people living in urban areas can well understood the ecological merits of RWH systems.

Social acceptance of RWH systems have been focused strongly on water quality, risk perception and health risks associated to the water system. Financial viability of adopters also play a huge role in the adoption of RWH systems by the people (Mankad and Tapsuwan, 2011; Velasco-Muñoz *et al.*, 2019). In contrast, the psychological perceptions about health risks and threats associated to decentralized water systems play a major role in adoption of RWH systems. Theses perceptions create a social barrier towards adoption of RWH systems among people in large scale (Alam et al., 2022; Bhat & Abraham, 2021; Bulteau et al., 2011). Hence, following hypothesis is formulated:

H4: Behavioral intention to adopt RWH influence the actual behavioral change to adopt RWH

The adoption behavior is also influence due to economic status, social awareness and prior experience of the water conservation technology (Syme *et al.*, 2004; Millock and

Nauges, 2010; Boyer *et al.*, 2015; Asfaw and Neka, 2017). Sometimes, the adoption of domestic WMS works inversely (Jara-Rojas, Bravo-Ureta and Díaz, 2012) and it was observed that domestic water consumption showed positive association with the total family members (Gregory and Di Leo, 2003). Some studies highlighted the crucial role of socio-economic factors for a household. Social networks have critical importance due to behavior imitation while adopting RWH systems (Mazzucato and Niemeijer, 2000; Nyangena, 2008). Social ties of the individual encourage them to adopt the RWH systems (Greenhalgh *et al.*, 2004). In contrast, various studies concluded that social networks have positive impact on the adoption (Abdulai, 2016; Bandiera & Rasul, 2006; de Graaff et al., 2008; Di Falco & Veronesi, 2014; Kassie et al., 2013, 2015). The adoption behavior of an individual may affected due to capital investment in the technology (Traoré, Landry and Amara, 1998; Drechsel and Olaleye, 2005). The farm size become crucial parameter that influence the adoption of agricultural innovations (Tadesse & Belay, 2004; Feder et al., 1985). In contrast, people with a stable or high income sources adopt the RWH more often (Rasoulkhani *et al.*, 2018). However, some regulations primarily focused on environmental issue. For example, according to Raimondi et al. (2023) RWH needs to follow standard regulation established by British government to use standard design, maintenance and installation for non-drinking water supplies. Furthermore, some nations used RWH systems for drinking and non-drinking purposes but keep the separate pipe system in order to avoid the contamination (Campisano et al., 2017). Gabe et al. (2012) investigated the RWH installation in New Zealand. The findings showed that respondents feel satisfaction and benefitted with the compulsory installation of RWH system in Auckland. It increased the social awareness of RWH systems and people get benefit from the government grants. The water crisis is increasing due to groundwater depletion and to meet the water demands of highly populated urban areas government needs to construct large-scale water projects such as pumping stations, run-off dams etc. which is a burden on the government due to high capital investments (Freni and Liuzzo, 2019). Therefore, installation of domestic RWH systems is economically feasible for the people by using the government subsidies. The RWH systems offered various benefits to surroundings by proving non-drinking and drinking water which ultimately reducing the stress of the local municipalities.

The performance of the RWH systems depend upon the set targets and different storage capacities needed as per the size of the family to improve the efficiency of the systems. Mugume et al. (2017) examined the RWH system of UK. The study identified that 95% of households fulfil their non-drinking water demands with the help of RWH systems. The domestic RWH is designed for 100 years by considering the future capacity and maintenance requirements which encourage the residents to adopt RWH system for their households. Palla and Gnecco (2022) examined the role of RWH systems to mitigate the storm-flooding conditions. The findings suggested that RWH system significantly minimize the storm-flooding by increasing the capacity of storage tanks up to 40% of the runoff water. However, Morales-Pinzón et al. (2015) analyzed the RWH systems using life cycle analysis. The findings showed that LCA helps to evaluate the pro-environmental role of RWH systems. The study suggested that to explore the tank size, building type and their impact on RWH systems, researchers need to employ multiple criteria analysis (MCA) for better reliability and performance. In addition, Khan (2023) found that the RWHs system highly effective in terms cost and performance which positively motivate the behavior intention of the people regarding RWH adoption. Therefore, following hypothesis is formulated:

H5: Motivation moderates the relationship between behavioral intention to adopt RWH and the actual behavioral change

People in urban areas were also found to be skeptical about the cost-usage ratio of an RWH system. The cost aspect was found to be a key determiner for adoption of RWH system (Bhat & Abraham, 2021). According to Cain (2014) cost concern is one the crucial barrier in the adoption of RWH systems. The findings revealed that for less educated and low-income families, it becomes challenging to adopt water conservation technologies. While the technical barriers and culture concerns also affect the adopter. Although the lack of acceptance of RWH system was related to cost, maintenance, cost-benefit ratio, water safety, health risks and water threats. To solve the water crisis, it is essential to understand the awareness gaps of rural Indians in detail. This must be done mainly in arid, semi-arid, drought struck, agriculture dominated and flood prone regions, where maximum benefit from RWH systems can be attained (Savari, Mombeni and Izadi, 2022). However, RWH systems must integrated with the municipal water supply lines to meet the non-drinking water demand. According to Brown et al. (2009), adopter's emotions, lack of adequate knowledge related to the RWH projects, high capital investment and maintenance costs served as barrier for the individual to adopt the RWH system for their household.

Sometimes, adopters health issues also become barrier for adopting the water management strategies (WMS) (Abdulai & Huffman, 2014). In some studies, where the head of the family is male, they were more willing to adopt new WMS (Doss, 2001; Kumar, 1995). In contrast, some researchers found that education helps to influence the technology adoption and showed the strong positive correlation with RWH adoption behavior. (De Oliver, 1999; Gilg and Barr, 2006; Lam, 2006). In contrary, some researchers found that less educated people showed more trust on governmental schemes and ready to adopt the WMS (Clark et al., 2003; Gregory & Di Leo, 2003). An educated individual can debate and understand the benefits of the water conservation in a better way. Marra et al. (2003) discussed the risk and inconsistencies associated with the adoption of innovative technologies. Canales et al. (2015) found that perceived risk can affect the adoption of new schemes launched by local government. Some studies revealed that elder population understand the worth of water conservation better as compared to younger population (Clark et al., 2003; Gregory & Di Leo, 2003; Russell & Fielding, 2010). In addition, some studies that found age as crucial barrier for adopting the RWH or water conservation strategies (He, Cao and Li, 2007; López-Felices *et al.*, 2023). For low-income group farmers land possession become barrier to adopt the WMS (Berk *et al.*, 1993). However, few researchers found that unstable income act as a determinant for the adoption behavior (Liu et al., 2018; Traoré et al., 1998). Parsons et al. (2010) identified the installation and maintenance cost of RWH system often become barrier to adoption of these sustainable systems. Therefore, local government needs to highlight the incentive and subsidies within their designed regulations to boost the adoption of RWH systems. For example, when people used RWH systems for primary water source it may leads to health issues due to contamination with arsenic (Ahamed *et al.*, 2006). However, Naser et al. (2017) explained the detrimental effects of using rainwater as a primary source of drinking water. The people consuming regular rain harvested water may suffer from cardiovascular diseases and other stomach infections because rainwater has associated low calcium as well as magnesium salts. Therefore, barriers significantly impact the behavior intention of the people to adopt RWH for domestic purposes.

H6: Barriers moderate the behavioral intention to adopt RWH and the actual behavioral change

India is rapidly growing in terms of urbanization, industrialization and its increasing population. Under such scenarios water crisis is becoming more pronounced which makes it difficult for agriculture and farming in many areas throughout the country which encourage farmers ability to use RWH (Tohidyan Far and Rezaei Moghaddam, 2015; Aliabadi, Gholamrezai and Ataei, 2020; Valizadeh *et al.*, 2023). RWH projects like check dams have shown increased benefits to farmers during water crisis. The maintenance efforts of the check dams was found to be less compared to the benefits that these systems provide to the farmers (Alam *et al.*, 2022). Some studies found that the geographical location of the individual is also associated with the ability to use RWH technology adoption behavior (Abdulai & Huffman, 2014; Lesch & Wachenheim, 2014). Several studies discussed the adoption process which mainly depend upon abilities to use the technology (Baumüller, 2013; Hall & Khan, 2016). Rainwater considered as cleanest form of water and treatment methods improve the water quality which attracts the adopters. For domestic use, water quality is the primary concern for the people who adopted the RWH systems. The study revealed that rainwater has as compared neutral pH (Krishna, 2005). However, the physical and microbiological characteristics of RWH system is affected due to storage material and ecological conditions (Hamilton et al., 2019; Mazurkiewicz et al., 2022). According to Despins et al. (2009) that the stored rainwater in a steel tank absorbs less contamination as compared to asphalt material. Findings showed that plastic storage tanks made the water acidic whereas concrete tank made the water slightly basic. Therefore, storage tank capacity and tank material act as an influential factor for the adoption of the RWH systems. Although the abilities to RWH systems have been discussed in which people were focusing on the multi-level advantages of RWH systems as the domestic RWH has limited storage capacity but excess of water overflows which contributes in the groundwater recharging and provides several benefits which includes ecological, social and cost benefits (Campisano et al., 2017). Further, Sefton et al. (2022) suggested the modern advantages which are community-oriented and boost the adoption of RWH systems. Specifically, based on mutual collaboration of residents and local authorities in a two-way communication. RWH systems are rainfall dependent systems which are highly vulnerable to environmental conditions. According to Musayev et al. (2018) climate change showed serious impact on RWH systems and sometimes it become barrier for the households to adopt these systems. The study suggested the use of proper software/technological abilities helps to identify the rainfall patterns before installing the RWH systems on wider scale (Ghodsi *et al.*, 2023). Therefore, abilities to use RWH has significant effect on RWH adoption. Hence, following hypothesis is formulated:

H7: Ability to use RWH moderates the behavioral intention to adopt RWH and the actual behavioral change.

Numerous studies were conducted to understand the benefits, abilities and barriers for adopting the RWH systems to meet the additional water requirements by considering the environmental concerns (Campisano et al., 2017; de Sá Silva et al., 2022). The RWH systems help the households to manage the water effectively during the drought conditions or water shortage. The RWH system worked as sustainable way to fulfil the water needs and the adoption of RWH systems evaluated on the basis of social, monetary and ecological factors which encourage the people for actual behavior change (Barbier, 1987). People perceived perception may influence the adoption of RWH systems. Therefore, it was highly recommended to examine the merits and demerits associated with RWH systems to encourage the individuals towards the adoption these systems. Therefore, authorities also become cautious while doing the promotions of the RWH system and encouraging people for the adoption. In contrast, RWH system unable to provide holistic solution for water management strategies. Although RWH is highly powerful process to minimize the individual’s dependency on tap water. Although to boost the adoption of RWH systems, government passed the standard water quality norms which has to be followed by the local governments. Campisano et al. (2017) conducted a study to analyze the installed RWH systems in Germany and also examined the benefits and issues faced by the households at grassroot level. The study outcomes revealed that effective social marketing of financial support provided by the local government to the people who adopt the RWH system showed positive feedback. In addition, Schuetze (2013) focused on the water preservation, protection of installed systems and flood control. Meanwhile, UK adopted the standard norms for the installation of RWH system throughout the country which improve the belief of the people towards RWH systems (Raimondi et al., 2023). Shetty et al. (2022) emphasized the integration of domestic RWH system with other sustainable systems to improve the reliability of the system and can meet the 50% of the household water demands. This encourages the people to adopt RWH systems for their household. According to GhaffarianHoseini et al. (2016) domestic water consumption percentage can be improved up to 80–90% by using RWH systems on the rooftop. Findings showed that water demands are classified into different categories such as daily, weekly, and yearly depending upon the tank stored capacity. In contrary, Marchioni et al. (2023) identified that RWH systems provide drinking water which is not used by some developed countries, even the advanced technologies improved the water quality. Due to perceived health risks, some developed countries avoid RWH systems water for drinking purposes. In modern times, the RWH systems consist of various integrated components which meet the quality expectations of the people. The advanced RWH systems utilis roof, tank screen, insect protection, gutter protection, flush diverter, irrigation filter and water level indicator (Van Seters, 2011). These advanced systems improve the trust factor of the people on RWH systems which helps to increase the adoption rate. Even, the advanced RWH systems equipped with sensors to enhance the automation and proper utilization of water resources (Abbasi and Abbasi, 2011). RWH systems modelling has been performed using simplified methods which are mostly suitable for low rainfall areas. Whereas, analytical methods used for designing RWH systems for the areas having more than average rainfall (Hall & Howell, 1963). The adopter's behavioral change is challenging to quantify due to dynamic nature. The adopter's behavior can be influence by socio-technical factors (Zhang et al., 2009). The moderate to high rainfall can increase the performance of the RWH systems (Khan et al., 2021). Various studies were conducted to analyze the performance of the RWH systems by investigating the tank size, roof area, family size etc. The findings revealed that RWH systems are rainfall dependent and people utilize this system efficiently for specific purposes like toilet, washing and laundry (Di Matteo *et al.*, 2019; Crosson *et al.*, 2021). Although the benefit to cost ratio (BCR) model helps to provide the technical support for RWH systems, maintain the benefits with respect to cost (installation, operation, power consumption and maintenance) of RWH systems. Study highlighted the financial analysis which includes the water pricing as primary factor which influence the adoption of the RWH systems provides (Jamali, Bach and Deletic, 2020). However, climate change also impact the RWH systems' performance and findings revealed that unfavorable environment conditions slightly reduce the reliability of the RWH systems (Zhang et al., 2019). The RWH systems have multiple benefits concerning to mankind but there is a lack of social understanding regarding the adoption of the modern RWH systems in the society. Different case studies have confirmed that people's perception towards accepting decentralized water systems have been tricky (Campsiano et al., 2017). Rural residents are an important part of social system and they play a major role in policy implementation (Aliabadi, Gholamrezai and Ataei, 2020). Understanding the behavioral intention of rural people towards water consumption and belief about decentralized water systems is essential. A study on two sites such as Shergarh and Ramwas in Rajasthan revealed the collaborative efforts of villagers to revive 15-20 years old rainwater harvesting systems. The study showed that material costs and labor charges are a matter of concern for the people and therefore the locals opted for equal contribution from all residents irrespective of caste and financial status. The cost of construction and maintenance of an RWH system was identified as a determining factor in the study (Cochran and Ray, 2009). Areas actively participating in agricultural practices have shown high dependence and positive outcomes of RWH systems. Therefore, it is likely for people belonging to such areas to have a positive approach towards adoption of RWH systems (Cochran and Ray, 2009; Alam *et al.*, 2022). These feedbacks should be publicized for better adoption of RWH systems by the mass. Therefore, local government needs to inform the importance of personal benefits after the adoption of RWH system in which government may also provide financial assistance for the same in order to accelerate the process (Bhat & Abraham, 2021). In contrast, the soil moisture and soil quality play an important role in cultivation and crop production. RWH has been found to have a major contribution in soil moisture and soil quality restoration. The NGO's intervention was one of the key determiners of the rural people which provide opportunity to had community as well as financial support and adopt RWH system in their household (Staddon *et al.*, 2018). Therefore, following hypothesis is formulated:

H8: Opportunity moderate the behavioral intention to adopt RWH and the actual behavioral change.

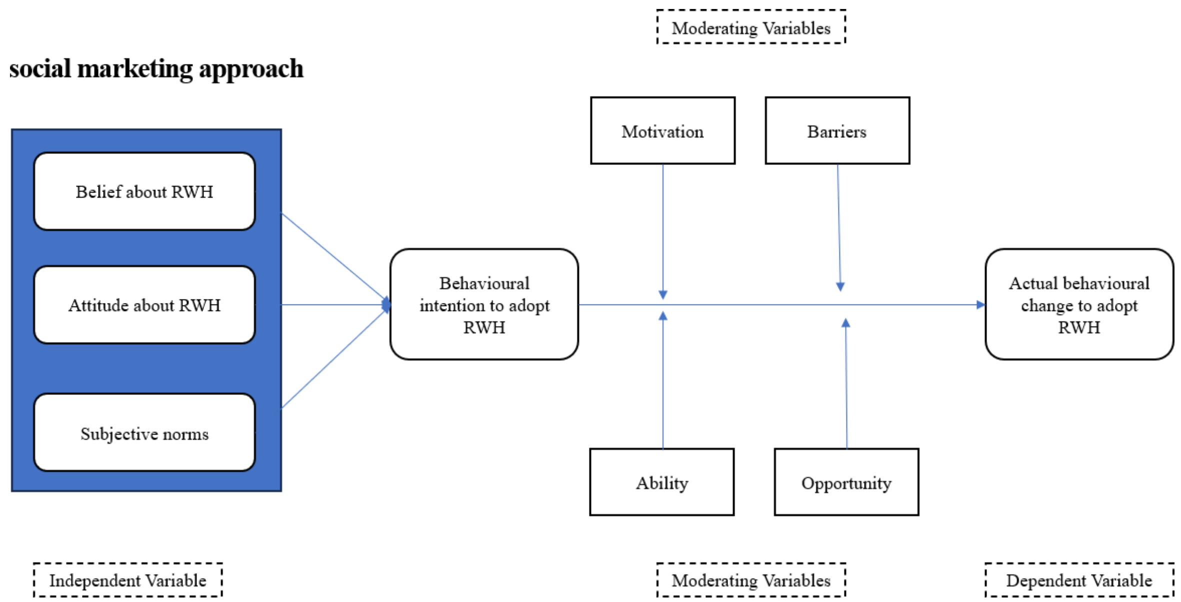

Figure 2.1

Conceptual model

1.21 Summary

The present review of literature critically explored the existing studies related to rainwater harvesting practices in developing and developed nations. In addition, this chapter also reviewed the various adoption models such as Logit, Probit, Tobit and rainfed for understanding the adoption behavior of the people towards the RWH systems in urban and rural areas. Further, chapter discussed the various theories such as TRA, NAT, TPB, HBM, SCT, STT in connection with adoption of RWH technologies. The reviewed theories help helps to understand the behavioral changes, planned behavior, barriers, challenges, benefits, perceived risks, perceived beliefs, subjective norms, social, technological, psychological, demographic and cost oriented aspects which effect the rate of adoption of RWH practices for agriculture and domestic purposes. Further, chapter explored the various factors such as social marketing, motivation, technical abilities and practical opportunities associated with the adoption of RWH practices. Additionally, adoption of RWH systems were found to depend on several aspects such as lack of knowledge about the RWH system, lack of awareness and low publicity about its benefits among the people, lack of social marketing aspects (attitude, belief and subjective norms) for the publicity and awareness of RWH system among the masses was identified as a gap in the literature review. This gap will be used to further develop the research methodology in next chapter.

CHAPTER III
METHODOLOGY

1.22 Overview

In a research work, research methodology plays a significant role which illustrates the techniques and steps adopted by the researcher to obtain the findings of the study. Also, this part of the research work demonstrates the rationale behind choosing certain techniques to systematically address the research questions. An appropriate strategy to gather data, analyze and interpret it helps to obtain scientific findings and address the studied objectives efficiently.

The present chapter is broadly divided into three dominant parts. The First six sections describe the research purpose, the philosophy followed in the specific study, approaches taken and instruments used to conduct the research. In the second part, detailed illustrations of data collection methods have been presented and in the last part, different data analyses used in the study have been discussed.

1.23 Research Purpose

The research purposes explain the aim of the study. It helps to fix the approach of the study and determine what the researcher wants to accomplish from this research. In general, there are three research purposes extensively used in the social science research domain, i.e., exploratory, descriptive and explanatory. By keeping the research objectives in mind, an explanatory research approach was adopted in the study which will help to identify the reasons behind the adoption of rainwater harvesting system by the users.

1.24 Research Philosophy

Research philosophy is a basic framework with certain principles and beliefs which helps researcher to decide the nature of the knowledge and guide them to follow specific techniques. There are many forms of research philosophies, namely, positivism, interpretivism, pragmatism, realism (Saunders *et al.*, 2023). In positivism, the principles of natural sciences are used to determine the human behavioral pattern (Park, Konge and Artino, 2020). On the other hand, in interpretivism, the meaning and context of social phenomena are tried to understand. Pragmatism philosophy seeks to integrate various approaches and perspectives to find out solution of complex problems. As in the current study, the behavioral intention and adoption to use rainwater harvesting and preservation have been studied, the present study adopted positivism philosophy.

1.25 Research Approach

A research approach denotes the plans and procedures to construct theories that can be inductive or deductive or both, based on the nature of a specific study (Saunders, Lewis and Thornhill, 2012). The present study aims to understand the different factors influencing the citizens to adopt rainwater harvesting system as well as help to understand the barriers, facilitators, opportunities and motivation to adopt rainwater harvesting. Therefore, deductive research approach was implemented to test the hypotheses through an empirical observation and analysis.

1.26 Research Method

Broadly in business research, there are two types of methods widely used, i.e., qualitative and quantitative. In qualitative research method, approaches are taken help to spread knowledge and understand theory-based concepts. In this method, more focus is given on creating ideas and formulating theoretical framework. On the contrary, in quantitative research method, numerical data are gathered and analyzed through statistical tools to reach a conclusion. In qualitative method, focus group studies, personal interviews, observations are used to gather data, whereas in quantitative research method structured survey questionnaire are used to collect data from a bigger pool of participants (Zikmund *et al.*, 2012). The present study used a quantitative method to obtain the data where structured questionnaire was used to collect data.

1.27 Research Instrument

A research instrument is a tool which is used to accumulate data which will be measured and analyzed to provide research findings (Cohen, 2013). Based on the type and nature of the study, research instruments are determined. There are various research instruments, such as interviews, surveys or checklists which are mostly used in social science, business research and education science. For the current study, a close-ended structured questionnaire was administered to measure the variables and understand the relationships among them. The subsequent sub-sections discuss the questionnaire or survey instrument and the variables used in the present research.

Survey instrument design

A questionnaire contains number of questions (items) that are meant to collect information from the respondents. Constructing a relevant and suitable research instrument is an important preliminary step in a research work. This will help to collect the data in a logical manner to reach to the scientific conclusions. Therefore, some characteristics of a good research instruments are needed to be maintained to conduct a proper research work. The question items used in the questionnaire should be logical and based on a conceptual framework constructed on existing theories. The questions should be framed keeping in mind the socio-demographic profile of respondents and it should be simple for everyone to understand and answer (Gray, 2004). Hypothetical and sensitive questions must be avoided. The question items can be open-ended without any fixed responses or it can be close ended processing multiple-choice questions. The questions should not convey the meaning of it clearly to the participants.

For the present study, the questionnaire was constructed after reviewing the existing literature related to barriers, motivation, opportunity and adoption behavior towards rainwater harvesting and preservation and understanding the perception of the respondents. The questionnaire for the present study contained close-ended question items and were grouped into two sections. The first section comprised of 5 questions regarding the participants' demographic details, such as age, gender, educational qualification, property type and house ownership type. The second section incorporated statements related to the social media marketing approach (7 items), beliefs about RWH (6 items), attitudes about RWH (6 items), subjective norms (6 items), intention to use (5 items), actual adoption behavior (6 items), motivators (6 items), barriers (10 items), opportunity (7 items) and ability to install (7 items) rainwater harvesting unit. Overall, combining all the sections of the questionnaire there were a total of 71 items for all factors in the questionnaire.

Study variables and sub-variables

The theoretical basis of the study is an integrated Motivation-Opportunity-Ability (MOA) framework which incorporates the Theory of Planned Behavior (TPB) to investigate the determinants of RWH behavior. The foundation of the MOA framework is the TPB (Ajzen, 1991) and includes ideas from Triandis (1971, 1977, 1982) Theory of Interpersonal Behavior (TIPB) which provides a versatile and useful model of behavior change. The MOA model submits that behavior change is fundamentally predicted by motivation, opportunity, and ability (Binney, Hall and Oppenheim, 2007).

The present study has the following variables, such as residents' beliefs about RWH, residents' attitude towards RWH, residents' subjective norms concerning RWH, behavioral intention to adopt RWH, actual behavioral change to adopt RWH, facilitators and Barriers to RWH acceptance and adoption, ability and opportunity related to RWH adoption and resident Demographics (Age, Gender, Qualification, Property type (House/Flat), Ownership (Owner/Rented)). Residents' beliefs, residents' attitude, residents' and subjective norms concerning RWH are considered as independent variables and the effect of these variables on the behavioral intention was explored in the present study. Furthermore, the moderating role of facilitators, barriers, ability and opportunity related to RWH adoption on the relationship between behavioral intention to adopt RWH and actual behavioral change to adopt RWH were investigated.

Levels of measurement

Several types of measurement scales are used in questionnaire survey depending on the nature of the variables. In the present study, to measure the categorical variables, a nominal scale is used. The nominal scale measures variables like gender, educational qualification, property type and ownership type of participants. Whereas, the quantitative variables, such as age were measured through a ratio scale. The study variables, such as social media marketing strategies, residents' beliefs about RWH, residents' attitude towards RWH, residents' subjective norms concerning RWH, behavioral intention to adopt RWH, actual behavioral change to adopt RWH, facilitators and Barriers to RWH acceptance and adoption, ability and opportunity related to RWH adoption were assessed through a 5-point Likert scale which has five numerical values. These values determine the high to low strength of agreement with a particular question. The interval between each response was calculated to be 0.8 and are provided in the Table 3.1.

Table 3.1

A five-point Likert scale

Responses	Number Code	Interval
Strongly disagree	1	1.0 - 1.8
Disagree	2	1.81 - 2.60
Agree/disagree or neutral	3	2.61 - 3.40
Agree	4	3.41 - 4.20
Strongly agree	5	4.21 - 5.0

Source: (Likert, 1932)

1.28 Research Timeline

Based on the time-period of data collection, the research can be of two types, i.e., cross-sectional and longitudinal. In cross-sectional research, the data collection occurs in a particular time-period and by this type of survey, different samples at one given point in time can be compared. On the other hand, in longitudinal study, data are gathered from same sample population over a long time period. Longitudinal study helps to observe the changes on the sample population over the years. In the present study, the data were collected from the present study for a short interval of time, and therefore conducted a cross-sectional survey.

1.29 Data Collection

The current study was constructed as a survey-based research where primary data was accumulated through a close-ended well-structured questionnaire. Data collection was conducted by circulation of the questionnaires to the target population to the participants. To ensure maximum responses the questionnaire was distributed from convenient centers.

Study population

The study population included the different stakeholders related with RWH installations and users. The primary respondents of the questionnaire survey were the urban residents of Bengaluru.

Sampling size

As of 2011, number of households in Bangalore was 2.39 million and data showed that the urban population in Bengaluru is increasing extensively. The sample size was calculated by following Krejcie and Morgan, (1970).

$$n = \frac{x^2 Np(1-p)}{e^2(N-1) + x2p(1-p)}$$

where n = required sample size

x2 = the table value of chi-square for one degree of freedom at the desired confidence level (2.58 for 99% confidence interval)

N = the population size

p = Percentage picking a choice which is expressed in a decimal form (0.1 for sample size calculation)

e = the degree of accuracy expressed as a proportion (0.05 in this case).

Therefore, a sample of 174 or more measurements/surveys are needed to have a confidence level of 95% that the real value is within ±5% of the measured/surveyed value.

In the present study, questionnaires were sent to 600 residents in Bengaluru. Totally, 452 responses were returned and out of these 400 were selected as valid responses. Therefore, the response rate derived in the present study was 66.6%.

Sampling technique

A study sample should be carefully selected as it is supposed to represent a whole group of a larger population. Choosing an adequate sampling method helps in minimizing the research bias during the drawing of conclusions. The nature of research, research purpose, and practicalities of a research work defines the type of sampling technique that are chosen for a target population.

In the present study, a stratified sampling method was used where people were initially divided into sub-groups based on their municipalities. The population from each sub-group was then selected randomly to create the representative sample of this study. This technique ensures that all municipalities were equally represented and it helps to draw precise conclusions of the study outcomes.

Pilot study

Prior to collection of the data, evaluation of the research instrument, i.e., the questionnaire is extremely important and this step is important in a quantitative research study. The questionnaire used in the present study were put through stringent procedures to measure the reliability the items. Initially, questions or item statements were chosen after reviewing the relevant literature on the present topic. The questionnaire was then submitted for feedback and consent of experts and academicians of the specific domain. Based on their suggestion, the items were revised and were administered to 100 respondents in the year 2024 for conducting a pilot survey and for confirming their accuracy.

Reliability analysis

Cronbach's Alpha was used to check the reliability of the questionnaire in the present study. Cronbach's Alpha coefficient value ranges from 0 to 1 where a high value shows a greater reliability and internal consistency. The value of Cronbach's Alpha coefficient is needed to be greater than 0.6 for the variables to be acceptable. Cronbach's alpha values for all factors, such as social media marketing strategies (0.924), beliefs about RWH (0.949), attitudes about RWH (0.846), subjective norms (0.766), behavioral intention (0.870), actual behavioral change to adopt rainwater harvesting (0.913), motivation (0.891), barriers (0.869), ability (0.849) and opportunity (0.919) were greater than 0.6 (Table 3.2). Thus, the questionnaire was considered to be reliable.

Table 3.2

Reliability analysis

	Cronbach's Alpha	N of Items
Social media marketing strategies	0.924	7
Beliefs about RWH	0.949	6
Attitudes about RWH	0.846	6
Subjective norms	0.766	6
Behavioral Intention	0.870	5
Actual behavioral change to adopt rainwater harvesting	0.913	6
Motivation	0.891	6
Barriers	0.869	10
Ability	0.849	7
Opportunity	0.919	7

Descriptive statistical analysis

The descriptive analysis provides the demographic and related information of the study respondents and it helps to understand thoroughly about the respondents. In the present study, frequency and percentage distribution were used as descriptive statistics to depict the demographic factors, such as gender, age, educational qualification, property types and ownership types of the residents.

Inferential statistical analysis

The statistical analysis which is being utilized to draw conclusions after analyzing the data by conducting certain statistical tools is known as inferential statistical analysis. Inferential analysis helps in deducing the data trends in a larger population on the basis of the results derived from a sample population. At first, the normality test was performed to check the distribution of the sample. The reliability of the questionnaire in the present study was determined through Cronbach's alpha. Subsequently, linear regression analysis and structural equation modelling (SEM) were performed to test the proposed hypotheses.

1.30 Summary

The steps that were undertaken to pursue this research work are illustrated in Figure 3.1. The present study deals with the factors influencing behavioral intention and actual usage intention of rainwater harvesting unit among the residents of Bangalore. A positivist, explanatory, and deductive research design was adopted to test the hypotheses through empirical observation and analysis. A quantitative research design utilizing questionnaire-based survey was adopted. This chapter discussed the sampling size, the sampling technique and details of survey instruments that were used in the study. In addition, the statistical methods and tools employed to analyze the data collected from the respondents were explained.

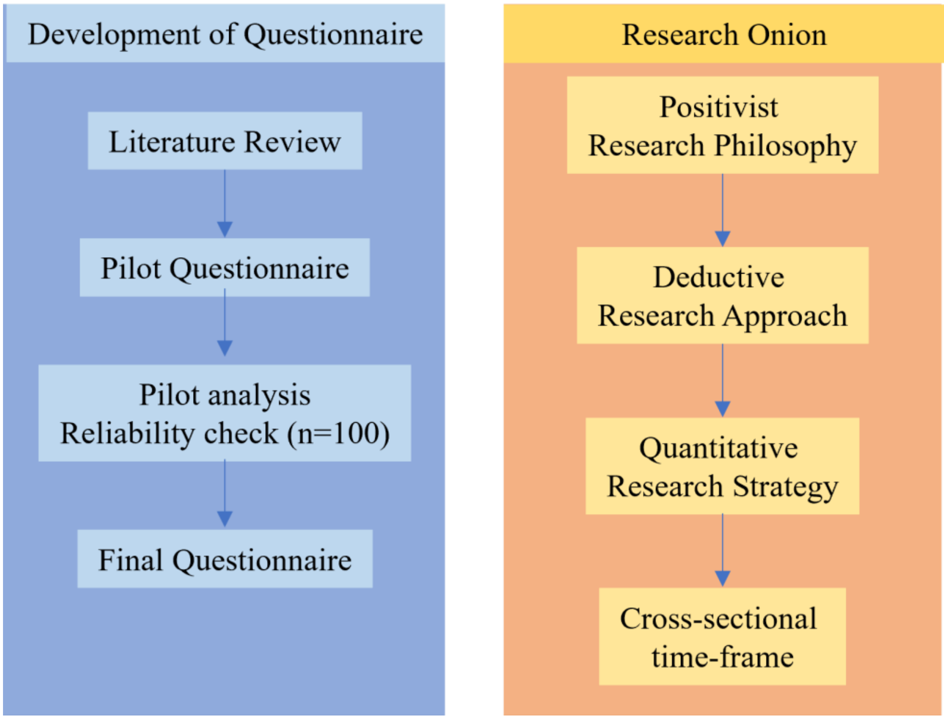

Figure 3.1

Overall research methodology of the present study

CHAPTER IV

RESULTS

1.31 Overview

This chapter presents the summarized findings of the study derived from the data obtained through a structured questionnaire developed for the present study. This chapter commences with the demographic profile of the respondents and their perceptions towards RWH. The results of the various analysis were interpreted and hypotheses tests were conducted.

1.32 Demographic Details of Residents

Gender of residents

Table 4.1 presents the distribution of the study population based on gender. The majority (61.0%) of the respondents in the study were men, while the rest (39.0%) were women (Figure 4.1).

Table 0.1

Gender of residents

Gender	Frequency	Percent
Male	244	61.0
Female	156	39.0
Total	400	100.0

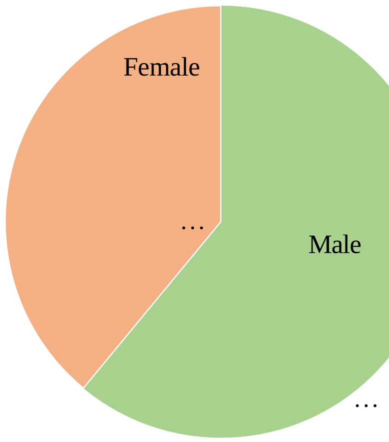

Figure 0.1

Gender of residents

Age of residents

The study population was found to be mixed-aged (Table 4.2; Figure 4.2) with most (63%) of the respondents young, belonging to the age group between 25-45 years old followed by almost one-fourth of them in the age group of 46-65 years old (24.8%) and another 12.3% of them were even older.

Table 0.2

Age of residents

Age (in years)	Frequency	Percent
25-45	252	63.0
46-65	99	24.8
66-75	42	10.5
More than 75	7	1.8
Total	400	100.0

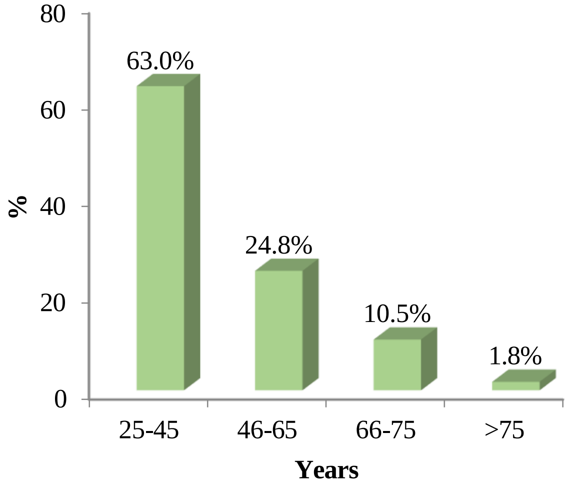

Figure 0.2

Age of residents

Educational qualification of residents

Table 4.3 presents the distribution of residents based on their educational qualifications (Figure 4.3). Among the 400 residents, most of the respondents for the present study were graduates (69.0%), followed by 13.0% graduates, and 11.5% post-graduates.

Table 0.3

Educational qualification of residents

Educational qualification	Frequency	Percent
Undergraduate degree	52	13.0
Graduate degree	276	69.0
Post-graduate degree	46	11.5
Higher than post-graduation	26	6.5
Total	400	100.0

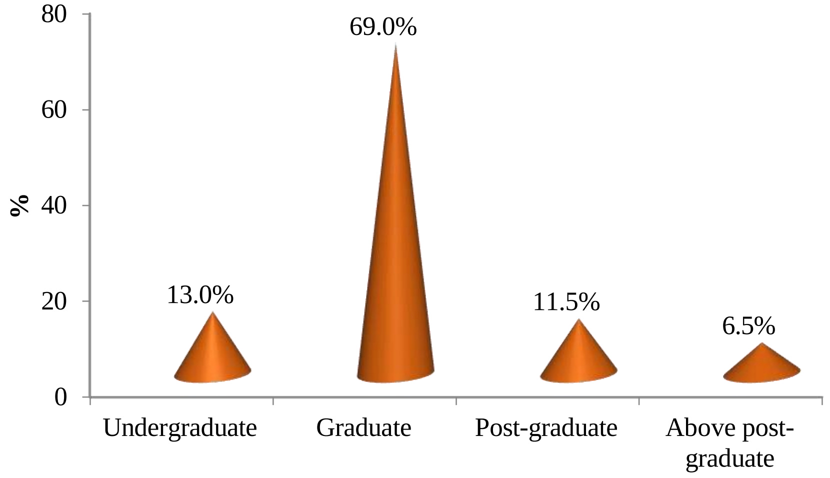

Figure 0.3

Educational qualification of residents

Type of house

Table 4.4 shows the distribution of residents according to the type of house they live in (Figure 4.4). Most (48.3%) of the participants live in multi-storied flats while another 45.0% of them live in individual houses. Very few respondents were from apartment society (6.8%) (Table 4.4; Figure 4.4). As individual house owners or residents of multi-storied flats are more associated with RWH installations, understanding the perceptions of these respondents helped to understand the factors for RWH installations.

Table 0.4

Type of house

Type of house	Frequency	Percent
Individual house	180	45.0
Multi-storied flat	193	48.3
Apartment society	27	6.8
Total	400	100.0

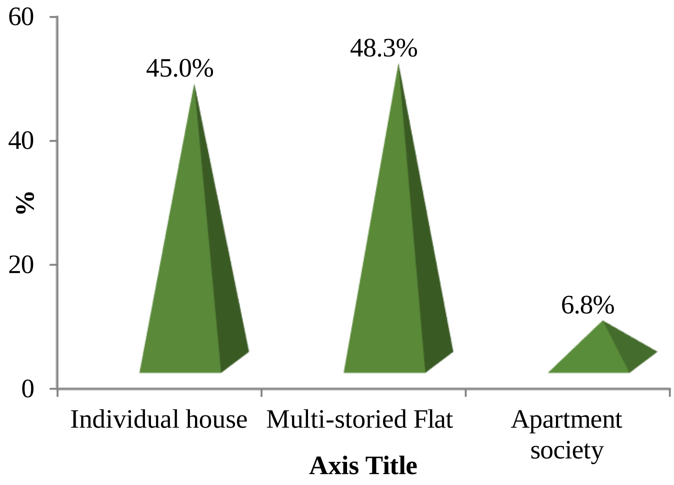

Figure 0.4

Type of house

Ownership of house

Table 4.5 provides the distribution of residents according to the type of ownership of the houses they live in. It was observed that the majority (76.5%) of the respondents stayed in rented accommodation, while the rest (23.5%) were living in their own house (Figure 4.5).

Table 0.5

Type of house ownership

Type of house ownership	Frequency	Percent
Rented	306	76.5
Owned	94	23.5
Total	400	100.0

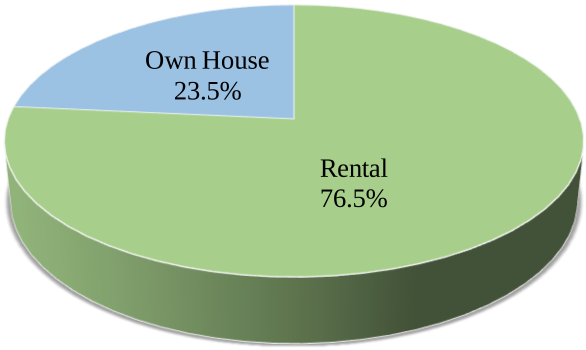

Figure 0.5

Type of house ownership

1.33 Social Marketing Approaches

Social marketing approaches were measured through three variables selected based on the theory of planned behavior: beliefs about RWH, attitude towards RWH, and subjective norms.

Beliefs about rainwater harvesting

Table 4.6 lists the perceptions of the residents towards their belief about RWH. It was observed that the participants of the study agreed that RWH diminishes the water scarcity problem (M= 4.03 ± 0.76), is good for the environment and ecosystem (M = 4.02 ± 0.70), is good for water conservation (M = 4.03 ± 0.80), helps in lowering water bills (M = 4.05 ± 0.83), helps in mitigating all the water-related problems in their house (M = 4.06 ± 0.74), and by building RWH system in their house, they are contributing to the society (M = 4.07 ± 0.8) (Table 4.6).

Table 0.6

Beliefs about rainwater harvesting

Beliefs about RWH	Mean	Std. Deviation
RWH can diminish the water scarcity problem.	4.035	0.758
RWH is good for the environment and ecosystem.	3.975	0.700
RWH is good for water conservation.	4.028	0.805
RWH helps in lowering water bills.	4.055	0.833
Rainwater preservation will help mitigate all the water-related problems in my house.	4.065	0.743
By building the RWH system in my house, I can contribute to society.	4.075	0.822

Attitudes about rainwater harvesting

Most of the participants agreed that it is a good idea to implement RWH in houses (M=3.2±1.1), it is important to install RWH in one’s house (M=3.6±0.9), everyone should adopt the RWH system in their houses for water conservation (M=3.8±0.8), they need to preserve rainwater even if there are other supplementary water source (M=4.0±0.8). They also think strongly that using RWH can save their water bills (M=3.8±0.9) and wasting rainwater is wrong (M=3.7±1.0) (Table 4.7).

Table 0.7

Attitudes about rainwater harvesting

Attitudes about RWH	Mean	Std. Deviation
It is a good idea to implement RWH in houses.	3.178	1.077
It is important to install RWH in one’s house.	3.600	0.923
Everyone should adopt the RWH system in their houses for water conservation.	3.790	0.847
Even if there are other supplementary water source, we need to preserve rainwater.	3.965	0.849
I think using RWH can save my water bills.	3.795	0.869
I think wasting rainwater is wrong.	3.723	1.021

Subjective norms

Regarding the subjective norm, most of the respondents agreed that the people surrounded them were interested to collect and preserve rainwater for water conservation (M=4.0±0.7), were installing RWH in their home which is inspiring (M=3.8±0.7), and their family and friends will be happy if they install RWH in their home (M=3.9±0.7). The participants felt that most people close to them think about environmental benefit of RWH and it motivates them (M=3.2±1.0) and they will be appreciated by their social media peers if they install RWH in their home (M=4.0±0.8). Also, they mostly agreed that most people in their social network think they should adopt RWH unit in their house (M=3.9±0.7) (Table 4.8).

Table 0.8

Subjective norms

Subjective norms	Mean	Std. Deviation
The people surround me are interested to collect and preserve rainwater for water conservation.	4.013	0.717
My peers and neighbors are installing RWH in their home which inspires me.	3.808	0.773
My family and friends will be happy if I install RWH in my home	3.938	0.791
Most people close to me think about environmental benefit of RWH and it motivates me.	3.193	1.092
If I install RWH in my home, I will be appreciated by my social media peers.	3.988	0.751

Subjective norms	Mean	Std. Deviation
Adopting RWH unit in my house is what most people in my social network think I should be doing	3.900	0.708

1.34 Behavioral Intention to Adopt Rainwater Harvesting

Majority of the participants wanted to use RWH in the future (M=4.0±0.8), would like to continue utilizing RWH in the future (M=3.9±0.8), recommended rainwater harvesting adoption to their surrounding people (M=4.0±0.9), wanted to use RWH for water conservation (M=3.4±0.9) and agreed that rainwater harvesting unit is very necessary for mankind and useful for the environment (M=3.9±0.9) (Table 4.9).

Table 0.9

Behavioral intention to adopt rainwater harvesting

Behavioral intention to adopt RWH	Mean	Std. Deviation
I want to use rainwater harvesting in the future.	4.045	0.755
I would like to continue utilizing rainwater harvesting in the future.	3.893	0.844
I recommend rainwater harvesting adoption to my surrounding people.	3.968	0.874
I want to use rainwater harvesting for water conservation	3.393	0.936
The rainwater harvesting unit is very necessary for mankind and useful for the environment	3.903	0.938

1.35 Actual Behavioral Change to Adopt Rainwater Harvesting

Regarding the actual behavioral change, respondents strongly agreed about the usefulness of RWH for their life (M=4.1±0.7), benefit of storing and utilizing rainwater for better water conservation regarding (M=3.9±0.7). They have installed a RWH unit in their residence (M=4.0±0.8) and they the campaigns to make others aware of installing it (M=3.9±0.8). Also, they feel it is their duty to maintain rainwater harvesting system in their house (M=3.8±0.8) and will bear the cost of rainwater harvesting in their house (M=3.9±0.8).

Table 0.10

Actual behavioral change to adopt rainwater harvesting

Actual behavioral change to adopt RWH	Mean	Std. Deviation
Rainwater harvesting is very useful for my life	4.055	0.684
I have installed a rainwater harvesting unit in my residence.	3.980	0.785

Actual behavioral change to adopt RWH	Mean	Std. Deviation
I know for better water conservation; I need to store and utilize rainwater.	3.880	0.743
I have joined the campaigns to make others aware of installing it	3.945	0.767
Being a responsible citizen, it is my duty to maintain rainwater harvesting system in my house	3.805	0.751
I will bear the cost of rainwater harvesting in my house.	3.913	0.832

1.36 Motivation to Use Rainwater Harvesting

Regarding motivation for RWH adoption, the participants agreed that they look forward for installing RWH unit in their houses (M=4.0±0.6), believe using RWH in their home will be beneficial for them (M=3.9±0.7), arranged space for installations of RWH in their houses (M=3.9±0.7) and wanted to contribute towards society by installing RWH unit in their house (M=3.8±0.8).In addition, they are convinced about the environmental benefit of rainwater storage (M=3.9±0.8) and they feel spending money in installing RWH is worthwhile (M=3.9±0.8) (Table 4.11).

Table 0.11

Motivation to use rainwater harvesting

Motivation to use RWH	Mean	Std. Deviation
I look forward for installing RWH unit in my house.	3.955	0.607
I believe using RWH in my home will be beneficial for me.	3.890	0.721
I have arranged space for installations of RWH in my house.	3.895	0.707
I want to contribute towards society by installing RWH unit in my house.	3.820	0.784
Spending money in installing RWH is worthwhile.	3.720	0.824
I am convinced about the environmental benefit of rainwater storage.	3.868	0.715

1.37 Barriers in Adoption of Rainwater Harvesting

Respondents did not agree about high cost of installation (M=2.0±0.7), poor quality of rainwater (M=2.4±1.0), not having enough place to install RWH unit (M=2.5±1.0), having adequate water from different sources (M=2.1±0.7), not having adequate resources to build their own RWH (M=2.5±0.8), not having knowledge on RWH (M=2.6±0.8), not having any government aid which will help them to build RWH structure (M=2.5±0.8), Also, they did not agree on no need for storing rainwater (M=1.9±0.8) or not feeling water conservation as a priority (M=2.0±0.7) (Table 4.12).

Table 0.62

Barriers in adoption of rainwater harvesting

Barriers in adoption of RWH	Mean	Std. Deviation
The installation cost is very high.	2.015	0.725
I don’t feel any requirement of storing rainwater.	1.945	0.761
I feel the quality of the rainwater is not good.	2.435	1.029
It does not rain adequately in my place so that I can install a RWH unit.	2.498	1.090
I don’t have enough space to install the RWH unit.	2.010	0.739
I have adequate water from different sources, so I don’t feel any urge to install RWH unit in my house.	2.098	0.774
I don’t have enough resources to build RWH by my own.	2.480	0.810
I don’t have any knowledge on RWH.	2.638	0.853
I don´t know about any government aid which will help me to build RWH structure.	2.485	0.769
I don’t feel water conservation is such a priority.	2.028	0.677

1.38 Ability of Residents

Regarding the abilities of the respondents, they agreed that they are able to take care of the regular maintenance that RWH unit needs (M=3.8±0.8) and to pay for the maintenance cost of the RWH unit (M=3.8±0.7). They also agreed that they have a good level of knowledge of storing rainwater via RWH (M=3.7±0.8), can manage their household’s water requirement through other sources during dry time (M=3.8±0.8) and they are able to spare enough space for RWH unit to be installed (M=3.5±0.8). Also, they agreed that it is important for their neighbors in their local area to have a coordinated plan for maintaining RWH. However, the respondents were majorly neutral that they got financial support from the government to pay for any damages in the RWH unit (M=2.7±1.1).

Table 0.73

Ability of respondents

Ability of respondents	Mean	Std. Deviation
I can take care of the regular maintenance that RWH unit needs.	3.793	0.831

Ability of respondents	Mean	Std. Deviation
I am able to pay for the maintenance cost of the RWH unit.	3.823	0.719
I possess a good level of knowledge of storing rainwater via RWH.	3.670	0.841
I got financial support from the government to pay for any damages in the RWH unit.	2.700	1.113
It is important for my neighbors in my local area to have a coordinated plan for maintaining RWH.	3.125	1.141
During dry time, I can manage my household's water requirement through other sources.	3.823	0.773
I can spare enough space for RWH unit to be installed.	3.530	0.775

1.39 Opportunity

The respondents mostly agreed that they get information on RWH installations easily (M=4.0±0.6), have spare time for the maintenance of RWH (M=3.7±0.7) and know where to seek help when stuck with any problem (M=3.8±0.8). Furthermore, they get enough support from government (M=3.8±0.8), get subsidies for RWH unit purchase and installation (M=3.6±0.8) and government provided supervisors are available to check on the RWH units in the locality in a regular manner (M=3.5±0.8). Also, the RWH company provides support for regular maintenance of the tank, pipes associated with RWH (M=3.8±0.8).

Table 0.84

Opportunity

Opportunity	Mean	Std. Deviation
It is easy to get information on RWH installations.	3.973	0.572
I have spare time for the maintenance of RWH.	3.683	0.734
I know where to seek help when I am stuck with any problem regarding RWH.	3.765	0.779
The government provides adequate support for installing RWH units.	3.775	0.782
The RWH company provides support for regular maintenance of the tank, pipes associated with RWH	3.800	0.704
There are subsidies for RWH unit purchase and installation.	3.570	0.782
The government provides supervisors to check on the RWH units in the locality in a regular manner.	3.488	0.819

1.40 Differences in Study Variables based on Demographic Details

Differences in study variables based on gender of respondents

Independent sample t-test was performed to find the differences in study variables based on gender of the residents. The result showed that within the social marketing strategies, beliefs about RWH (t= 2.464, p<0.05), attitudes about RWH (t= 2.700, p<0.05), subjective norms (t= 2.038, p<0.05), behavioral intention (t= 2.217, p<0.05), actual behavioral change to adopt rainwater harvesting (t= 3.095, p<0.05) were significantly different for male and female residents (Table 4.15). All these factors, such as social media marketing strategies (M=4.267), beliefs about RWH (M=4.105), attitudes about RWH (M=3.745), subjective norms (M=3.850), behavioral intention (M=3.898), actual behavioral change to adopt rainwater harvesting (M=4.007) were significantly higher for male residents compared to females. However, perceptions of motivation (t= 0.571, p>0.05), barriers (t= 0.084, p>0.05), ability (t= 1.807, p>0.05) and opportunity (t= -0.841, p>0.05) were not significantly different for the male and female participants.

Table 0.95

Differences in study variables based on gender of residents

Variable	Gender	N	Mean	Std. Deviation	t	p value
Beliefs about RWH	Male	244	4.105	0.634	2.464	0.014
	Female	156	3.935	0.734		
Attitudes about RWH	Male	244	3.745	0.630	2.700	0.007
	Female	156	3.565	0.681		
Subjective norms	Male	244	3.850	0.509	2.038	0.042
	Female	156	3.737	0.590		
Behavioral Intention to adopt RWH	Male	244	3.898	0.599	2.217	0.027
	Female	156	3.750	0.720		
Actual behavioral change to adopt RWH	Male	244	4.007	0.539	3.095	0.002
	Female	156	3.809	0.739		
Motivation to use RWH	Male	244	3.871	0.547	0.571	0.568
	Female	156	3.838	0.601		
Barriers in adoption of RWH	Male	244	2.265	0.473	0.084	0.933
	Female	156	2.260	0.584		
Ability	Male	244	3.525	0.375	1.807	0.071

Variable	Gender	N	Mean	Std. Deviation	t	p value
	Female	156	3.447	0.488		
Opportunity	Male	244	3.703	0.529	-0.841	0.401
	Female	156	3.752	0.633		

Difference in study variables based on age

ANOVA analysis showed a significant relationship of resident's age with factors like perceptions on social media marketing strategies (F= 5.478, p<0.05), beliefs about RWH (F= 8.392, p<0.05), attitudes about RWH (F= 4.844, p<0.05), subjective norms (F= 2.877, p<0.05), actual behavioral change to adopt rainwater harvesting (F= 6.395, p<0.05), motivation (F= 3.002, p<0.05) and barriers (F= 2.918, p<0.05) (Table 4.16). The result showed that perceptions regarding social media marketing strategies (M=4.313), beliefs about RWH (M=4.158) and attitudes about RWH (M=3.742) were significantly higher among the age group between 25 to 45 years old. On the other hand, perception of barriers (M=2.455) was higher for the age group of 66-75 years old and subjective norms (M=4.143), actual behavioral change to adopt rainwater harvesting (M=4.167) and motivation (M=4.333) were seen to be highest among the residents with more than 75 years of age. However, no significant differences were observed in behavioral intention (F= 2.149, p>0.05), ability (F= 2.621, p>0.05) and opportunity (F= 1.773, p>0.05) of the residents based on their age.

Table 0.106

Difference in study variables based on age

	Age (Years)	N	Mean	Std. Deviation	F	Sig.
Social media marketing strategies	25-45	252	4.313	0.744	5.478	0.001
	46-65	99	4.022	0.755		
	66-75	42	4.034	0.942		
	>75	7	3.592	1.492		
Beliefs about RWH	25-45	252	4.158	0.688	8.392	0.000
	46-65	99	3.901	0.534		
	66-75	42	3.694	0.634		
	>75	7	3.762	1.254		
Attitudes about RWH	25-45	252	3.742	0.650	4.844	0.003
	46-65	99	3.657	0.666		

	Age (Years)	N	Mean	Std. Deviation	F	Sig.
	66-75	42	3.337	0.612		
	>75	7	3.548	0.343		
Subjective norms	25-45	252	3.847	0.552	2.877	0.036
	46-65	99	3.742	0.520		
	66-75	42	3.659	0.502		
	>75	7	4.143	0.634		
Behavioral Intention	25-45	252	3.895	0.673	2.149	0.094
	46-65	99	3.780	0.541		
	66-75	42	3.710	0.672		
	>75	7	3.486	1.012		
Actual behavioral change to adopt rainwater harvesting	25-45	252	4.010	0.593	6.395	0.000
	46-65	99	3.850	0.651		
	66-75	42	3.595	0.719		
	>75	7	4.167	0.304		
Motivation	25-45	252	3.891	0.573	3.002	0.030
	46-65	99	3.788	0.560		
	66-75	42	3.746	0.548		
	>75	7	4.333	0.289		
Barriers	25-45	252	2.224	0.535	2.918	0.034
	46-65	99	2.295	0.475		
	66-75	42	2.455	0.484		
	>75	7	2.057	0.500		
Ability	25-45	252	3.519	0.424	2.621	0.050
	46-65	99	3.506	0.379		
	66-75	42	3.364	0.444		
	>75	7	3.224	0.709		
Opportunity	25-45	252	3.765	0.593	1.773	0.152
	46-65	99	3.659	0.544		
	66-75	42	3.588	0.479		
	>75	7	3.857	0.535		

Table 0.117

Multiple comparison for difference in study variables based on age

Dependent Variable	Age (I)	Age (J)	Mean Difference (I-J)	Std. Error	Sig.
Social media marketing strategies	25-45	46-65	0.292	0.093	0.010
		66-75	0.279	0.131	0.144

Dependent Variable	Age (I)	Age (J)	Mean Difference (I-J)	Std. Error	Sig.
		>75	0.722	0.301	0.079
	46-65	25-45	-0.292	0.093	0.010
		66-75	-0.012	0.145	1.000
		>75	0.430	0.307	0.501
	66-75	25-45	-0.279	0.131	0.144
		46-65	0.012	0.145	1.000
		>75	0.442	0.321	0.513
	>75	25-45	-0.722	0.301	0.079
		46-65	-0.430	0.307	0.501
		66-75	-0.442	0.321	0.513
Beliefs about RWH	25-45	46-65	0.257	0.078	0.006
		66-75	0.464	0.110	0.000
		>75	0.396	0.253	0.400
	46-65	25-45	-0.257	0.078	0.006
		66-75	0.206	0.122	0.328
		>75	0.139	0.258	0.950
	66-75	25-45	-0.464	0.110	0.000
		46-65	-0.206	0.122	0.328
		>75	-0.067	0.270	0.995
	>75	25-45	-0.396	0.253	0.400
		46-65	-0.139	0.258	0.950
		66-75	0.067	0.270	0.995
Attitudes about RWH	25-45	46-65	0.085	0.077	0.680
		66-75	0.405	0.108	0.001
		>75	0.194	0.248	0.861
	46-65	25-45	-0.085	0.077	0.680
		66-75	0.319	0.119	0.038
		>75	0.109	0.253	0.973
	66-75	25-45	-0.405	0.108	0.001
		46-65	-0.319	0.119	0.038
		>75	-0.210	0.264	0.856
	>75	25-45	-0.194	0.248	0.861
		46-65	-0.109	0.253	0.973
		66-75	0.210	0.264	0.856
Subjective norms	25-45	46-65	0.104	0.064	0.366
		66-75	0.188	0.090	0.159
		>75	-0.296	0.207	0.481

Dependent Variable	Age (I)	Age (J)	Mean Difference (I-J)	Std. Error	Sig.
	46-65	25-45	-0.104	0.064	0.366
		66-75	0.084	0.099	0.835
		>75	-0.400	0.211	0.232
	66-75	25-45	-0.188	0.090	0.159
		46-65	-0.084	0.099	0.835
		>75	-0.484	0.221	0.126
	>75	25-45	0.296	0.207	0.481
		46-65	0.400	0.211	0.232
		66-75	0.484	0.221	0.126
Actual behavioral change to adopt rainwater harvesting	25-45	46-65	0.160	0.073	0.131
		66-75	0.415	0.103	0.000
		>75	-0.157	0.237	0.911
	46-65	25-45	-0.160	0.073	0.131
		66-75	0.255	0.114	0.115
		>75	-0.316	0.242	0.558
	66-75	25-45	-0.415	0.103	0.000
		46-65	-0.255	0.114	0.115
		>75	-0.571	0.252	0.109
	>75	25-45	0.157	0.237	0.911
		46-65	0.316	0.242	0.558
		66-75	0.571	0.252	0.109
Motivation	25-45	46-65	0.103	0.067	0.415
		66-75	0.145	0.094	0.414
		>75	-0.442	0.216	0.173
	46-65	25-45	-0.103	0.067	0.415
		66-75	0.042	0.104	0.978
		>75	-0.545	0.221	0.066
	66-75	25-45	-0.145	0.094	0.414
		46-65	-0.042	0.104	0.978
		>75	-0.587	0.230	0.054
	>75	25-45	0.442	0.216	0.173
		46-65	0.545	0.221	0.066
		66-75	0.587	0.230	0.054
Barriers	25-45	46-65	-0.071	0.061	0.654
		66-75	-0.231	0.086	0.038
		>75	0.167	0.197	0.832
	46-65	25-45	0.071	0.061	0.654

Dependent Variable	Age (I)	Age (J)	Mean Difference (I-J)	Std. Error	Sig.
		66-75	-0.160	0.095	0.333
		>75	0.238	0.201	0.639
	66-75	25-45	0.231	0.086	0.038
		46-65	0.160	0.095	0.333
		>75	0.398	0.210	0.233
	>75	25-45	-0.167	0.197	0.832
		46-65	-0.238	0.201	0.639
		66-75	-0.398	0.210	0.233

Difference in study variables based on educational qualification

ANOVA analysis showed a significant relationship of resident's educational qualifications with factors like perceptions on social media marketing strategies (F= 14.138, p<0.05), beliefs about RWH (F= 18.088, p<0.05), attitudes about RWH (F= 12.985, p<0.05), subjective norms (F= 3.234, p<0.05), behavioral intention (F= 6.402, p<0.05), actual behavioral change to adopt rainwater harvesting (F= 5.964, p<0.05), motivation (F= 4.822, p<0.05), barriers (F= 8.047, p<0.05), ability (F= 7.916, p>0.05) and opportunity (F= 5.656, p<0.05) (Table 4.18). The results showed that perceptions regarding social media marketing strategies (M=4.599) and subjective norms (M=4.006) were higher for the residents with post-graduation qualifications. Moreover, beliefs about RWH (M=4.158), attitudes about RWH (M=4.077) behavioral intention (M=4.231), actual behavioral change to adopt rainwater harvesting (M=4.179), motivation (M=4.224), ability (M=3.568) and opportunity (M=4.115) were significantly higher for residents having degree above post-graduate compared to others. Only perception of barriers (M=2.487) was significantly higher for residents with undergraduate qualification compared to others.

Table 0.18

Difference in study variables based on educational qualification

	Educational qualification	N	Mean	Std. Deviation	F	Sig.
Social media marketing strategies	Undergraduate	52	3.643	1.312		
	Graduate	276	4.218	0.641	14.138	0.000
	Post-graduate	46	4.599	0.474		

	Educational qualification	N	Mean	Std. Deviation	F	Sig.
	Above post-graduate	26	4.401	0.871		
Beliefs about RWH	Undergraduate	52	3.574	0.883	18.088	0.000
	Graduate	276	4.025	0.565		
	Post-graduate	46	4.402	0.669		
	Above post-graduate	26	4.468	0.750		
Attitudes about RWH	Undergraduate	52	3.333	0.607	12.985	0.000
	Graduate	276	3.748	0.589		
	Post-graduate	46	3.395	0.788		
	Above post-graduate	26	4.077	0.747		
Subjective norms	Undergraduate	52	3.641	0.618	3.234	0.022
	Graduate	276	3.804	0.512		
	Post-graduate	46	3.895	0.556		
	Above post-graduate	26	4.006	0.628		
Behavioral Intention	Undergraduate	52	3.569	0.807	6.402	0.000
	Graduate	276	3.849	0.583		
	Post-graduate	46	3.874	0.640		
	Above post-graduate	26	4.231	0.817		
Actual behavioral change to adopt rainwater harvesting	Undergraduate	52	3.625	0.731	5.964	0.001
	Graduate	276	3.950	0.595		
	Post-graduate	46	4.011	0.625		
	Above post-graduate	26	4.179	0.622		
Motivation	Undergraduate	52	3.718	0.658	4.822	0.003
	Graduate	276	3.848	0.536		
	Post-graduate	46	3.870	0.534		
	Above post-graduate	26	4.224	0.648		
Barriers	Undergraduate	52	2.487	0.606	8.047	0.000
	Graduate	276	2.267	0.466		
	Post-graduate	46	2.185	0.544		
	Above post-graduate	26	1.908	0.616		
Ability	Undergraduate	52	3.269	0.558	7.916	0.000
	Graduate	276	3.505	0.360		
	Post-graduate	46	3.568	0.419		
	Above post-graduate	26	3.703	0.573		
Opportunity	Undergraduate	52	3.497	0.631	8.656	0.000
	Graduate	276	3.700	0.509		
	Post-graduate	46	3.885	0.542		
	Above post-graduate	26	4.115	0.835		

Table 0.19

Multiple comparisons for difference in study variables based on educational qualification

	Educational qualification (I)	Educational qualification (J)	Mean Difference (I-J)	Std. Error	Sig
Social media marketing strategies	Undergraduate	Graduate	-0.576	0.115	0.000
		Post-graduate	-0.957	0.154	0.000
		Above post-graduate	-0.758	0.183	0.000
	Graduate	Undergraduate	0.576	0.115	0.000
		Post-graduate	-0.381	0.121	0.010
		Above post-graduate	-0.183	0.156	0.647
	Post-graduate	Undergraduate	0.957	0.154	0.000
		Graduate	0.381	0.121	0.010
		Above post-graduate	0.198	0.187	0.714
	Above post-graduate	Undergraduate	0.758	0.183	0.000
		Graduate	0.183	0.156	0.647
		Post-graduate	-0.198	0.187	0.714
Beliefs about RWH	Undergraduate	Graduate	-0.452	0.097	0.000
		Post-graduate	-0.828	0.129	0.000
		Above post-graduate	-0.894	0.153	0.000
	Graduate	Undergraduate	0.452	0.097	0.000
		Post-graduate	-0.377	0.102	0.001
		Above post-graduate	-0.443	0.131	0.004
	Post-graduate	Undergraduate	0.828	0.129	0.000
		Graduate	0.377	0.102	0.001
		Above post-graduate	-0.066	0.157	0.975
	Above post-graduate	Undergraduate	0.894	0.153	0.000
		Graduate	0.443	0.131	0.004
		Post-graduate	0.066	0.157	0.975
Attitudes about RWH	Undergraduate	Graduate	-0.415	0.095	0.000
		Post-graduate	-0.062	0.127	0.962
		Above post-graduate	-0.744	0.151	0.000
	Graduate	Undergraduate	0.415	0.095	0.000
		Post-graduate	0.353	0.100	0.003
		Above post-graduate	-0.329	0.129	0.054
	Post-graduate	Undergraduate	0.062	0.127	0.962
		Graduate	-0.353	0.100	0.003
		Above post-graduate	-0.682	0.154	0.000

	Educational qualification (I)	Educational qualification (J)	Mean Difference (I-J)	Std. Error	Sig.
Subjective norms	Above post-graduate	Undergraduate	0.744	0.151	0.000
		Graduate	0.329	0.129	0.054
		Post-graduate	0.682	0.154	0.000
	Undergraduate	Graduate	-0.163	0.082	0.192
		Post-graduate	-0.254	0.109	0.094
		Above post-graduate	-0.365	0.130	0.026
	Graduate	Undergraduate	0.163	0.082	0.192
		Post-graduate	-0.091	0.086	0.713
		Above post-graduate	-0.203	0.111	0.260
	Post-graduate	Undergraduate	0.254	0.109	0.094
		Graduate	0.091	0.086	0.713
		Above post-graduate	-0.111	0.132	0.834
	Above post-graduate	Undergraduate	0.365	0.130	0.026
		Graduate	0.203	0.111	0.260
		Post-graduate	0.111	0.132	0.834
Behavioral Intention	Undergraduate	Graduate	-0.279	0.097	0.021
		Post-graduate	-0.305	0.129	0.088
		Above post-graduate	-0.662	0.154	0.000
	Graduate	Undergraduate	0.279	0.097	0.021
		Post-graduate	-0.025	0.102	0.995
		Above post-graduate	-0.382	0.131	0.020
	Post-graduate	Undergraduate	0.305	0.129	0.088
		Graduate	0.025	0.102	0.995
		Above post-graduate	-0.357	0.157	0.106
	Above post-graduate	Undergraduate	0.662	0.154	0.000
		Graduate	0.382	0.131	0.020
		Post-graduate	0.357	0.157	0.106
Actual behavioral change to adopt rainwater harvesting	Undergraduate	Graduate	-0.325	0.094	0.003
		Post-graduate	-0.386	0.125	0.012
		Above post-graduate	-0.554	0.149	0.001
	Graduate	Undergraduate	0.325	0.094	0.003
		Post-graduate	-0.061	0.099	0.926
		Above post-graduate	-0.230	0.127	0.272
	Post-graduate	Undergraduate	0.386	0.125	0.012
		Graduate	0.061	0.099	0.926
		Above post-graduate	-0.169	0.152	0.684

	Educational qualification (I)	Educational qualification (J)	Mean Difference (I-J)	Std. Error	Sig.
Motivation	Above post-graduate	Undergraduate	0.554	0.149	0.001
		Graduate	0.230	0.127	0.272
		Post-graduate	0.169	0.152	0.684
	Undergraduate	Graduate	-0.130	0.085	0.419
		Post-graduate	-0.152	0.113	0.540
		Above post-graduate	-0.506	0.135	0.001
	Graduate	Undergraduate	0.130	0.085	0.419
		Post-graduate	-0.022	0.089	0.995
		Above post-graduate	-0.377	0.115	0.006
	Post-graduate	Undergraduate	0.152	0.113	0.540
		Graduate	0.022	0.089	0.995
		Above post-graduate	-0.355	0.138	0.050
Barriers	Above post-graduate	Undergraduate	0.506	0.135	0.001
		Graduate	0.377	0.115	0.006
		Post-graduate	0.355	0.138	0.050
	Undergraduate	Graduate	0.219	0.076	0.022
		Post-graduate	0.302	0.102	0.018
		Above post-graduate	0.579	0.121	0.000
	Graduate	Undergraduate	-0.219	0.076	0.022
		Post-graduate	0.083	0.080	0.734
		Above post-graduate	0.360	0.104	0.003
	Post-graduate	Undergraduate	-0.302	0.102	0.018
		Graduate	-0.083	0.080	0.734
		Above post-graduate	0.277	0.124	0.116
Ability	Above post-graduate	Undergraduate	-0.579	0.121	0.000
		Graduate	-0.360	0.104	0.003
		Post-graduate	-0.277	0.124	0.116
	Undergraduate	Graduate	-0.236	0.062	0.001
		Post-graduate	-0.299	0.084	0.002
		Above post-graduate	-0.434	0.099	0.000
	Graduate	Undergraduate	0.236	0.062	0.001
		Post-graduate	-0.063	0.066	0.772
		Above post-graduate	-0.198	0.085	0.091
	Post-graduate	Undergraduate	0.299	0.084	0.002
		Graduate	0.063	0.066	0.772
		Above post-graduate	-0.135	0.101	0.543

	Educational qualification (I)	Educational qualification (J)	Mean Difference (I-J)	Std. Error	Sig.
Opportunity	Above post-graduate	Undergraduate	0.434	0.099	0.000
		Graduate	0.198	0.085	0.091
		Post-graduate	0.135	0.101	0.543
	Undergraduate	Graduate	-0.203	0.084	0.076
		Post-graduate	-0.388	0.112	0.003
		Above post-graduate	-0.618	0.133	0.000
	Graduate	Undergraduate	0.203	0.084	0.076
		Post-graduate	-0.185	0.088	0.156
		Above post-graduate	-0.416	0.114	0.002
	Post-graduate	Undergraduate	0.388	0.112	0.003
		Graduate	0.185	0.088	0.156
		Above post-graduate	-0.230	0.136	0.330
	Above post-graduate	Undergraduate	0.618	0.133	0.000
		Graduate	0.416	0.114	0.002
		Post-graduate	0.230	0.136	0.330

Difference in study variables based on type of house

ANOVA analysis was conducted to understand the variation of study variables based on property type. It showed significant variations in beliefs about RWH (F= 3.840, p<0.05), subjective norms (F= 13.656, p<0.05), behavioral intention (F= 4.261, p<0.05), actual behavioral change to adopt rainwater harvesting (F= 6.248, p<0.05) and motivation (F= 4.822, p<0.05) with different property types. The results showed that beliefs about RWH (M=4.132), subjective norms (M=3.943), behavioral intention (M=3.938), actual behavioral change to adopt rainwater harvesting (M=4.038) and motivation (M=3.965) were higher for the residents from multi-storied flat compared to residents of other property type. However, perceptions on social media marketing strategies (F= 0.254, p>0.05), attitudes about RWH (F= 1.847, p>0.05), barriers (F= 1.816, p>0.05), ability (F= 0.739, p>0.05) and opportunity (F= 0.424, p>0.05) were not significantly different for having different property types (Table 4.20).

Table 0.20

Differences in study variables based on type of house

Variables	Property type	N	Mean	Std. Deviation	F	Sig.
Social media marketing strategies	Individual house	180	4.213	0.832	0.254	0.776
	Multi-storied Flat	193	4.201	0.761		
	Apartment society	27	4.095	0.860		
Beliefs about RWH	Individual house	180	3.965	0.691	3.840	0.022
	Multi-storied Flat	193	4.132	0.641		
	Apartment society	27	3.864	0.786		
Attitude about RWH	Individual house	180	3.634	0.738	1.847	0.159
	Multi-storied Flat	193	3.734	0.573		
	Apartment society	27	3.525	0.593		
Subjective norms	Individual house	180	3.657	0.531	13.656	0.000
	Multi-storied Flat	193	3.943	0.498		
	Apartment society	27	3.821	0.695		
Behavioral Intention to adopt RWH	Individual house	180	3.749	0.683	4.261	0.015
	Multi-storied Flat	193	3.938	0.550		
	Apartment society	27	3.748	0.973		
Actual behavioral change to adopt RWH	Individual house	180	3.810	0.580	6.248	0.002
	Multi-storied Flat	193	4.038	0.625		
	Apartment society	27	3.951	0.851		
Motivation to use RWH	Individual house	180	3.749	0.611	6.956	0.001
	Multi-storied Flat	193	3.965	0.501		
	Apartment society	27	3.821	0.608		
Barriers to adopt RWH	Individual house	180	2.317	0.528	1.816	0.164
	Multi-storied Flat	193	2.221	0.488		
	Apartment society	27	2.200	0.640		
Ability	Individual house	180	3.477	0.421	0.739	0.478
	Multi-storied Flat	193	3.499	0.433		
	Apartment society	27	3.582	0.374		
Opportunity	Individual house	180	3.693	0.621	0.424	0.654
	Multi-storied Flat	193	3.744	0.515		
	Apartment society	27	3.757	0.616		

Table 0.21

Multiple comparisons for difference in study variables based on type of house

Variables	Property type (I)	Property type (J)	Mean Difference (I-J)	Std. Error	Sig.
Beliefs about RWH	Individual house	Multi-storied Flat	-0.167	0.070	0.045
		Apartment society	0.101	0.139	0.750
	Multi-storied Flat	Individual house	0.167	0.070	0.045
		Apartment society	0.268	0.139	0.130
	Apartment society	Individual house	-0.101	0.139	0.750
		Multi-storied Flat	-0.268	0.139	0.130
Subjective norms	Individual house	Multi-storied Flat	-0.286	0.055	0.000
		Apartment society	-0.164	0.109	0.291
	Multi-storied Flat	Individual house	0.286	0.055	0.000
		Apartment society	0.122	0.108	0.499
	Apartment society	Individual house	0.164	0.109	0.291
		Multi-storied Flat	-0.122	0.108	0.499
Behavioral Intention	Individual house	Multi-storied Flat	-0.189	0.067	0.014
		Apartment society	0.001	0.134	1.000
	Multi-storied Flat	Individual house	0.189	0.067	0.014
		Apartment society	0.190	0.133	0.328
	Apartment society	Individual house	-0.001	0.134	1.000
		Multi-storied Flat	-0.190	0.133	0.328
Actual behavioral change to adopt rainwater harvesting	Individual house	Multi-storied Flat	-0.228	0.065	0.001
		Apartment society	-0.140	0.129	0.519
	Multi-storied Flat	Individual house	0.228	0.065	0.001
		Apartment society	0.087	0.128	0.774
	Apartment society	Individual house	0.140	0.129	0.519
		Multi-storied Flat	-0.087	0.128	0.774
Motivation	Individual house	Multi-storied Flat	-0.216	0.058	0.001
		Apartment society	-0.072	0.116	0.808

Variables	Property type (I)	Property type (J)	Mean Difference (I-J)	Std. Error	Sig.
	Multi-storied Flat	Individual house	0.216	0.058	0.001
		Apartment society	0.144	0.115	0.426
	Apartment society	Individual house	0.072	0.116	0.808
		Multi-storied Flat	-0.144	0.115	0.426

Differences in study variables based on ownership type

Independent sample t-test was performed to find the differences in study variables based on ownership type of the residents. The result showed that social media marketing strategies (t= -0.039, p>0.05), beliefs about RWH (t= -1.047, p>0.05), attitudes about RWH (t= -0.219, p>0.05) and opportunity (t= -1.419, p>0.05) were not significantly different for different ownership type. However, resident's perception about subjective norms (t= -4.060, p<0.05), behavioral intention (t= -2.964, p<0.05), actual behavioral change to adopt rainwater harvesting (t= -3.857, p<0.05), motivation (t= -3.874, p<0.05), barriers (t= 3.605, p<0.05), and ability (t= -3.156, p<0.05) were significantly different for residents in renting or with own house (Table 4.22). The study showed that perception of subjective norms (M=4.002), behavioral intention (M=4.013), actual behavioral change to adopt rainwater harvesting (M=4.145), motivation (M=4.053) and ability were higher for residents with own house compared to those staying in rental basis. However, perception of barriers was higher for those staying in rental property (M=2.314) compared to the residents with own house.

Table 0.22

Difference in study variables based on ownership type

	Ownership type	N	Mean	Std. Deviation	t	p value
Social media marketing strategies	Rental	306	4.198	0.827	-0.039	0.969
	Own House	94	4.202	0.704		
Beliefs about RWH	Rental	306	4.019	0.711	-1.047	0.296
	Own House	94	4.103	0.562		
Attitudes about RWH	Rental	306	3.671	0.642	-0.219	0.827
	Own House	94	3.688	0.702		
Subjective norms	Rental	306	3.746	0.540	-4.060	0.000

	Ownership type	N	Mean	Std. Deviation	t	p value
	Own House	94	4.002	0.515		
Behavioral intention to adopt RWH	Rental	306	3.787	0.677	-2.964	0.003
	Own House	94	4.013	0.533		
Actual behavioral change to adopt RWH	Rental	306	3.863	0.656	-3.857	0.000
	Own House	94	4.145	0.485		
Motivation	Rental	306	3.798	0.582	-3.874	0.000
	Own House	94	4.053	0.475		
Barriers	Rental	306	2.314	0.530	3.605	0.000
	Own House	94	2.097	0.445		
Ability	Rental	306	3.458	0.411	-3.156	0.002
	Own House	94	3.614	0.446		
Opportunity	Rental	306	3.699	0.582	-1.419	0.157
	Own House	94	3.795	0.531		

1.41 Correlations among Study Variables

Correlation between the study variables were conducted to understand the relationship between various factors in the study, such as perceptions on social media marketing strategies, beliefs about RWH, attitudes about RWH, subjective norms, behavioral intention, actual behavioral change to adopt rainwater harvesting, motivation, barriers, ability and opportunity using Pearson's bivariate correlation. Table 4.23 displays the correlation between these variables. The correlation measures the strength of the linear association between two variables and the correction coefficient (denoted as r) varies from +1 to -1. The correlation co-efficient values ranging between 0.1-0.3, 0.3-0.5 and more than 0.5 indicate small level, moderate level and strong level of correlation, respectively. The result showed that the correlations between subjective norms and beliefs about RWH (r=0.579), actual behavioral change to adopt rainwater harvesting and beliefs about RWH (r=0.582), motivation and beliefs about RWH (r=0.592), barriers and beliefs about RWH (r=-0.630), ability and beliefs about RWH (r=0.513), opportunity and beliefs about RWH (r=0.627), actual behavioral change to adopt rainwater harvesting and attitudes about RWH (r=0.532), behavioral intention and subjective norm (r=0.567), actual behavioral change to adopt rainwater harvesting and subjective norm (r=0.698), motivation and subjective norm (r=0.730), barriers and subjective norm (r=-0.672), ability and subjective norm (r=0.520), opportunity and subjective norm (r=0.643), actual behavioral change to adopt rainwater harvesting and behavioral intention (r=0.563), motivation and behavioral intention (r=0.643), barriers and behavioral intention (r=-0.579), opportunity and behavioral intention (r=0.532), motivation and actual behavioral change to adopt rainwater harvesting (r=0.699), barriers and actual behavioral change to adopt rainwater harvesting (r=-0.700), ability and actual behavioral change to adopt rainwater harvesting (r=0.533), opportunity and actual behavioral change to adopt rainwater harvesting (r=0.555), barriers and motivation (r=-0.695), ability and motivation (r=0.501), opportunity and motivation (r=0.670), barriers and ability (r=-0.682), opportunity and barriers (r=-0.759) and opportunity and ability (r=0.656) were strong. Moderate correlations were observed between beliefs about RWH and social media marketing strategies (r=0.436), behavioral intention and social media marketing strategies (r=0.304), barriers and social media marketing strategies (r=-0.364), ability and social media marketing strategies (r=0.349), attitudes about RWH and beliefs about RWH (r=0.410), behavioral intention and beliefs about RWH (r=0.463), attitudes about RWH and subjective norms (r=0.353), behavioral intention and attitudes about RWH (r= 0.388), motivation and attitudes about RWH (r= 0.406), barriers and attitudes about RWH (r= -0.424), ability and attitudes about RWH (r= 0.388),opportunity and attitudes about RWH (r= 0.352), and ability and behavioral intention (r= 0.447). On the other hand, low correlations were found between social media marketing strategies and attitudes about RWH (r=0.211), social media marketing strategies and subjective norms (r=0.287), social media marketing strategies and actual behavioral change to adopt rainwater harvesting (r=0.295), motivation and social media marketing strategies (r=0.277), and opportunity and social media marketing strategies (r=0.292).

Table 0.23

Correlations among study variables

Variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Social media marketing strategies (1)	1									
Beliefs about RWH (2)	0.436**	1								
Attitudes about RWH (3)	0.211**	0.410**								
Subjective norms (4)	0.287**	0.579**	0.353**	1						
Behavioral Intention to adopt RWH (5)	0.304**	0.463**	0.388**	0.567**	1					
Actual behavioral change to adopt RWH (6)	0.295**	0.582**	0.532**	0.698**	0.563**	1				
Motivation (7)	0.277**	0.592**	0.406**	0.730**	0.643**	0.699**	1			
Barriers (8)	-0.364**	-0.630**	-0.424**	-0.672**	-0.579**	-0.700**	-0.695**	1		
Ability (9)	0.349**	0.513**	0.388**	0.520**	0.447**	0.533**	0.501**	-0.682**	1	
Opportunity (10)	0.292**	0.627**	0.352**	0.643**	0.532**	0.555**	0.670**	-0.759**	0.656**	1

1.42 Impact of Beliefs about Rainwater Harvesting on Behavioral Intention

Linear regression analysis was performed to find out the impact of beliefs about RWH on behavioral intention. Table 4.25 and Table 4.26 represent the model summary and path coefficients, respectively. The coefficient of determination (R square) indicates the proportion of the total variation in the dependent variable which can be explained by the variation in the independent variable(s). It ranges between 0 and 1. Since R Square value is equal to 0.214, It implies that 21.4 % variation in behavioral intention to adopt RWH can be explained by residents' beliefs about RWH with $F(1,398) = 108.577$. The adjusted R square value of 0.212, indicates that 21.2% of the variance was explained by the model. The result of regression represents that residents' beliefs about RWH significantly influence behavioral intention to adopt RWH ($p<0.05$).

The regression coefficient in a regression analysis characterizes the change in the dependent variable for each unit change in the independent variable. The statistical analysis shows that the effect of residents' beliefs about RWH on behavioral intention is positive and significant ($t = 10.420$, $p < 0.05$). The coefficient value (B) for residents' beliefs about RWH is 0.445. This means that for every unit increase in residents' beliefs about RWH, behavioral intention to adopt RWH among the residents is expected to increase by 0.445 units.

Therefore, the hypothesis H1: Residents' beliefs about RWH influence behavioral intention to adopt RWH is accepted. The regression equation can be expressed as the following.

Behavioral intention to adopt RWH = 2.043+0.445 (Residents' beliefs about RWH)

Table 0.24

Descriptive statistics for impact of beliefs about rainwater harvesting on behavioral intention on adoption of rainwater harvesting

Variable	Mean	Std. Deviation
Behavioral Intention	3.840	0.652

Variable	Mean	Std. Deviation
Beliefs about RWH	4.039	0.679

Table 0.25

Model summary for impact of beliefs about rainwater harvesting behavioral intention

R	R Square	Adjusted R Square	Std. Error of the Estimate	R Square Change	Change Statistics			
					F Change	df1	df2	Sig. F Change
0.463	0.214	0.212	0.579	0.214	108.577	1	398	0.000

Table 0.126

Path coefficients for impact of beliefs about rainwater harvesting behavioral intention

Variable	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
	B	Std. Error	Beta		
(Constant)	2.043	0.175		11.683	0.000
Beliefs about RWH	0.445	0.043	0.463	10.420	0.000

1.43 Impact of Attitudes about Rainwater Harvesting on Behavioral Intention

Linear regression analysis was also performed to find out the impact of attitudes about RWH on behavioral intention of the residents. Table 4.28 and Table 4.29 represent the model summary and path coefficients, respectively. The R Square value for the present relationship is equal to 0.150, It implies that 15.0 % variation in behavioral intention to adopt RWH can be explained by residents' attitudes about RWH with F (1,398) = 70.501. The adjusted R square value of 0.148, indicates that 14.8% of the variance was explained by the model. The result of regression represents that residents' attitudes about RWH significantly influence behavioral intention to adopt RWH ($p<0.05$).

The statistical analysis shows that the effect of residents' attitude about RWH on behavioral intention is positive and significant ($t = 8.396$, $p < 0.05$). The coefficient value (B) for residents' attitudes about RWH is 0.386. This means that for every unit increase in residents' attitudes about RWH, behavioral intention to adopt RWH among the residents is expected to increase by 0.386 units. Therefore, the hypothesis H2: Residents' attitudes about RWH influence behavioral intention to adopt RWH is accepted. The regression equation can be expressed as the following.

Behavioral intention to adopt RWH = 2.421+0.386 (Residents' attitudes about RWH)

Table 0.27

Descriptive statistics for impact of attitudes about rainwater harvesting on behavioral intention

	Mean	Std. Deviation
Behavioral Intention	3.840	0.652
Attitudes about RWH	3.675	0.656

Table 0.28

Model summary for impact of attitudes about rainwater harvesting on behavioral intention to adopt rainwater harvesting

R	R Square	Adjusted R Square	Std. Error of Estimate	R Square Change	Change Statistics			
					F Change	df1	df2	Sig. F Change
0.388	0.150	0.148	0.602	0.150	70.501	1	398	0.000

Table 0.29

Path coefficients for impact of attitudes about rainwater harvesting on behavioral intention to adopt rainwater harvesting

	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
	B	Std. Error	Beta		
(Constant)	2.421	0.172		14.107	0.000
Attitudes about RWH	0.386	0.046	0.388	8.396	0.000

1.44 Impact of Subjective Norms on Behavioral Intention to adopt Rainwater Harvesting

To understand the impact of subjective norm on behavioral intention of the residents, linear regression analysis was executed. Table 4.31 and Table 4.32 represent the model summary and path coefficients, respectively. The R Square value for the present relationship is equal to 0.322, It implies that 32.2 % variation in behavioral intention to adopt RWH can be explained by subjective norm with F

(1,398) = 188.739. The adjusted R square value of 0.320, indicates that 32.0% of the variance was explained by the model. The result of regression represents that the subjective norm significantly influence behavioral intention to adopt RWH ($p<0.05$).

The statistical analysis shows that the effect of subjective norm on behavioral intention is positive and significant ($t = 13.738$, $p < 0.05$). The coefficient value (B) for subjective norm is 0.680. This means that for every unit increase in subjective norm, behavioral intention to adopt RWH among the residents is expected to increase by 0.680 units. Therefore, the hypothesis H3: Residents' subjective norms about RWH influence behavioral intention to adopt RWH is accepted. The regression equation can be expressed as the following.

Behavioral intention to adopt RWH = 1.251+0.680 (Subjective norms)

Table 0.30

Descriptive statistics for impact of subjective norms on behavioral intention to adopt rainwater harvesting

Variable	Mean	Std. Deviation
Behavioral Intention to adopt RWH	3.840	0.652
Subjective norms	3.806	0.544

Table 0.31

Model summary for impact of attitudes about rainwater harvesting on behavioral intention

R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics				
				R Square Change	F Change	df1	df2	Sig. F Change
0.567	0.322	0.320	0.538	0.322	188.739	1	398	0.000

Table 0.32

Path coefficients for impact of attitudes about rainwater harvesting on behavioral intention

Variable	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
	B	Std. Error	Beta		
(Constant)	1.251	0.190		6.575	0.000
Subjective norms	0.680	0.050	0.567	13.738	0.000

1.45 Influence of Motivation on Actual Behavioral Change to Adopt Rainwater Harvesting

To comprehend the influence of motivation on actual behavioral change to adopt rainwater harvesting, linear regression analysis was executed. Table 4.33 and Table 4.34 represent the model summary and path coefficients, respectively. The R Square value for the present relationship is equal to 0.488, It implies that 48.8 % variation in actual behavioral change to adopt rainwater harvesting can be explained by motivation of the residents with $F(1,398) = 379.30$. The adjusted R square value of 0.487, indicates that 48.7% of the variance was explained by the model. The result of regression represents that the motivation significantly influences actual behavioral change to adopt rainwater harvesting ($p<0.05$).

The statistical analysis shows that the effect of motivation on actual behavioral change to adopt rainwater harvesting is positive and significant ($t = 19.476$, $p < 0.05$). The coefficient value (B) for behavioral intention is 0.775. This means that for every unit increase in motivation, actual behavioral change to adopt rainwater harvesting is expected to increase by 0.755 units. The regression equation can be expressed as the following.

Actual behavioral change to adopt RWH = 0.939+0.775 (Motivation)

Table 4.33

Model summary

R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics		
				R Square Change	F Change	Sig. F Change
0.699	0.488	0.487	0.452	0.488	379.30	0.000

Table 4.34

Path coefficients

	Unstandardized Coefficients		T	Sig.
	B	Std. Error		
(Constant)	0.939	0.155	6.048	0.000
Motivation	0.775	0.040	19.476	0.000

1.46 Influence of Barriers on Actual Behavioral Change to Adopt Rainwater Harvesting

To comprehend the influence of barrier on actual behavioral change to adopt rainwater harvesting, linear regression analysis was executed. Table 4.35 and Table 4.36 represent the model summary and path coefficients, respectively. The R Square value for the present relationship is equal to 0.700, It implies that 70.0 % variation in actual behavioral change to adopt rainwater harvesting can be explained by barrier of the residents with $F(1,398) = 382.08$. The adjusted R square value of 0.489, indicates that 48.9% of the variance was explained by the model. The result of regression represents that the barrier significantly influences actual behavioral change to adopt rainwater harvesting ($p<0.05$).

The statistical analysis shows that the effect of barrier on actual behavioral change to adopt rainwater harvesting is negative and significant ($t = -19.547$, $p < 0.05$). The coefficient value (B) for behavioral intention is -0.851. This means that for every unit increase in barrier, actual behavioral change to adopt rainwater harvesting is expected to decrease by 0.851 units. The regression equation can be expressed as the following.

Actual behavioral change to adopt RWH = 5.856−0.851 (Barrier)

Table 4.35

Model summary

R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics		
				R Square Change	F Change	Sig. F Change
0.700	0.490	0.489	0.451	0.490	382.08	0.000

Table 4.36

Path coefficients

	Unstandardized Coefficients		t	Sig.
	B	Std. Error		
(Constant)	5.856	0.101	57.919	0.000
Barriers	-0.851	0.044	-19.547	0.000

1.47 Influence of Ability on Actual Behavioral Change to Adopt Rainwater Harvesting

To comprehend the influence of ability on actual behavioral change to adopt rainwater harvesting, linear regression analysis was executed. Table 4.37 and Table 4.38 represent the model summary and path coefficients, respectively. The R Square value for the present relationship is equal to 0.533, It implies that 53.3 % variation in actual behavioral change to adopt rainwater harvesting can be explained by ability of the residents with F (1,398) = 157.55. The adjusted R square value of 0.282, indicates that 28.2% of the variance was explained by the model. The result of regression represents that the ability significantly influences actual behavioral change to adopt rainwater harvesting ($p<0.05$).

The statistical analysis shows that the effect of ability on actual behavioral change to adopt rainwater harvesting is positive and significant ($t = 12.552$, $p < 0.05$). The coefficient value (B) for behavioral intention is 0.793. This means that for every unit increase in ability actual behavioral change to adopt rainwater harvesting is expected to increase by 0.793 units. The regression equation can be expressed as the following.

Actual behavioral change to adopt RWH = 1.159+0.793 (Ability)

Table 4.37

Model summary

R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics		
				R Square Change	F Change	Sig. F Change
0.533	0.284	0.282	0.534	0.284	157.55	0.000

Table 4.38

Path coefficients

	Unstandardized Coefficients		t	Sig.
	B	Std. Error		
(Constant)	1.159	0.222	5.213	0.000
Ability	0.793	0.063	12.552	0.000

1.48 Influence of Opportunity on Actual Behavioral Change to Adopt Rainwater Harvesting

To comprehend the influence of opportunity on actual behavioral change to adopt rainwater harvesting, linear regression analysis was executed. Table 4.39 and Table 4.40 represent the model summary and path coefficients, respectively. The R Square value for the present relationship is equal to 0.308, It implies that 30.8 % variation in actual behavioral change to adopt rainwater harvesting can be explained by opportunity of the residents with $F (1,398) = 176.76$. The adjusted R square value of 0.306, indicates that 30.6% of the variance was explained by the model. The result of regression represents that the opportunity significantly influences actual behavioral change to adopt rainwater harvesting ($p<0.05$).

The statistical analysis shows that the effect of opportunity on actual behavioral change to adopt rainwater harvesting is positive and significant ($t = 13.295$, $p < 0.05$). The coefficient value (B) for behavioral intention is 0.613. This means that for every unit increase in opportunity, actual behavioral change to adopt rainwater harvesting is expected to increase by 0.613 units. The regression equation can be expressed as the following.

Actual behavioral change to adopt RWH = 1.650+0.613 (Opportunity)

Table 4.39

Model summary

R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics		
				R Square Change	F Change	Sig. F Change
0.555	0.308	0.306	0.525	0.308	176.76	0.000

Table 4.40

Path coefficients

	Unstandardized Coefficients		t	Sig.
	B	Std. Error		
(Constant)	1.650	0.173	9.509	0.000
Opportunity	0.613	0.046	13.295	0.000

1.49 Impact of Behavioral Intention on Actual Behavioral Change to Adopt Rainwater Harvesting

To understand the impact of behavioral intention on actual behavioral change to adopt rainwater harvesting, linear regression analysis was executed. Table 4.42 and Table 4.43 represent the model summary and path coefficients, respectively. The R Square value for the present relationship is equal to 0.316, It implies that 31.6 % variation in actual behavioral change to adopt rainwater harvesting can be explained by behavioral intention of the residents with F (1,398) = 184.270. The adjusted R square value of 0.315, indicates that 31.5% of the variance was explained by the model. The result of regression represents that the behavioral intention significantly influences actual behavioral change to adopt rainwater harvesting ($p<0.05$).

The statistical analysis shows that the effect of behavioral intention on actual behavioral change to adopt rainwater harvesting is positive and significant ($t = 13.575$, $p < 0.05$). The coefficient value (B) for behavioral intention is 0.544. This means that for every unit increase in behavioral intention, actual behavioral change to adopt rainwater harvesting is expected to increase by 0.544 units. Therefore, the hypothesis H4: Behavioral intention to adopt RWH influence the actual behavioral change to adopt RWH is accepted. The regression equation can be expressed as the following.

Actual behavioral change to adopt RWH = 1.841+0.544 (Behavioral intention)

Table 0.41

Descriptive statistics for impact of behavioral intention on actual behavioral change to adopt rainwater harvesting

Variable	Mean	Std. Deviation
Actual behavioral change to adopt RWH	3.930	0.631
Behavioral Intention to adopt RWH	3.840	0.652

Table 0.42

Model summary for impact of behavioral intention on actual behavioral change to adopt rainwater harvesting

R	R Square	Adjusted R Square	Std. Error of Estimate	R Square Change	Change Statistics			
					F Change	df1	df2	Sig. F Change
0.563	0.316	0.315	0.522	0.316	184.270	1	398	0.000

Table 0.43

Path coefficients for impact of behavioral intention on actual behavioral change to adopt rainwater harvesting

Variable	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
	B	Std. Error	Beta		
(Constant)	1.841	0.156		11.792	0.000
Behavioral Intention	0.544	0.040	0.563	13.575	0.000

1.50 Moderating Role of Motivation on the Effect of Behavioral Intention on Actual Adoption of Rainwater Harvesting

Moderating role of motivation was conducted by using the partial-least square structural equation modelling using SmartPLS (Hair *et al.*, 2022). PLS-SEM is recognized as a multivariate data analysis technique where intricate relationships among various latent variables can be evaluated (Hair *et al.*, 2022; Becker *et al.*, 2023).

Assessment measurement model

To evaluate the measurement model, all variables were assessed through factor loadings, (Hair *et al.*, 2022). As demonstrated in 4.37, factor loadings for all items crossed the value of 0.7 (Table 4.44). Moreover, the Cronbach's Alpha coefficients for all the constructs inspected in the study were above 0.7 which specify an internally stable and reliable measurement scale. In addition, the composite reliability values of the present model were greater than or equal to 0.8 for all constructs, i.e., belief (0.956), attitude (0.879), subjective norms (0.877), behavioral intention (0.915), motivation (0.902) and actual behavioral change to adopt RWH (0.930) which supports that internal consistency of the scale to be high. Likewise, rho A values for all the variables were more than 0.8 depicting a high level of reliability (Table 4.45).

Convergent validity

If the Average Variance Extracted (AVE) value of a construct exceeds 0.5, it shows convergent validity. For the present study, the AVE value of the construct was found to be greater than 0.6 suggesting a good convergent validity for the model (Table 4.45).

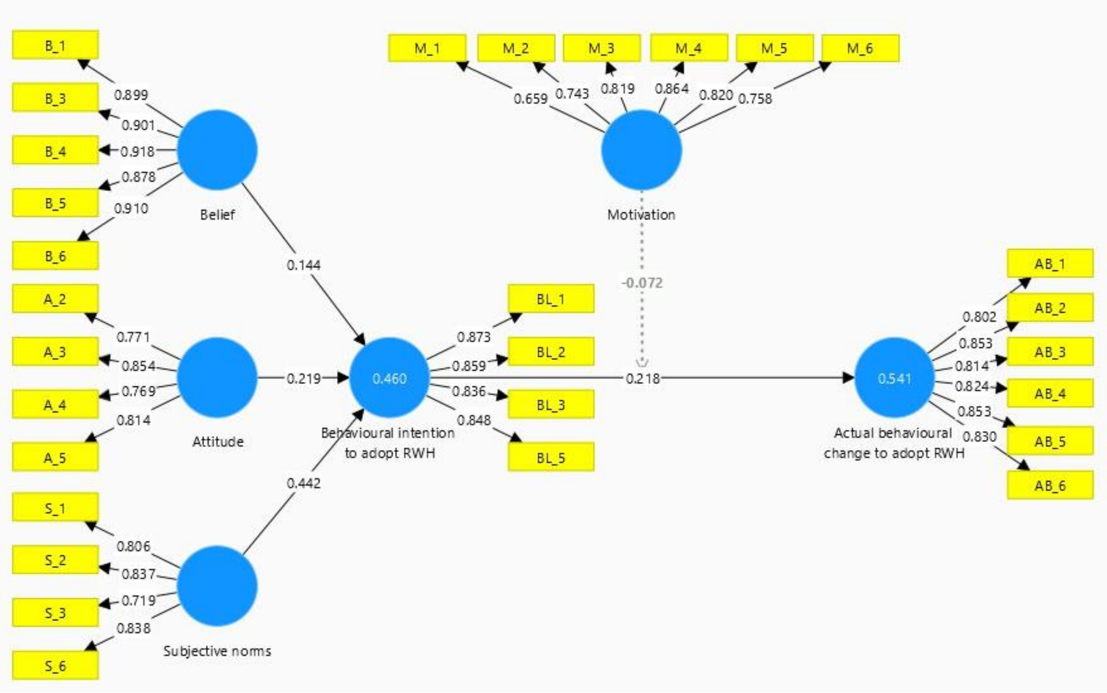

Figure 4.6

Measurement model having motivation as a moderator

Table 4.44

Estimates (outer loadings) for motivation as moderator

	AB	A	BL	B	M	S
Actual behavioral change to adopt RWH						
AB 1	0.802					
AB 2	0.853					
AB 3	0.814					
AB 4	0.824					
AB 5	0.853					
AB 6	0.83					
Attitude						
A 2		0.771				
A 3		0.854				
A 4		0.769				
A 5		0.814				
Behavioral intention to adopt RWH						
BL 1			0.873			
BL 2			0.859			
BL 3			0.836			
BL 5			0.848			

	AB	A	BL	B	M	S
Belief						
B 1				0.899		
B 3				0.901		
B 4				0.918		
B 5				0.878		
B 6				0.91		
Motivation						
M 1					0.659	
M 2					0.743	
M 3					0.819	
M 4					0.864	
M 5					0.82	
M 6					0.758	
Subjective norms						
S 1						0.806
S 2						0.837
S 3						0.719
S 6						0.838

Table 4.45

Reliability and validity

	Cronbach's alpha	Composite reliability (rho a)	Composite reliability (rho c)	Average variance extracted
Actual behavioral change to adopt RWH	0.909	0.910	0.930	0.688
Attitude	0.816	0.819	0.879	0.644
Behavioral intention to adopt RWH	0.877	0.878	0.915	0.730
Belief	0.942	0.948	0.956	0.812
Motivation	0.870	0.879	0.902	0.608
Subjective norms	0.815	0.834	0.877	0.642

Table 4.46

Cross loadings

	AB	A	BL	B	M	S
Actual behavioral change to adopt RWH						
AB 1	0.802	0.563	0.461	0.522	0.596	0.550

	AB	A	BL	B	M	S
AB 2	0.853	0.522	0.530	0.507	0.584	0.588
AB 3	0.814	0.442	0.488	0.408	0.545	0.581
AB 4	0.824	0.487	0.503	0.483	0.611	0.588
AB 5	0.853	0.480	0.516	0.488	0.600	0.657
AB 6	0.830	0.463	0.475	0.545	0.568	0.580
Attitude						
A 2	0.439	0.771	0.357	0.352	0.319	0.282
A 3	0.440	0.854	0.398	0.323	0.406	0.435
A 4	0.476	0.769	0.406	0.419	0.478	0.440
A 5	0.543	0.814	0.440	0.429	0.482	0.388
Behavioral intention to adopt RWH						
BL 1	0.525	0.495	0.873	0.416	0.563	0.534
BL 2	0.518	0.459	0.859	0.445	0.510	0.551
BL 3	0.497	0.344	0.836	0.395	0.522	0.506
BL 5	0.504	0.407	0.848	0.455	0.612	0.560
Belief						
B 1	0.548	0.488	0.520	0.899	0.558	0.553
B 3	0.477	0.381	0.444	0.901	0.494	0.472
B 4	0.528	0.415	0.440	0.918	0.553	0.521
B 5	0.549	0.429	0.394	0.878	0.521	0.513
B 6	0.573	0.428	0.444	0.910	0.552	0.517
Motivation						
M 1	0.409	0.336	0.415	0.334	0.659	0.440
M 2	0.602	0.452	0.501	0.423	0.743	0.588
M 3	0.582	0.400	0.494	0.439	0.819	0.609
M 4	0.616	0.453	0.594	0.571	0.864	0.644
M 5	0.548	0.405	0.510	0.521	0.820	0.628
M 6	0.503	0.421	0.492	0.473	0.758	0.550
Subjective norms						
S 1	0.604	0.459	0.513	0.554	0.610	0.806
S 2	0.602	0.345	0.565	0.493	0.626	0.837
S 3	0.414	0.283	0.352	0.286	0.511	0.719
S 6	0.627	0.446	0.549	0.460	0.630	0.838

Discriminant validity

Discriminant validity was estimated through two tests, i.e., Fornell-Larcker Criterion and Heterotrait-Monotrait (HTMT) ratio correlation. the Heterotrait-

Monotrait (HTMT) ratio demonstrated that all of the constructs' HTMT values surpass the cut-off value of 0.85 which demonstrates good discriminant validity (Table 4.48).

Furthermore, the Fornell-Larcker Criterion states that if all factor values were higher than the highest correlation of the specific variable with others in the model, then it establishes discriminant validity for that construct. Here, all the factors satisfy the required criteria. Hence, discriminant validity of the constructs is established (Table 4.49).

Table 4.47

Discriminant validity

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Actual behavioral change to adopt RWH (1)	1.000						
Attitude (2)	0.687						
Behavioral intention to adopt RWH (3)	0.669	0.587					
Belief (4)	0.641	0.539	0.546				
Motivation (5)	0.785	0.622	0.737	0.652			
Subjective norms (6)	0.813	0.582	0.729	0.636	0.874		
Motivation × Behavioral intention to adopt RWH (7)	0.399	0.403	0.410	0.361	0.392	0.472	

Table 4.48

Heterotrait-Monotrait ratio

	HTMT ratio
Attitude <-> Actual behavioral change to adopt RWH	0.687
Behavioral intention to adopt RWH <-> Actual behavioral change to adopt RWH	0.669
Behavioral intention to adopt RWH <-> Attitude	0.587
Belief <-> Actual behavioral change to adopt RWH	0.641
Belief <-> Attitude	0.539
Belief <-> Behavioral intention to adopt RWH	0.546
Motivation <-> Actual behavioral change to adopt RWH	0.785
Motivation <-> Attitude	0.622
Motivation <-> Behavioral intention to adopt RWH	0.737

	HTMT ratio
Motivation <-> Belief	0.652
Subjective norms <-> Actual behavioral change to adopt RWH	0.813
Subjective norms <-> Attitude	0.582
Subjective norms <-> Behavioral intention to adopt RWH	0.729
Subjective norms <-> Belief	0.636
Subjective norms <-> Motivation	0.874

Table 4.49

Fornell-Larcker criterion

	(1)	(2)	(3)	(4)	(5)	(6)
Actual behavioral change to adopt RWH (1)	0.829					
Attitude (2)	0.594	0.803				
Behavioral intention to adopt RWH (3)	0.598	0.502	0.854			
Belief (4)	0.594	0.477	0.501	0.901		
Motivation (5)	0.705	0.530	0.646	0.595	0.780	
Subjective norms (6)	0.713	0.485	0.630	0.573	0.746	0.801

Collinearity assessment

Collinearity was measured through variance inflation factor (VIF) criteria. The collinearity among the variables is indicated if the VIF values are greater than 5. The findings in Table 4.50 demonstrates that VIF values for all variables were less than 5, suggestive of an absence of collinearity among the indicators.

Table 4.50

Collinearity statistics

	VIF
AB 1	2.098
AB 2	2.634
AB 3	2.222
AB 4	2.283
AB 5	2.633
AB 6	2.451
A 2	1.661
A 3	2.114
A 4	1.608

	VIF
A 5	1.703
BL 1	2.405
BL 2	2.233
BL 3	2.076
BL 5	2.109
B 1	3.173
B 3	3.604
B 4	4.318
B 5	3.151
B 6	3.784
M 1	1.661
M 2	1.869
M 3	2.251
M 4	2.713
M 5	2.366
M 6	1.988
S 1	1.678
S 2	1.784
S 3	1.536
S 6	1.844
M × BL	1.000

Evaluation of model fitness

Coefficient of determination

The coefficient of determination (R^2 value) is the amount of variation in the dependent variable(s) that can be successfully explained by the independent variables. Here, R square value for behavioral intention to adopt is 0.460. This indicates 46 % of variation in behavioral intention to adopt RWH by residents in Bangalore is explained by beliefs about RWH, attitude about RWH and subjective norms (Table 4.51). On the other hand, as the R square value for actual behavioral change to adopt RWH is 0.541, it indicates that 54.1% of variation in actual behavioral change to adopt RWH can be explained by behavioral intention and motivation of residents.

Table 4.51

R square

	R-square	R-square adjusted
Actual behavioral change to adopt RWH	0.541	0.537
Behavioral intention to adopt RWH	0.460	0.456

Effect size (f2)

Effect size is a measure of the extent to which an independent variable has an influence on a dependent variable. Values higher than or equal to 0.35 indicate strong impact, 0.15 to 0.35 indicate moderate impact and lower than 0.15 indicate weak impact. The findings (Table 4.52) demonstrated that beliefs about RWH (0.024), attitude about RWH (0.063) weakly influence behavioral intention of the residents, whereas subjective norm (0.222) exert a moderate impact on the behavioral intention of the residents and behavioral intention (0.058) weakly impact on the actual behavioral change to adopt RWH. Motivation exerts moderate impact (0.222) on actual behavioral change to adopt RWH. On the other hand, motivation and behavioral intention together exerts a weak impact (0.020) on actual behavioral change to adopt RWH.

Table 4.52

F value

	f-square
Attitude -> Behavioral intention to adopt RWH	0.063
Behavioral intention to adopt RWH -> Actual behavioral change to adopt RWH	0.058
Belief -> Behavioral intention to adopt RWH	0.024
Motivation -> Actual behavioral change to adopt RWH	0.339
Subjective norms -> Behavioral intention to adopt RWH	0.222
Motivation × Behavioral intention to adopt RWH -> Actual behavioral change to adopt RWH	0.020

Goodness of fit of the model

To check the model’s adequacy, standardized root mean square residual (SRMR) has been used (Hu, Bentler and Hu, 1999). For adequate model fitness, the value should be less than 0.08. The results of the present study showed that the model had an SRMR value of 0.061, which is adequate enough to designate the optimal fitness of the model. In addition, d_ULS value of 1.01, d_G value of 0.707, Chi-Square value of 1631.138 and NFI value of 0.813 indicated a good fit for the model (Table 4.53).

Table 4.53

Model fit

	Saturated model	Estimated model
SRMR	0.061	0.079
d ULS	1.601	2.695
d G	0.707	0.769
Chi-square	1631.138	1694.817
NFI	0.813	0.806

Testing of model

The structural model was analyzed subsequent to assessing the measurement model. Bootstrapping method was performed with 5000 sampling iterations to determine the path coefficient and t-values. For the result values to be considered significant, the t values must be greater than 1.96. The structural model is illustrated in Figure 4.7.

Table 4.54 displays the path coefficients of the SEM model. Beliefs about RWH ($t = 3.172$, $p < 0.05$), attitude about RWH ($t = 4.582$, $p < 0.05$) and subjective norms ($t = 8.937$, $p < 0.05$) significantly influenced behavioral intention to adopt RWH, which further supports the earlier findings of the present study. On the other hand, the moderation effect of motivation was found to be significant in the relationship between behavioral intention and actual behavioral change ($t = 2.577$, $p < 0.05$). Thus, the hypothesis, *H5: Motivation moderates the relationship between behavioral intention to adopt RWH and the actual behavioral change*, is accepted.

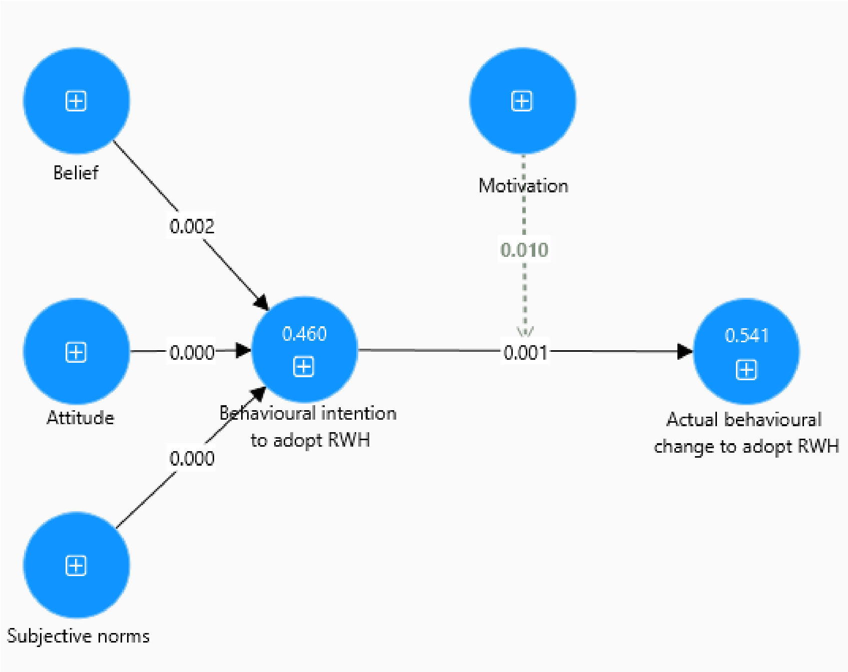

Figure 4.7

Structural model for motivation as a moderator

Table 4.54

Path coefficients

	Original sample	Sample mean	Standard deviation	T statistics	p values
Direct effect					
Belief -> Behavioral intention to adopt RWH	0.144	0.145	0.045	3.172	0.002
Attitude -> Behavioral intention to adopt RWH	0.219	0.221	0.048	4.582	0.000
Subjective norms -> Behavioral intention to adopt RWH	0.442	0.441	0.049	8.937	0.000
Behavioral intention to adopt RWH -> Actual behavioral change to adopt RWH	0.218	0.223	0.063	3.475	0.001
Motivation -> Actual behavioral change to adopt RWH	0.525	0.523	0.055	9.472	0.000
Motivation × Behavioral intention to adopt RWH -> Actual behavioral change to adopt RWH	-0.072	-0.068	0.028	2.577	0.010
Total indirect effect					

	Original sample	Sample mean	Standard deviation	T statistics	p values
Belief -> Actual behavioral change to adopt RWH	0.031	0.033	0.016	1.999	0.046
Attitude -> Actual behavioral change to adopt RWH	0.048	0.049	0.018	2.706	0.007
Subjective norms -> Actual behavioral change to adopt RWH	0.096	0.100	0.035	2.758	0.006

1.51 Moderating Role of Barriers on the Effect of Behavioral Intention on Actual Adoption of Rainwater Harvesting

Assessment of measurement model

To evaluate the measurement model, all variables were assessed through factor loadings, (Hair *et al.*, 2022). As demonstrated in Table 4.55, factor loadings for all items crossed the value of 0.7. Moreover, the Cronbach's Alpha coefficients for all the constructs inspected in the study were above 0.8 which specify an internally stable and reliable measurement scale. In addition, the composite reliability values of the present model were greater than or equal to 0.8 for all constructs, i.e., belief (0.956), attitude (0.879), subjective norms (0.877), behavioral intention (0.872), barriers (0.902) and actual behavioral change to adopt RWH (0.923) which supports that internal consistency of the scale to be high. Likewise, rho A values for all the variables were more than 0.8 depicting a high level of reliability (Table 4.56).

Convergent validity

If the Average Variance Extracted (AVE) value of a construct exceeds 0.5, it shows convergent validity. For the present study, the AVE value of the construct was found to be greater than 0.6 suggesting a good convergent validity for the model (Table 4.56).

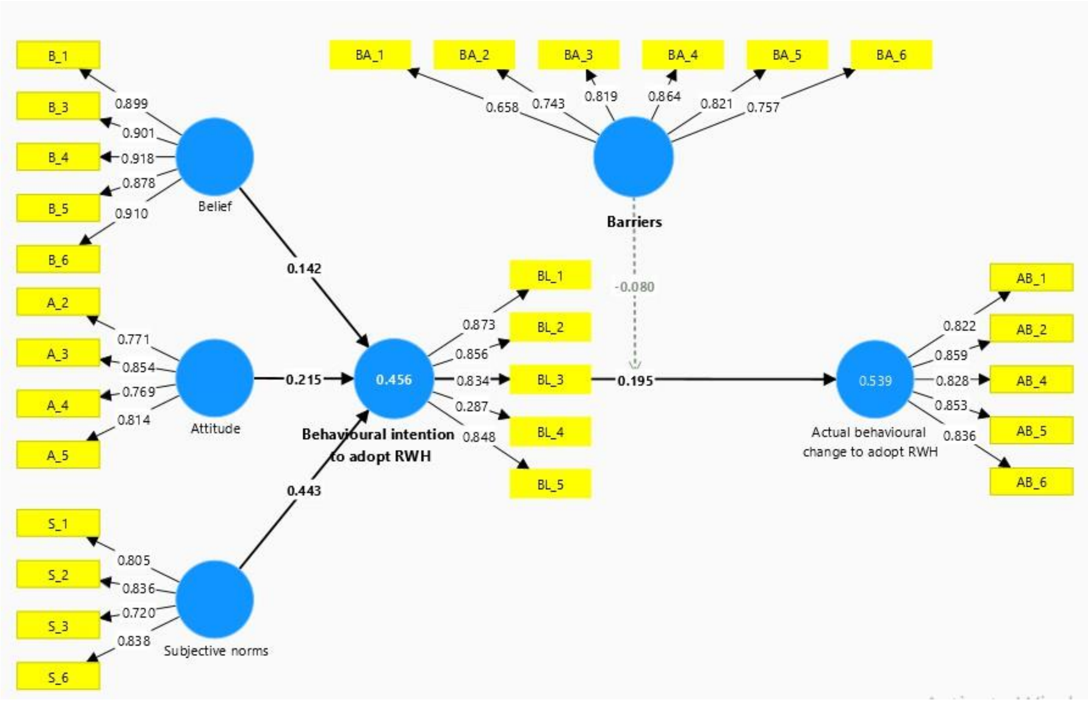

Figure 4.8

Measurement model having barriers as a moderator

Table 4.55

Estimates (outer loadings) for barriers as moderator

	AB	A	BA	BL	B	S
Actual behavioral change to adopt RWH						
AB 1	0.822					
AB 2	0.859					
AB 4	0.828					
AB 5	0.853					
AB 6	0.836					
Attitude						
A 2		0.771				
A 3		0.854				
A 4		0.769				
A 5		0.814				
Barriers						
BA 1			0.658			
BA 2			0.743			
BA 3			0.819			
BA 4			0.864			
BA 5			0.821			

	AB	A	BA	BL	B	S
BA 6			0.757			
Behavioral intention to adopt RWH						
BL 1				0.873		
BL 2				0.856		
BL 3				0.834		
BL 4				0.287		
BL 5				0.848		
Belief						
B 1					0.899	
B 3					0.901	
B 4					0.918	
B 5					0.878	
B 6					0.910	
Subjective norms						
S 1						0.805
S 2						0.836
S 3						0.720
S 6						0.838

Table 4.56

Reliability and validity

	Cronbach's alpha	Composite reliability (rho a)	Composite reliability (rho c)	Average variance extracted (AVE)
Actual behavioral change to adopt RWH	0.895	0.896	0.923	0.705
Attitude	0.816	0.819	0.879	0.644
Barriers	0.870	0.880	0.902	0.608
Behavioral intention to adopt RWH	0.813	0.882	0.872	0.599
Belief	0.942	0.948	0.956	0.812
Subjective norms	0.815	0.833	0.877	0.642

Table 4.57

Cross loadings

	AB	A	BA	BL	B	S
Actual behavioral change to adopt RWH						

	AB	A	BA	BL	B	S
AB 1	0.822	0.563	0.596	0.458	0.522	0.550
AB 2	0.859	0.522	0.584	0.524	0.507	0.587
AB 4	0.828	0.487	0.611	0.504	0.483	0.588
AB 5	0.853	0.480	0.600	0.516	0.488	0.657
AB 6	0.836	0.463	0.568	0.469	0.545	0.580
Attitude						
A 2	0.430	0.771	0.319	0.355	0.352	0.282
A 3	0.443	0.854	0.406	0.396	0.323	0.435
A 4	0.486	0.769	0.478	0.401	0.419	0.440
A 5	0.551	0.814	0.482	0.436	0.429	0.388
Barriers						
BA 1	0.407	0.336	0.658	0.417	0.334	0.440
BA 2	0.603	0.452	0.743	0.505	0.423	0.588
BA 3	0.583	0.400	0.819	0.496	0.439	0.609
BA 4	0.616	0.453	0.864	0.595	0.571	0.644
BA 5	0.551	0.405	0.821	0.512	0.521	0.628
BA 6	0.502	0.421	0.757	0.499	0.473	0.550
Behavioral intention to adopt RWH						
BL 1	0.519	0.495	0.563	0.873	0.416	0.534
BL 2	0.503	0.459	0.510	0.856	0.445	0.550
BL 3	0.494	0.344	0.522	0.834	0.395	0.506
BL 4	0.096	0.045	0.231	0.287	0.068	0.135
BL 5	0.509	0.406	0.612	0.848	0.455	0.560
Belief						
B 1	0.560	0.488	0.558	0.516	0.899	0.552
B 3	0.489	0.381	0.494	0.442	0.901	0.472
B 4	0.537	0.415	0.553	0.437	0.918	0.521
B 5	0.554	0.429	0.521	0.390	0.878	0.512
B 6	0.586	0.428	0.552	0.441	0.910	0.517
Subjective norms						
S 1	0.603	0.459	0.610	0.512	0.554	0.805
S 2	0.596	0.345	0.626	0.562	0.493	0.836
S 3	0.408	0.283	0.511	0.355	0.286	0.720
S 6	0.620	0.446	0.630	0.547	0.460	0.838

Discriminant validity

Discriminant validity was estimated through two tests, i.e., Fornell-Larcker Criterion and Heterotrait-Monotrait (HTMT) ratio correlation. the Heterotrait-Monotrait (HTMT) ratio demonstrated that all of the constructs' HTMT values surpass the cut-off value of 0.85 which demonstrates good discriminant validity (Table 4.59).

Furthermore, the Fornell-Larcker Criterion states that if all factor values were higher than the highest correlation of the specific variable with others in the model, then it establishes discriminant validity for that construct. Here, all the factors satisfy the required criteria. Hence, discriminant validity of the constructs is established (Table 4.60).

Table 4.58

Discriminant validity

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Actual behavioral change to adopt RWH (1)	1.000						
Attitude (2)	0.697						
Barriers (3)	0.791	0.622					
Behavioral intention to adopt RWH (4)	0.657	0.567	0.765				
Belief (5)	0.660	0.539	0.652	0.533			
Subjective norms (6)	0.811	0.582	0.874	0.730	0.636		
Barriers × Behavioral intention to adopt RWH (7)	0.410	0.402	0.387	0.441	0.360	0.469	

Table 4.59

Heterotrait-Monotrait ratio

	HTMT ratio
Attitude <-> Actual behavioral change to adopt RWH	0.697
Barriers <-> Actual behavioral change to adopt RWH	0.791
Barriers <-> Attitude	0.622
Behavioral intention to adopt RWH <-> Actual behavioral change to adopt RWH	0.657
Behavioral intention to adopt RWH <-> Attitude	0.567

	HTMT ratio
Behavioral intention to adopt RWH <-> Barriers	0.765
Belief <-> Actual behavioral change to adopt RWH	0.660
Belief <-> Attitude	0.539
Belief <-> Barriers	0.652
Belief <-> Behavioral intention to adopt RWH	0.533
Subjective norms <-> Actual behavioral change to adopt RWH	0.811
Subjective norms <-> Attitude	0.582
Subjective norms <-> Barriers	0.874
Subjective norms <-> Behavioral intention to adopt RWH	0.730
Subjective norms <-> Belief	0.636

Table 4.60

Fornell-Larcker criterion

	(1)	(2)	(3)	(4)	(5)	(6)
Actual behavioral change to adopt RWH (1)	0.840					
Attitude (2)	0.599	0.803				
Barriers (3)	0.705	0.530	0.780			
Behavioral intention to adopt RWH (4)	0.590	0.497	0.650	0.774		
Belief (5)	0.605	0.477	0.595	0.498	0.901	
Subjective norms (6)	0.706	0.484	0.746	0.628	0.573	0.801

Collinearity assessment

Collinearity was measured through variance inflation factor (VIF) criteria. The collinearity among the variables is indicated if the VIF values are greater than 5. The findings in Table 4.61 demonstrates that VIF values for all variables were less than 5, suggestive of an absence of collinearity among the indicators.

Table 4.61

Collinearity statistics

	VIF
AB 1	2.098
AB 2	2.523
AB 4	2.185
AB 5	2.473
AB 6	2.389

	VIF
A 2	1.661
A 3	2.114
A 4	1.608
A 5	1.703
BA 1	1.661
BA 2	1.869
BA 3	2.251
BA 4	2.713
BA 5	2.366
BA 6	1.988
BL 1	2.426
BL 2	2.233
BL 3	2.077
BL 4	1.066
BL 5	2.126
B 1	3.173
B 3	3.604
B 4	4.318
B 5	3.151
B 6	3.784
S 1	1.678
S 2	1.784
S 3	1.536
S 6	1.844
B × BL	1.000

Evaluation of model fitness

Coefficient of determination

The coefficient of determination (R^2 value) is the amount of variation in the dependent variable(s) that can be successfully explained by the independent variables. Here, R square value for behavioral intention to adopt is 0.456. This indicates 45.6 % of variation in behavioral intention to adopt RWH by residents in Bangalore is explained by beliefs about RWH, attitude about RWH and subjective norms (Table 4.62). On the other hand, as the R square value for actual behavioral change to adopt

RWH is 0.539, it indicates that 53.9% of variation in actual behavioral change to adopt RWH can be explained by behavioral intention and barriers of the residents.

Table 4.62

R square

	R-square	R-square adjusted
Actual behavioral change to adopt RWH	0.539	0.535
Behavioral intention to adopt RWH	0.456	0.451

Effect size (f2)

Effect size is a measure of the extent to which an independent variable has an influence on a dependent variable. Values higher than or equal to 0.35 indicate strong impact, 0.15 to 0.35 indicate moderate impact and lower than 0.15 indicate weak impact. The findings (Table 4.63) demonstrated that beliefs about RWH (0.023), attitude about RWH (0.060) weakly influence behavioral intention of the residents, whereas subjective norm (0.221) exert a moderate impact on the behavioral intention of the residents and behavioral intention (0. 046) weakly impact on the actual behavioral change to adopt RWH. Barrier exerts moderate impact (0.349) on actual behavioral change to adopt RWH. On the other hand, barrier and behavioral intention together exerts a weak impact (0.026) on actual behavioral change to adopt RWH.

Table 4.63

F value

	f-square
Attitude -> Behavioral intention to adopt RWH	0.060
Barriers -> Actual behavioral change to adopt RWH	0.349
Behavioral intention to adopt RWH -> Actual behavioral change to adopt RWH	0.046
Belief -> Behavioral intention to adopt RWH	0.023
Subjective norms -> Behavioral intention to adopt RWH	0.221
Barriers × Behavioral intention to adopt RWH -> Actual behavioral change to adopt RWH	0.026

Goodness of fit of the model

To check the model's adequacy, standardized root mean square residual (SRMR) has been used (Hu, Bentler and Hu, 1999). For adequate model fitness, the value should be less than 0.08. The results of the present study showed that the model had an SRMR value of 0.062, which is adequate enough to designate the optimal fitness of the model. In addition, d_ULS value of 1.646, d_G value of 0.719, Chi-Square value of 1648.422 and NFI value of 0.805 indicated a good fit for the model (Table 4.64).

Table 4.64

Model fit

	Saturated model	Estimated model
SRMR	0.062	0.079
d ULS	1.646	2.721
d G	0.719	0.781
Chi-square	1648.422	1711.195
NFI	0.805	0.798

Testing of model

The structural model was analyzed subsequent to assessing the measurement model. Bootstrapping method was performed with 5000 sampling iterations to determine the path coefficient and t-values. For the result values to be considered significant, the t values must be greater than 1.96. The structural model is illustrated in Figure 4.9.

Table 4.65 displays the path coefficients of the SEM model. Beliefs about RWH ($t = 3.138$, $p < 0.05$), attitude about RWH ($t = 4.445$, $p < 0.05$) and subjective norms ($t = 8.929$, $p < 0.05$) significantly influenced behavioral intention to adopt RWH, which further supports the earlier findings of the present study. On the other hand, the moderation effect of barrier was found to be significant in the relationship between behavioral intention and actual behavioral change ($t = 2.891$, $p < 0.05$). Thus, the hypothesis, *H6: Barrier moderates the relationship between behavioral intention to adopt RWH and the actual behavioral change*, is accepted.

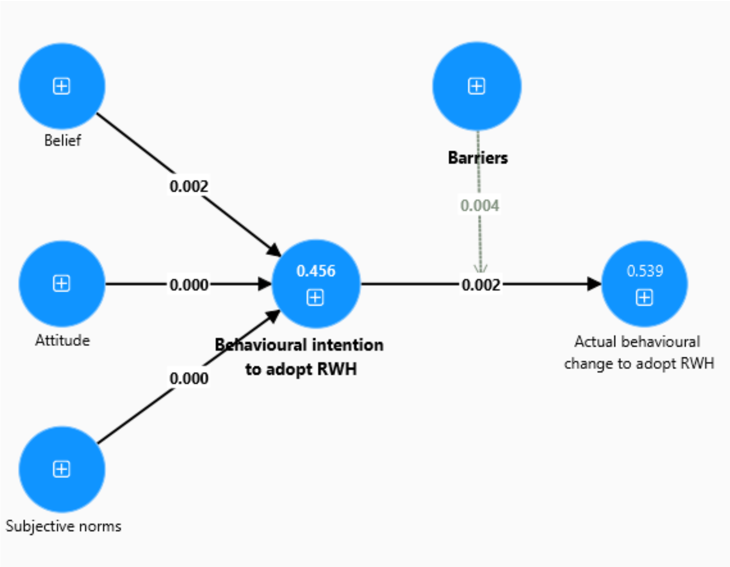

Figure 6.9

Structural model for barriers as a moderator

Table 4.65

Path coefficients

	Original sample	Sample mean	Standard deviation	T statistics	P values
Direct effect					
Belief -> Behavioral intention to adopt RWH	0.142	0.143	0.045	3.138	0.002
Attitude -> Behavioral intention to adopt RWH	0.215	0.217	0.048	4.445	0.000
Subjective norms -> Behavioral intention to adopt RWH	0.443	0.442	0.050	8.929	0.000
Behavioral intention to adopt RWH -> Actual behavioral change to adopt RWH	0.195	0.202	0.064	3.046	0.002
Barriers -> Actual behavioral change to adopt RWH	0.535	0.532	0.056	9.547	0.000
Barriers × Behavioral intention to adopt RWH -> Actual behavioral change to adopt RWH	-0.080	-0.076	0.028	2.891	0.004
Total indirect effect					
Belief -> Actual behavioral change to adopt RWH	0.028	0.030	0.015	1.829	0.067
Attitude -> Actual behavioral change to adopt RWH	0.042	0.044	0.017	2.455	0.014

	Original sample	Sample mean	Standard deviation	T statistics	P values
Subjective norms -> Actual behavioral change to adopt RWH	0.087	0.091	0.035	2.474	0.013

1.52 Moderating Role of Ability on the Effect of Behavioral Intention on Actual Adoption of Rainwater Harvesting

Assessment of measurement model

To evaluate the measurement model, all variables were assessed through factor loadings, (Hair *et al.*, 2022). As demonstrated in 4.59, factor loadings for all items crossed the value of 0.7 (Table 4.66). Moreover, the Cronbach's Alpha coefficients for all the constructs inspected in the study were above 0.7 which specify an internally stable and reliable measurement scale. In addition, the composite reliability values of the present model were greater than or equal to 0.8 for all constructs, i.e., belief (0.956), attitude (0.879), subjective norms (0.877), behavioral intention (0.915), ability (0. 868) and actual behavioral change to adopt RWH (0.930) which supports that internal consistency of the scale to be high. Likewise, rho A values for all the variables were more than 0.8 depicting a high level of reliability (Table 4.67).

Convergent validity

If the Average Variance Extracted (AVE) value of a construct exceeds 0.5, it shows convergent validity. For the present study, the AVE value of the construct was found to be greater than 0.6 suggesting a good convergent validity for the model (Table 4.67).

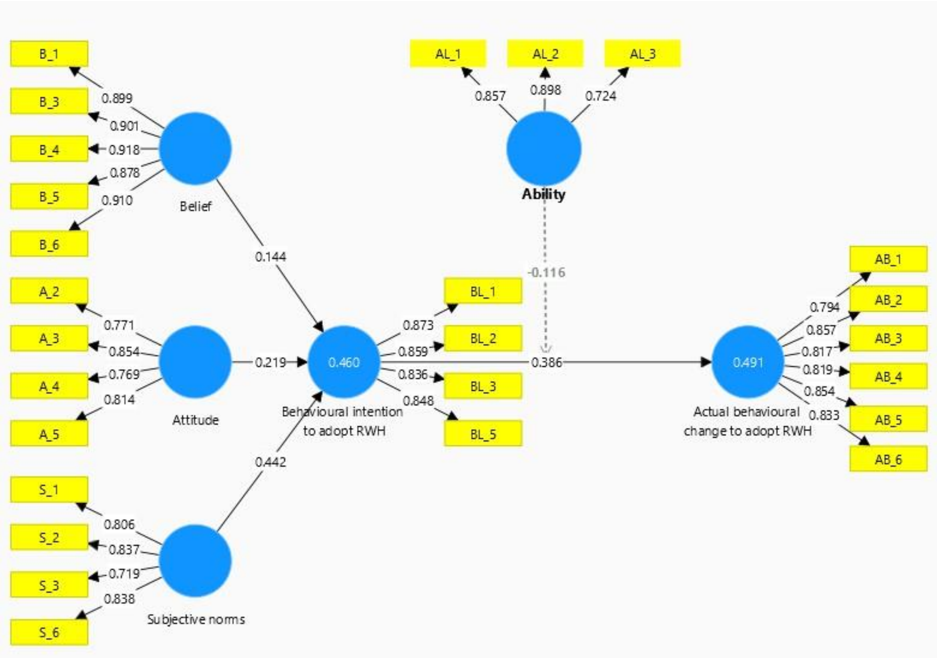

Figure 4.10

Measurement model having ability as a moderator

Table 4.66

Estimates (outer loadings) for ability as moderator

	AB	AL	A	BL	B	S
Ability						
AB 1		0.794				
AB 2		0.857				
AB 3		0.817				
AB 4		0.819				
AB 5		0.854				
AB 6		0.833				
Actual behavioral change to adopt RWH						
AL 1	0.857					
AL 2	0.898					
AL 3	0.724					
Attitude						
A 2			0.771			
A 3			0.854			
A 4			0.769			
A 5			0.814			
Behavioral intention to adopt RWH						
BL 1				0.873		

	AB	AL	A	BL	B	S
BL 2				0.859		
BL 3				0.836		
BL 5				0.848		
Belief						
B 1					0.899	
B 3					0.901	
B 4					0.918	
B 5					0.878	
B 6					0.910	
Subjective norms						
S 1						0.806
S 2						0.837
S 3						0.719
S 6						0.838

Table 4.67

Reliability and validity

	Cronbach's alpha	Composite reliability (rho a)	Composite reliability (rho c)	Average variance extracted
Ability	0.774	0.831	0.868	0.688
Actual behavioral change to adopt RWH	0.909	0.912	0.930	0.688
Attitude	0.816	0.819	0.879	0.644
Behavioral intention to adopt RWH	0.877	0.878	0.915	0.730
Belief	0.942	0.948	0.956	0.812
Subjective norms	0.815	0.834	0.877	0.642

Table 4.68

Cross loadings

	AB	AL	A	BL	B	S
Ability						
AB 1	0.794	0.419	0.563	0.461	0.522	0.55
AB 2	0.857	0.546	0.522	0.53	0.507	0.588
AB 3	0.817	0.485	0.442	0.488	0.408	0.581
AB 4	0.819	0.455	0.487	0.503	0.483	0.588
AB 5	0.854	0.519	0.48	0.516	0.488	0.657

	AB	AL	A	BL	B	S
AB 6	0.833	0.498	0.463	0.475	0.545	0.58
Actual behavioral change to adopt RWH						
AL 1	0.444	0.857	0.327	0.365	0.333	0.423
AL 2	0.606	0.898	0.407	0.486	0.527	0.648
AL 3	0.374	0.724	0.182	0.354	0.363	0.451
Attitude						
A 2	0.292	0.44	0.771	0.358	0.352	0.282
A 3	0.275	0.439	0.854	0.398	0.323	0.435
A 4	0.359	0.473	0.769	0.406	0.419	0.44
A 5	0.306	0.541	0.814	0.44	0.429	0.388
Behavioral intention to adopt RWH						
BL 1	0.358	0.525	0.495	0.873	0.416	0.534
BL 2	0.504	0.519	0.459	0.859	0.445	0.551
BL 3	0.467	0.498	0.344	0.836	0.395	0.506
BL 5	0.359	0.503	0.407	0.848	0.455	0.56
Belief						
B 1	0.495	0.547	0.488	0.52	0.899	0.553
B 3	0.457	0.475	0.381	0.444	0.901	0.472
B 4	0.417	0.527	0.415	0.44	0.918	0.521
B 5	0.469	0.55	0.429	0.394	0.878	0.513
B 6	0.43	0.572	0.428	0.444	0.91	0.517
Subjective norms						
S 1	0.53	0.604	0.459	0.513	0.554	0.806
S 2	0.59	0.604	0.345	0.565	0.493	0.837
S 3	0.33	0.412	0.283	0.352	0.286	0.719
S 6	0.512	0.627	0.446	0.549	0.46	0.838

Discriminant validity

Discriminant validity was estimated through two tests, i.e., Fornell-Larcker Criterion and Heterotrait-Monotrait (HTMT) ratio correlation. the Heterotrait-Monotrait (HTMT) ratio demonstrated that all of the constructs' HTMT values surpass the cut-off value of 0.85 which demonstrates good discriminant validity (Table 4.70).

Furthermore, the Fornell-Larcker Criterion states that if all factor values were higher than the highest correlation of the specific variable with others in the model, then it establishes discriminant validity for that construct. Here, all the factors satisfy the required criteria. Hence, discriminant validity of the constructs is established (Table 4.71).

Table 4.69

Discriminant validity

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Ability (1)							
Actual behavioral change to adopt RWH (2)	0.679						
Attitude (3)	0.462	0.687					
Behavioral intention to adopt RWH (4)	0.589	0.669	0.587				
Belief (5)	0.574	0.641	0.539	0.546			
Subjective norms (6)	0.751	0.813	0.582	0.729	0.636		
Ability × Behavioral intention to adopt RWH (7)	0.403	0.398	0.266	0.306	0.277	0.380	

Table 4.70

Heterotrait-Monotrait ratio

	HTMT ratio
Actual behavioral change to adopt RWH <-> Ability	0.679
Attitude <-> Ability	0.462
Attitude <-> Actual behavioral change to adopt RWH	0.687
Behavioral intention to adopt RWH <-> Ability	0.589
Behavioral intention to adopt RWH <-> Actual behavioral change to adopt RWH	0.669
Behavioral intention to adopt RWH <-> Attitude	0.587
Belief <-> Ability	0.574
Belief <-> Actual behavioral change to adopt RWH	0.641
Belief <-> Attitude	0.539
Belief <-> Behavioral intention to adopt RWH	0.546
Subjective norms <-> Ability	0.751
Subjective norms <-> Actual behavioral change to adopt RWH	0.813
Subjective norms <-> Attitude	0.582
Subjective norms <-> Behavioral intention to adopt RWH	0.729
Subjective norms <-> Belief	0.636

Table 4.71

Fornell-Larcker criterion

	(1)	(2)	(3)	(4)	(5)	(6)
Ability (1)	0.829					
Actual behavioral change to adopt RWH (2)	0.589	0.829				
Attitude (3)	0.385	0.592	0.803			
Behavioral intention to adopt RWH (4)	0.493	0.598	0.502	0.854		
Belief (5)	0.504	0.592	0.477	0.501	0.901	
Subjective norms (6)	0.627	0.713	0.485	0.630	0.573	0.801

Collinearity assessment

Collinearity was measured through variance inflation factor (VIF) criteria. The collinearity among the variables is indicated if the VIF values are greater than 5. The findings in Table 4.72 demonstrates that VIF values for all variables were less than 5, suggestive of an absence of collinearity among the indicators.

Table 4.72

Collinearity statistics

	VIF
AB 1	2.098
AB 2	2.634
AB 3	2.222
AB 4	2.283
AB 5	2.633
AB 6	2.451
AL 1	1.909
AL 2	1.879
AL 3	1.359
A 2	1.661
A 3	2.114
A 4	1.608
A 5	1.703
BL 1	2.405
BL 2	2.233
BL 3	2.076

	VIF
BL 5	2.109
B 1	3.173
B 3	3.604
B 4	4.318
B 5	3.151
B 6	3.784
S 1	1.678
S 2	1.784
S 3	1.536
S 6	1.844

Evaluation of model fitness

Coefficient of determination

The coefficient of determination (R^2 value) is the amount of variation in the dependent variable(s) that can be successfully explained by the independent variables. Here, R square value for behavioral intention to adopt is 0.460. This indicates 46 % of variation in behavioral intention to adopt RWH by residents in Bangalore is explained by beliefs about RWH, attitude about RWH and subjective norms (Table 4.73). On the other hand, as the R square value for actual behavioral change to adopt RWH is 0.491, it indicates that 49.1% of variation in actual behavioral change to adopt RWH can be explained by behavioral intention and ability of the residents.

Table 4.73

R square

	R-square	R-square adjusted
Actual behavioral change to adopt RWH	0.491	0.487
Behavioral intention to adopt RWH	0.460	0.456

Effect size (f2)

Effect size is a measure of the extent to which an independent variable has an influence on a dependent variable. Values higher than or equal to 0.35 indicate strong impact, 0.15 to 0.35 indicate moderate impact and lower than 0.15 indicate weak impact. The findings (Table 4.74) demonstrated that beliefs about RWH (0.024), attitude about RWH (0.063) weakly influence behavioral intention of the residents, whereas subjective norm (0.222) exert a moderate impact on the behavioral intention of the residents and behavioral intention (0.218) moderately impact on the actual behavioral change to adopt RWH. Ability exerts moderate impact (0. 164) on actual behavioral change to adopt RWH. On the other hand, ability and behavioral intention together exerts a weak impact (0.036) on actual behavioral change to adopt RWH.

Table 4.74

F value

	f-square
Ability -> Actual behavioral change to adopt RWH	0.164
Attitude -> Behavioral intention to adopt RWH	0.063
Behavioral intention to adopt RWH -> Actual behavioral change to adopt RWH	0.218
Belief -> Behavioral intention to adopt RWH	0.024
Subjective norms -> Behavioral intention to adopt RWH	0.222
Ability × Behavioral intention to adopt RWH -> Actual behavioral change to adopt RWH	0.036

Goodness of fit of the model

To check the model's adequacy, standardized root mean square residual (SRMR) has been used (Hu, Bentler and Hu, 1999). For adequate model fitness, the value should be less than 0.08. The results of the present study showed that the model had an SRMR value of 0.066, which is adequate enough to designate the optimal fitness of the model. In addition, d_ULS value of 1.530, d_G value of 0. 665, Chi-Square value of 1515.568 and NFI value of 0.803 indicated a good fit for the model (Table 4.75).

Table 4.75

Model fit

	Saturated model	Estimated model
SRMR	0.066	0.095
d ULS	1.530	3.185
d G	0.665	0.736
Chi-square	1515.568	1600.537

	Saturated model	Estimated model
NFI	0.803	0.792

Testing of model

The structural model was analyzed subsequent to assessing the measurement model. Bootstrapping method was performed with 5000 sampling iterations to determine the path coefficient and t-values. For the result values to be considered significant, the t values must be greater than 1.96. The structural model is illustrated in Figure 4.11.

Table 4.76 displays the path coefficients of the SEM model. Beliefs about RWH ($t = 3.172$, $p < 0.05$), attitude about RWH ($t = 4.582$, $p < 0.05$) and subjective norms ($t = 8.936$, $p < 0.05$) significantly influenced behavioral intention to adopt RWH, which further supports the earlier findings of the present study. On the other hand, the moderation effect of ability was found to be significant in the relationship between behavioral intention and actual behavioral change ($t = 2.861$, $p < 0.05$). Thus, the hypothesis, *H7: Ability moderates the relationship between behavioral intention to adopt RWH and the actual behavioral change*, is accepted.

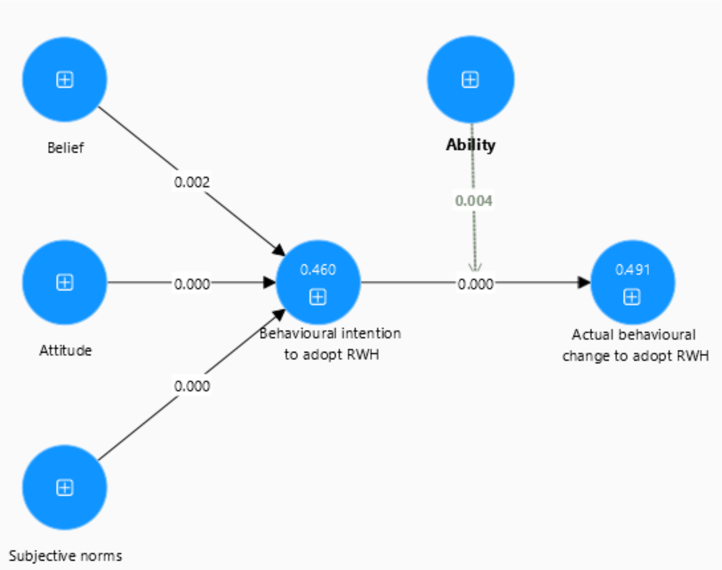

Figure 4.11

Structural model for ability as a moderator

Table 4.76

Path coefficients

	Original sample	Sample mean	Standard deviation	T statistics	P values
Direct effects					
Belief -> Behavioral intention to adopt RWH	0.144	0.145	0.045	3.172	0.002
Attitude -> Behavioral intention to adopt RWH	0.219	0.221	0.048	4.582	0.000
Subjective norms -> Behavioral intention to adopt RWH	0.442	0.441	0.049	8.936	0.000
Behavioral intention to adopt RWH -> Actual behavioral change to adopt RWH	0.386	0.388	0.053	7.344	0.000
Ability -> Actual behavioral change to adopt RWH	0.345	0.348	0.047	7.277	0.000
Ability × Behavioral intention to adopt RWH -> Actual behavioral change to adopt RWH	-0.116	-0.115	0.041	2.861	0.004
Total indirect effect					
Belief -> Actual behavioral change to adopt RWH	0.056	0.057	0.022	2.575	0.010
Attitude -> Actual behavioral change to adopt RWH	0.085	0.086	0.023	3.630	0.000
Subjective norms -> Actual behavioral change to adopt RWH	0.171	0.173	0.037	4.602	0.000

1.53 Moderating Role of Opportunity on the Effect of Behavioral Intention on Actual Adoption of Rainwater Harvesting

Assessment of measurement model

To evaluate the measurement model, all variables were assessed through factor loadings, (Hair *et al.*, 2022). As demonstrated in 4.79, factor loadings for all items crossed the value of 0.7 (Table 4.77). Moreover, the Cronbach's Alpha coefficients for all the constructs inspected in the study were above 0.7 which specify an internally stable and reliable measurement scale. In addition, the composite reliability values of the present model were greater than or equal to 0.8 for all constructs, i.e., belief (0.956), attitude (0.879), subjective norms (0.877), behavioral intention (0.915), opportunity (0.912) and actual behavioral change to adopt RWH (0.923) which supports that internal consistency of the scale to be high. Likewise, rho A values for all the variables were more than 0.8 depicting a high level of reliability (Table 4.78).

Convergent validity

If the Average Variance Extracted (AVE) value of a construct exceeds 0.5, it shows convergent validity. For the present study, the AVE value of the construct was found to be greater than 0.6 suggesting a good convergent validity for the model (Table 4.78).

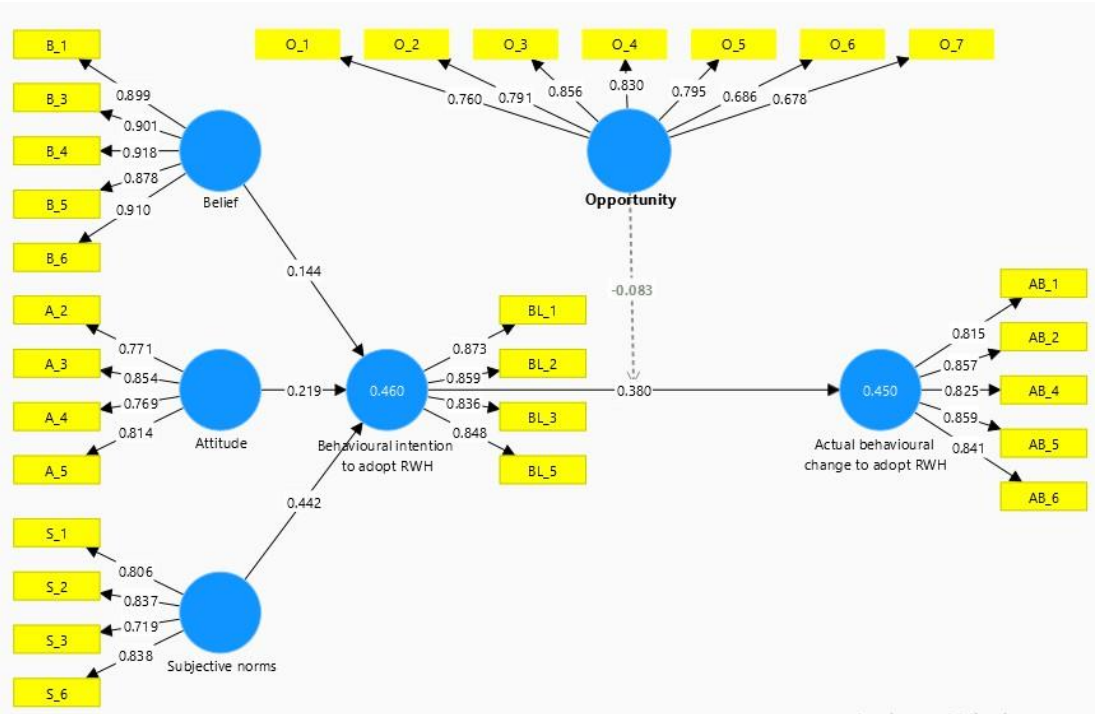

Figure 4.12

Measurement model having opportunity as a moderator

Table 4.77

Estimates (outer loadings) for opportunity as moderator

	AB	A	BL	B	O	S
Actual behavioral change to adopt RWH						
AB 1	0.815					
AB 2	0.857					
AB 4	0.825					
AB 5	0.859					
AB 6	0.841					
Attitude						
A 2		0.771				
A 3		0.854				
A 4		0.769				
A 5		0.814				
Behavioral intention to adopt RWH						
BL 1			0.873			
BL 2			0.859			
BL 3			0.836			
BL 5			0.848			
Belief						
B 1				0.899		
B 3				0.901		
B 4				0.918		
B 5				0.878		
B 6				0.910		
Opportunity						
O 1					0.760	
O 2					0.791	
O 3					0.856	
O 4					0.830	
O 5					0.795	
O 6					0.686	
O 7					0.678	
Subjective norms						
S 1						0.806
S 2						0.837
S 3						0.719
S 6						0.838

Table 4.78

Reliability and validity

	Cronbach's alpha	Composite reliability (rho a)	Composite reliability (rho c)	Average variance extracted (AVE)
Actual behavioral change to adopt RWH	0.895	0.898	0.923	0.705
Attitude	0.816	0.819	0.879	0.644
Behavioral intention to adopt RWH	0.877	0.878	0.915	0.730
Belief	0.942	0.948	0.956	0.812
Opportunity	0.887	0.900	0.912	0.598
Subjective norms	0.815	0.834	0.877	0.642

Table 4.79

Cross loadings

	AB	A	BL	B	O	S
Actual behavioral change to adopt RWH						
AB 1	0.815	0.563	0.461	0.522	0.418	0.550
AB 2	0.857	0.522	0.530	0.507	0.434	0.588
AB 4	0.825	0.487	0.503	0.483	0.470	0.588
AB 5	0.859	0.480	0.516	0.488	0.536	0.657
AB 6	0.841	0.463	0.475	0.545	0.506	0.580
Attitude						
A 2	0.431	0.771	0.357	0.352	0.291	0.282
A 3	0.442	0.854	0.398	0.323	0.365	0.435
A 4	0.482	0.769	0.406	0.419	0.331	0.440
A 5	0.548	0.814	0.440	0.429	0.380	0.388
Behavioral intention to adopt RWH						
BL 1	0.519	0.495	0.873	0.416	0.413	0.534
BL 2	0.504	0.459	0.859	0.445	0.453	0.551
BL 3	0.494	0.344	0.836	0.395	0.469	0.506
BL 5	0.508	0.407	0.848	0.455	0.474	0.560
Belief						
B 1	0.559	0.488	0.520	0.899	0.608	0.553
B 3	0.489	0.381	0.444	0.901	0.562	0.472
B 4	0.536	0.415	0.440	0.918	0.543	0.521
B 5	0.555	0.429	0.394	0.878	0.518	0.513

	AB	A	BL	B	O	S
B 6	0.587	0.428	0.444	0.910	0.578	0.517
Opportunity						
O 1	0.430	0.396	0.486	0.527	0.760	0.614
O 2	0.409	0.320	0.426	0.493	0.791	0.493
O 3	0.499	0.350	0.458	0.559	0.856	0.653
O 4	0.530	0.363	0.430	0.529	0.830	0.553
O 5	0.458	0.290	0.417	0.468	0.795	0.591
O 6	0.308	0.213	0.255	0.341	0.686	0.380
O 7	0.373	0.367	0.350	0.434	0.678	0.399
Subjective norms						
S 1	0.604	0.459	0.513	0.554	0.589	0.806
S 2	0.598	0.345	0.566	0.493	0.619	0.837
S 3	0.406	0.283	0.352	0.286	0.446	0.719
S 6	0.620	0.446	0.549	0.460	0.540	0.838

Discriminant validity

Discriminant validity was estimated through two tests, i.e., Fornell-Larcker Criterion and Heterotrait-Monotrait (HTMT) ratio correlation. the Heterotrait-Monotrait (HTMT) ratio demonstrated that all of the constructs' HTMT values surpass the cut-off value of 0.85 which demonstrates good discriminant validity (Table 4.81).

Furthermore, the Fornell-Larcker Criterion states that if all factor values were higher than the highest correlation of the specific variable with others in the model, then it establishes discriminant validity for that construct. Here, all the factors satisfy the required criteria. Hence, discriminant validity of the constructs is established (Table 4.82).

Table 4.80

Discriminant validity

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Actual behavioral change to adopt RWH (1)							
Attitude(2)	0.697						
Behavioral (3) intention to adopt RWH ((4)	0.668	0.587					

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Belief	0.660	0.539	0.546				
Opportunity (5)	0.621	0.497	0.593	0.674			
Subjective norms (6)	0.811	0.582	0.729	0.636	0.792		
Opportunity × Behavioral intention to adopt RWH (7)	0.326	0.273	0.332	0.314	0.242	0.412	

Table 4.81

Heterotrait-Monotrait ratio

	HTMT ratio
Attitude <-> Actual behavioral change to adopt RWH	0.697
Behavioral intention to adopt RWH <-> Actual behavioral change to adopt RWH	0.668
Behavioral intention to adopt RWH <-> Attitude	0.587
Belief <-> Actual behavioral change to adopt RWH	0.660
Belief <-> Attitude	0.539
Belief <-> Behavioral intention to adopt RWH	0.546
Opportunity <-> Actual behavioral change to adopt RWH	0.621
Opportunity <-> Attitude	0.497
Opportunity <-> Behavioral intention to adopt RWH	0.593
Opportunity <-> Belief	0.674
Subjective norms <-> Actual behavioral change to adopt RWH	0.811
Subjective norms <-> Attitude	0.582
Subjective norms <-> Behavioral intention to adopt RWH	0.729
Subjective norms <-> Belief	0.636
Subjective norms <-> Opportunity	0.792

Table 4.82

Fornell-Larcker criterion

	(1)	(2)	(3)	(4)	(5)	(6)
Actual behavioral change to adopt RWH (1)	0.840					
Attitude(2)	0.597	0.803				
Behavioral (3) intention to adopt RWH ((4)	0.593	0.502	0.854			
Belief	0.605	0.477	0.501	0.901		
Opportunity (5)	0.566	0.428	0.529	0.626	0.773	
Subjective norms (6)	0.707	0.485	0.630	0.573	0.691	0.801

Collinearity assessment

Collinearity was measured through variance inflation factor (VIF) criteria. The collinearity among the variables is indicated if the VIF values are greater than 5. The findings in Table 4.83 demonstrates that VIF values for all variables were less than 5, suggestive of an absence of collinearity among the indicators.

Table 4.83

Collinearity statistics

	VIF
AB 1	2.098
AB 2	2.523
AB 4	2.185
AB 5	2.473
AB 6	2.389
A 2	1.661
A 3	2.114
A 4	1.608
A 5	1.703
BL 1	2.405
BL 2	2.233
BL 3	2.076
BL 5	2.109
B 1	3.173
B 3	3.604
B 4	4.318
B 5	3.151
B 6	3.784
O 1	1.907
O 2	2.189
O 3	3.017
O 4	2.404
O 5	2.443
O 6	2.011
O 7	1.997
S 1	1.678
S 2	1.784
S 3	1.536
S 6	1.844
O × BL	1.000

Evaluation of model fitness

Coefficient of determination

The coefficient of determination (R^2 value) is the amount of variation in the dependent variable(s) that can be successfully explained by the independent variables. Here, R square value for behavioral intention to adopt is 0.460. This indicates 46 % of variation in behavioral intention to adopt RWH by residents in Bangalore is explained by beliefs about RWH, attitude about RWH and subjective norms (Table 4.84). On the other hand, as the R square value for actual behavioral change to adopt RWH is 0.450, it indicates that 45.0% of variation in actual behavioral change to adopt RWH can be explained by behavioral intention and opportunity of the residents.

Table 4.84

R square

	R-square	R-square adjusted
Actual behavioral change to adopt RWH	0.450	0.446
Behavioral intention to adopt RWH	0.460	0.456

Effect size (f2)

Effect size is a measure of the extent to which an independent variable has an influence on a dependent variable. Values higher than or equal to 0.35 indicate strong impact, 0.15 to 0.35 indicate moderate impact and lower than 0.15 indicate weak impact. The findings (Table 4.85) demonstrates that beliefs about RWH (0.024), attitude about RWH (0.063) weakly influence behavioral intention of the residents, whereas subjective norm (0.222) exert a moderate impact on the behavioral intention of the residents and behavioral intention (0.180) moderately impact on the actual behavioral change to adopt RWH. Opportunity exerts moderate impact (0.148) on actual behavioral change to adopt RWH. On the other hand, opportunity and behavioral intention together exerts a weak impact (0.020) on actual behavioral change to adopt RWH.

Table 4.85

F value

	f-square
Attitude -> Behavioral intention to adopt RWH	0.063
Behavioral intention to adopt RWH -> Actual behavioral change to adopt RWH	0.180
Belief -> Behavioral intention to adopt RWH	0.024
Opportunity -> Actual behavioral change to adopt RWH	0.148
Subjective norms -> Behavioral intention to adopt RWH	0.222
Opportunity × Behavioral intention to adopt RWH -> Actual behavioral change to adopt RWH	0.020

Goodness of fit of the model

To check the model's adequacy, standardized root mean square residual (SRMR) has been used (Hu, Bentler and Hu, 1999). For adequate model fitness, the value should be less than 0.08. The results of the present study showed that the model had an SRMR value of 0.063, which is adequate enough to designate the optimal fitness of the model. In addition, d_ULS value of 1.712, d_G value of 0.744, Chi-Square value of 1688.865 and NFI value of 0.804 indicated a good fit for the model (Table 4.86).

Table 4.86

Model fit

	Saturated model	Estimated model
SRMR	0.063	0.083
d ULS	1.712	3.022
d G	0.744	0.827
Chi-square	1688.865	1785.389
NFI	0.804	0.793

Testing of model

The structural model was analyzed subsequent to assessing the measurement model. Bootstrapping method was performed with 5000 sampling iterations to determine the path coefficient and t-values. For the result values to be considered significant, the t values must be greater than 1.96. The structural model is illustrated in Figure 4.13.

Table 4.87 displays the path coefficients of the SEM model. Beliefs about RWH ($t = 3.172$, $p < 0.05$), attitude about RWH ($t = 4.582$, $p < 0.05$) and subjective norms ($t = 8.937$, $p < 0.05$) significantly influenced behavioral intention to adopt RWH, which further supports the earlier findings of the present study. On the other hand, the moderation effect of opportunity was found to be significant in the relationship between behavioral intention and actual behavioral change ($t = 2.057$, $p < 0.05$). Thus, the hypothesis, *H8: Opportunity moderates the relationship between behavioral intention to adopt RWH and the actual behavioral change*, is accepted.

Structural model

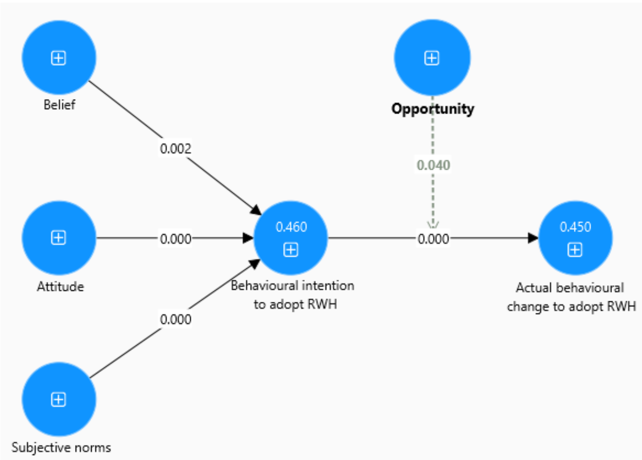

Figure 4.13

Structural model for opportunity as a moderator

Table 4.87

Path coefficients

	Original sample	Sample mean	Standard deviation	T statistics	P values
Direct effects					
Belief -> Behavioral intention to adopt RWH	0.144	0.145	0.045	3.174	0.002
Attitude -> Behavioral intention to adopt RWH	0.219	0.221	0.048	4.580	0.000
Subjective norms -> Behavioral intention to adopt RWH	0.442	0.441	0.049	8.938	0.000
Behavioral intention to adopt RWH -> Actual behavioral change to adopt RWH	0.380	0.384	0.065	5.839	0.000
Opportunity -> Actual behavioral change to adopt RWH	0.338	0.339	0.055	6.118	0.000
Opportunity × Behavioral intention to adopt RWH -> Actual behavioral change to adopt RWH	-0.083	-0.081	0.041	2.057	0.040
Total indirect effect					
Belief -> Actual behavioral change to adopt RWH	0.055	0.057	0.023	2.380	0.017
Attitude -> Actual behavioral change to adopt RWH	0.083	0.085	0.024	3.509	0.000
Subjective norms -> Actual behavioral change to adopt RWH	0.168	0.171	0.043	3.893	0.000

Table 4.88

Status of hypotheses

Hypotheses	Status
H1: Residents' beliefs about RWH influence behavioral intention to adopt RWH.	Accepted
H2: Residents' attitudes about RWH influence behavioral intention to adopt RWH.	Accepted
H3: Residents' subjective norms about RWH influence behavioral intention to adopt RWH.	Accepted
H4: Behavioral intention to adopt RWH influence the actual behavioral change to adopt RWH	Accepted
H5: Motivation moderates the relationship between behavioral intention to adopt RWH and the actual behavioral change	Accepted
H6: Barriers moderate the behavioral intention to adopt RWH and the actual behavioral change	Accepted
H7: Ability to use RWH moderates the behavioral intention to adopt RWH and the actual behavioral change.	Accepted
H8: Opportunity moderate the behavioral intention to adopt RWH and the actual behavioral change.	Accepted

1.54 Summary

The present chapter demonstrated that in the context of demographic details, mostly the participants were male residents, with a dominant age group of 25 to 45 years old, graduate and have majorly belong to individual house or multi-storied flat. Independent t-test and ANOVA showed significant differences in social media marketing strategies, beliefs about RWH, attitudes about RWH, subjective norms, behavioral intention, actual behavioral change to adopt rainwater harvesting based on different demographic characteristics. Furthermore, linear regression analysis showed the relationships different factors. Moreover, structural equation modelling results suggested significant moderation effects of motivation, ability, opportunity and barrier on the actual behavioral change of the residents.

CHAPTER V

DISCUSSIONS, CONCLUSIONS AND IMPLICATIONS

1.55 Overview

The present chapter summarizes the key findings of the research. At first, the demographics of the studied population were summarized followed by the perception of them regarding RWH installation. The studied findings were corroborated with previous research. Furthermore, various hypothesized relationships studied in this thesis are discussed and concluded. Finally, based on the findings, recommendations are given. Theoretical, managerial, and societal implications are provided along with suggestions for future research. Limitations of the study has been also provided.

1.56 Key Findings

Demographics

The study was conducted on the urban residents (n=400) residing in one of the major cities in India, Bengaluru. Majority of the residents in the study were male (61.0%) and belonged to the age group between 25-45 years old (63%). Most of them were graduates (69%). Also, they mostly lived in individual house (45%) or multi-storied flat (48.3%), however it was dominantly rented accommodations (76.5%).

Perceptions of residents

A survey was conducted by distributing a structured questionnaires to the urban residents in Bengaluru. The perception of the residents on various aspects of RWH installation were recorded. The key perceptions gathered from the residents are mentioned below.

The survey participants mostly believed that RWH would solve all their water problems and that by installing one in their homes, they might benefit society. Independent sample t-test showed that there are significant differences in beliefs about RWH based on gender, age, educational qualification, property type. However, no significant differences were found for ownership type and property type.

While responding the attitude towards RWH installation, most of the participants agreed that they need to preserve rainwater even if there are other supplementary water sources. They also thought strongly that using RWH can save their water bills and wasting rainwater is wrong. The present study, further, revealed that there are significant differences in attitude towards RWH for gender, age, educational qualification. However, no significant differences are found for various ownership type or property type.

Most of the respondents agreed that the people surrounded them were interested to collect and preserve rainwater for water conservation, and they will be appreciated by their social media peers if they install RWH in their homes.

Survey participants dominantly expressed interest in using rainwater harvesting in the future, would like to continue using it, recommended it to others, and saw it as essential for water conservation. It is also found that subjective norms for RWH were significantly different for gender, age, educational qualification, ownership type and property type.

Regarding the actual behavioral change, respondents strongly agreed that RWH was good for their life and that storing and using rainwater conserved water. They placed a RWH unit in their home and promoted it. They also believe it is their job to maintain a rainwater collecting system in their home and will pay for it. Furthermore, there are significant differences in actual behavioral change based on gender, age, educational qualification, ownership type and property type.

In terms of motivation for RWH adoption, participants said they wanted to install RWH units in their homes, believed they would benefit from them, had space for them, and wanted to contribute to society. They also believe rainwater storage is environmentally friendly and worth implementing. Motivation was not significantly different for different gender and different property type in the present study. However, significant differences in motivation are found for different age groups and various educational qualification.

On the other hand, respondents of this present study disagreed about various barriers cited, i.e., high installation costs, poor rainwater quality, not having enough space to install RWH units, having enough water from different sources, not having enough resources to build their own RWH, not having RWH knowledge, and not having government aid to build RWH structures. Not storing rainwater or not conserving water were other disagreements. The present study demonstrated that there are no significant differences in barriers perception based on their gender and property types. However, individuals with different ownership type, different age groups, different educational qualifications have different perceptions.

Respondents agreed on their ability that they can maintain the RWH unit and pay for its upkeep. They also agreed that they knew how to store rainwater using RWH, can manage their household's water needs during dry periods, and can make space for a RWH unit. There are significant differences in ability perception of the respondents based on ownership type, age groups, educational qualification. However, there are no significant differences in ability based on gender and property types.

Most respondents highly agreed on their opportunity for RWH installation and stated that they easily find RWH installation instructions, have time for RWH maintenance, and know where to get help with problems. Also, they receive government subsidies for RWH unit acquisition and installation, and government supervisors regularly inspect local RWH units. RWH also supports tank and pipe maintenance. There are no significant differences in opportunity perception of the respondents based on gender, ownership type, age groups, educational qualification. However, there are significant differences in opportunity based on educational qualifications.

1.57 Objective-wise Findings

By establishing suitable hypotheses, the specific study objectives were attained. Subsequently, the determining factors were analyzed.

Factors influencing residents’ intention to adopt rainwater harvesting

According to Wong et al. (2018), environmental consciousness is defined as an innate behavior of people's environmental interest that manifests from a commitment towards the environment's safety and welfare to address ecological issues through daily activities that safeguard the environment. Researches have also demonstrated, among other things, that environmental instruction may have an impact on people's perceptions of their environmental responsibilities (Slavoljub *et al.*, 2015). Maintaining a clean environment, using energy efficiently, and taking action to combat environmental injustices are all examples of how one might demonstrate their sense of caring for the planet. Furthermore, Ryan et al. (2024) emphasized the significance of environmental responsibility at the individual and business levels, respectively. Previous studies have found that ideas about responsibility for the environment have an impact on pro-environmental behavior.

Objective 1: To understand the factors that influence residents’ intention to adopt RWH.

Influence of residents’ belief on intention to adopt rainwater harvesting

One of the key characteristics that makes it easier to absorb and resolve environmental-related challenges and concerns is the belief in being environmentally responsible. This belief involves making pro-environmental choices and changing society to support these actions. Linear regression analysis was performed to find out the impact of beliefs about RWH on behavioral intention. The statistical analysis shows that the effect of residents’ beliefs about RWH on behavioral intention is positive and significant ($t = 10.420$, $p < 0.05$). It is found that every unit increase in residents’ beliefs about RWH, behavioral intention to adopt RWH among the residents is expected to increase by 0.445 units. Therefore, the present study demonstrated that majority of the studied population in Bangalore city strongly believed that RWH can diminish water scarcity problem, is good for the environment and ecosystem, good for water conservation, and helps in lowering water bills. They highly considered that rainwater preservation will help mitigate all the water-related problems in their house and by building the RWH system in their house, they can contribute to society. Furthermore, the present study suggested that these beliefs increased the behavioral intention to adopt RWH in their houses. Similarly, Yue et al. (2020) showed that environmental responsibility has a major impact on environmentally conscious behavior and concern. Also, Kaiser and Scheuthle (2003) found in another study that a belief of ecological responsibility had an impact on eco-friendly behavior. Furthermore, the linear association between environmental consciousness and environmentally friendly conduct was validated by (Canlas, Karpudewan and Mohamed Ali Khan, 2022), and the same relationship was reiterated by Attaran and Celik (2015) between ecological responsibility and the intent to invest in green buildings. Consistent with the preceding arguments, this research suggests that beliefs on environmental accountability exhibit a noteworthy correlation with the use of rainwater harvesting.

Therefore, the following hypothesis is accepted in the present study.

H1: Residents' beliefs about RWH influence behavioral intention to adopt RWH. (Accepted)

Influence of residents' attitude on intention to adopt rainwater harvesting

In the present study, the urban residents in Bangalore demonstrated positive attitude about rainwater harvesting, such as they thought RWH is a good idea to implement RWH in houses and it is very much important to install it in one's house. Linear regression analysis was also performed to find out the impact of attitudes about RWH on behavioral intention of the residents. The statistical analysis shows that the effect of residents' attitude about RWH on behavioral intention is positive and significant ($t = 8.396$, $p < 0.05$). It is found that for every unit increase in residents' attitudes about RWH, behavioral intention to adopt RWH among the residents is expected to increase by 0.386 units. Therefore, the present study suggested that attitude play a significant role in changing behavioral intention of urban people to use RWH in their houses. In line with the study's findings, earlier studies showed that attitude is one of the key factors in developing individual behavior (Kaiser, 2006; Nigbur, Lyons and Uzzell, 2010; Tohidyan Far and Rezaei Moghaddam, 2015). Similarly, a study on rural population in Asad Abad and Nahavand cities, Hamadan province, Iran showed that attitude played the key role in influencing the people to engage in sustainable management of water resources (Aliabadi, Gholamrezai and Ataei, 2020). This is also in line with the previous studies which showed positive attitude towards the adoption of RWH in households which significantly increase the participation of the community groups and residents (Aliabadi, Gholamrezai and Ataei, 2020; Savari, Mombeni and Izadi, 2022). Similarly, some studies found that adoption of water management projects depend on the behavior intention of the people which directly or indirectly involve the attitude of an individual towards the acceptance (Sivanappan, 2006; Malek-Saeidi, Rezaei-Moghaddam and Ajili, 2012; Ward *et al.*, 2012). Similarly, studies on farmers demonstrated that positive attitude or perception of farmers significantly increased the adoption of storage-based RWH technology in Ethiopia (Sunkemo, 2022).

Therefore, the following hypothesis is accepted.

H2: Residents' attitudes about RWH influence behavioral intention to adopt RWH (Accepted).

Influence of residents' subjective norm on intention to adopt rainwater harvesting

Subjective norms, according to Fishbein and Ajzen (2011), are people's references to well-known and significant people's acts and behaviors when completing a task. Ajzen (1991) previously believed that internalized social pressure actively influences behavior. Subjective norms are important even in day-to-day actions. Numerous scholars have elucidated the noteworthy influence of subjective norms on environmentally sound conduct. For instance, investigation by Marcos et al.

(2021) into the impact of subjective standards on water conservation revealed a close relationship between them and people's intentions to conserve water. But Kim and Seock (2019) study found that pro-environmental buying decisions were highly influenced by societal norms. According to López-Mosquera et al. (2014), people would plan to spend money on environmental protection, which starkly revealed the value of social norms.

Additionally, experimental research has demonstrated that people's engagement in pro-environmental behavior is positively influenced by subjective norms (Reese, Loew and Steffgen, 2014). Subjective norm is another important factor which influence individual’s behavioral intention to engage in environment friendly activities. In line with this, other studies showed subjective norms are one of the key factors in influencing pro-environmental behavior (Hallaj *et al.*, 2021), recycling intention (Wan, Shen and Yu, 2014).

Correspondingly, Thakur et al. (2022) showed that subjective norms were significant factor to influence water conservation intention among water users in the Waterloo low-costing housing area. Moreover, Shanmugavel and Rajendran (2022), in line with the present study showed that subjective norm has a significant impact on the adoption of rainwater harvesting by the people who were constructing their own house. Also, according to Lam (1999), subjective norms are the instructions one receives or inherits from others on how to carry out a task. As a result, previous empirical research indicates that they have a substantial impact on people's behavioral intents and behaviors. However, Marcos et al.(2021), by examining the perception of citizens in Bekasi city, Indonesia, showed that subjective norm had the lowest impact on their behavioral intention. Subjective norms are therefore thought to be a powerful predictor of whether or not a building would install rainwater harvesting. To understand the impact of subjective norm on behavioral intention of the residents, linear regression analysis was executed. The statistical analysis, in line with the previous findings, shows that the effect of subjective norm on behavioral intention is positive and significant ($t = 13.738$, $p < 0.05$). It is observed that for every unit increase in subjective norm, behavioral intention to adopt RWH among the residents is expected to increase by 0.680 units.

Therefore, the following hypothesis was accepted.

H3: Residents' subjective norms about RWH influence behavioral intention to adopt RWH (Accepted)

Factors influencing actual adoption of rainwater harvesting

Objective 2: To understand the influence of barriers and motivation on residents' actual adoption of RWH

Effect of motivation on actual adoption of rainwater harvesting

Motivation is one of the core elements in the MOA framework and it is the prime driving force to generate specific behaviors. Self-determination theory suggests that when the outside environment cause satisfaction of individual needs, the intrinsic motivation of one is triggered and activated, which in turn initiates goal-oriented behavior to satisfy this need (Avşar and Pekmezci, 2022). To comprehend the influence of motivation on actual behavioral change to adopt rainwater harvesting, linear regression analysis was executed. The statistical analysis shows that the effect of motivation on actual behavioral change to adopt rainwater harvesting is positive and significant ($t = 19.476$, $p < 0.05$). It is observed that for every unit increase in motivation, actual behavioral change to adopt rainwater harvesting is expected to increase by 0.755 units.

Effect of barrier on actual adoption of RWH

To comprehend the influence of barrier on actual behavioral change to adopt rainwater harvesting, linear regression analysis was executed. The statistical analysis shows that the effect of barrier on actual behavioral change to adopt rainwater harvesting is negative and significant ($t = -19.547$, $p < 0.05$). The coefficient value (B) for behavioral intention is -0.851. This means that for every unit increase in barrier, actual behavioral change to adopt rainwater harvesting is expected to decrease by 0.851 units.

Objective 3: To determine the influence of ability and opportunities on residents' actual adoption of RWH.

Effect of ability on actual adoption of RWH

To comprehend the influence of ability on actual behavioral change to adopt rainwater harvesting, linear regression analysis was executed. The statistical analysis shows that the effect of ability on actual behavioral change to adopt rainwater harvesting is positive and significant ($t = 12.552$, $p < 0.05$). The coefficient value (B) for behavioral intention is 0.793. This means that for every unit increase in ability actual behavioral change to adopt rainwater harvesting is expected to increase by 0.793 units.

Effect of opportunity on actual adoption of RWH

To comprehend the influence of opportunity on actual behavioral change to adopt rainwater harvesting, linear regression analysis was executed. The statistical analysis shows that the effect of opportunity on actual behavioral change to adopt rainwater harvesting is positive and significant ($t = 13.295$, $p < 0.05$). The coefficient value (B) for behavioral intention is 0.613. This means that for every unit increase in opportunity, actual behavioral change to adopt rainwater harvesting is expected to increase by 0.613 units.

Objective 4: To determine the relationship between residents' intention to adopt RWH and actual adoption of RWH.

Effect of behavioral intention on actual adoption of RWH

To understand the impact of behavioral intention on actual behavioral change to adopt rainwater harvesting, linear regression analysis was executed. The statistical analysis shows that the effect of behavioral intention on actual behavioral change to adopt rainwater harvesting is positive and significant ($t = 13.575$, $p < 0.05$). It was found that for every unit increase in behavioral intention, actual behavioral change to adopt rainwater harvesting is expected to increase by 0.544 units. It was seen in the present study that behavioral intention to adopt RWH influences the actual behavioral change to adopt RWH. Intention is a crucial step before changing behavior (Ajzen, 1991). According to French (2017), volitional behavior modification is correlated with a strong and favorable intention to undertake the behavior. Positive assessments of the conduct, intense feelings of social pressure, and easiness of performance all influence intention (Ajzen, 1991). As a result, this study shows that the more strongly someone intends to adopt RWH, the more likely it is that they will alter their behavior in that direction. Furthermore, the present study reveals that actual behavioral change to adopt rainwater harvesting were significantly higher for male residents and residents having degree above post-graduate compared to others. In line with this, study from Brazilian semi-arid areas showed that rainwater use for drinking reached 90% (Barros *et al.*, 2013), while other studies from Malaysia and the UK showed that the adoption rate is quite lower (17%) (Parsons *et al.*, 2010; Asmuni *et al.*, 2016).

H4: Behavioral intention to adopt RWH influence the actual behavioral change to adopt RWH (Accepted)

1.58 Moderating Effect of Barriers, Motivation, Ability and Opportunity on the Effect of Behavioral Intention on Actual Adoption of Rainwater Harvesting

Objective 5: To determine how behavioral intention together with barriers, motivation, ability and opportunity influence residents' actual adoption of RWH

Moderating role of motivation

SEM was conducted to understand the moderating effect of motivation on the effect of behavioral intention on actual adoption of RWH. The study showed that the moderation effect of motivation was found to be significant in the relationship between behavioral intention and actual behavioral change ($t = 2.577$, $p < 0.05$). Thus, the following hypothesis was accepted.

H5: Motivation moderates the relationship between behavioral intention to adopt RWH and the actual behavioral change (Accepted).

Moderating role of barriers

SEM was conducted to understand the moderating effect of barrier on the effect of behavioral intention on actual adoption of RWH. The study showed that the moderation effect of barrier was found to be significant in the relationship between behavioral intention and actual behavioral change ($t = 2.891$, $p < 0.05$). Thus, the following hypothesis was accepted.

H6: Barrier moderates the relationship between behavioral intention to adopt RWH and the actual behavioral change (Accepted)

Moderating role of ability

SEM was conducted to understand the moderating effect of ability on the effect of behavioral intention on actual adoption of RWH. The study showed that the moderation effect of ability was found to be significant in the relationship between behavioral intention and actual behavioral change ($t = 2.861$, $p < 0.05$). Thus, the following hypothesis was accepted.

H7: Ability moderates the relationship between behavioral intention to adopt RWH and the actual behavioral change (Accepted)

Moderating role of opportunity

SEM was conducted to understand the moderating effect of opportunity on the effect of behavioral intention on actual adoption of RWH. The study showed that the moderation effect of opportunity was found to be significant in the relationship between behavioral intention and actual behavioral change ($t = 2.057$, $p < 0.05$). Thus, the following hypothesis was accepted.

H8: Opportunity moderates the relationship between behavioral intention to adopt RWH and the actual behavioral change (Accepted)

Based on the discussion above, it can be said that the research topic was addressed and all study objectives were satisfactorily met.

1.59 Recommendations

Residents mentioned that they get enough support from government, get subsidies for RWH unit purchase and installation and government provided supervisors are available to check on the RWH units in the locality in a regular manner, indicating that government aid plays a big role in RWH uptake. Hence, the following are suggested as a next step:

- Policy makers in developing nations should offer preference to a rebate program for RWH systems. Additionally, there is evidence to suggest that financing tank installations will succeed provided proper maintenance training is supplied.
- In areas with scarce water, financial incentives might be very helpful for the population. It is important to recognize the value of financial assistance like subsidies, grants, tax breaks, revolving funds, and income-generating ventures. A more complex strategy will incorporate the aforementioned recommendations and employ a number of coordinated tactics that adapt over time to fit different situations.
- To ascertain the proper level of investment in both strategies, at the environment and household levels, in-depth cost-benefit assessments would be necessary.
- Standardizing the approaches used for RWH system economic evaluation is necessary.
- In order to increase the acceptability of RWH, more research on the topic should concentrate on the following areas: productive usage of water, life cycle evaluation that takes energy use and GHG emissions into account; and institutional along with socio-political backing.
- In practice, education is frequently disregarded, despite its importance. Additionally, technical assistance and frequent training programs on RWH are

necessary to help the public avoid having misconceptions and insufficient knowledge.

This study demonstrates that respondents' positive attitudes and perceptions about the behavior play a critical role in influencing their intentions to reduce water waste.

- It is therefore advised that those preparing social marketing interventions on preventing waste concentrate on changing the apartment owners' perspective by acting in a way that encourages them to make positive behavioral changes and gives them the impression that doing so would be in line with their perspective. The goal is to persuade individuals participating in RWH activities of the beneficial effects of the suggested behavior on the environment, since this will probably affect their adoption.

Residents’ beliefs and attitudes about RWH were seen to influence behavioral intention to adopt RWH.

- When creating intervention programs for RWH adoption, social marketers should prioritize enhancing the positive attitudes and beliefs of their target audiences while also providing sufficient resources and skills to facilitate sustainable behavior.

1.60 Theoretical, Managerial, and Societal Implications

This research makes a few implications to the growing body of literature. Firstly, as regards to social marketing theory building, this research departs from earlier studies that used a single theory to understand pro-environmental behaviors. Here, an extended version of Theory of Planned Behavior (TPB) model has been used to understand a complex social issue. Many scholars (such as Bamberg et al., 2003) use the Theory of Planned Behavior (TPB) as a key theoretical framework for examining peoples' intentions to engage in environmentally friendly activity. This study adds more constructs to the TPB mode in an attempt to increase the explanatory power of the theory, while still admitting the TPB's overall usefulness.

More specifically, the research looks into residents’ beliefs, attitudes, and subjective norms, influence on behavioral intent to adopt RWH, and the role of motivation, barriers, opportunity and ability on the intent–behavior relationship. The study found that subjective norms had the most significant motivating factors predicting behavioral intent to adopt RWH. The results further indicate that motivation and barriers strongly influence actual behavioral change to adopt RWH, while abilities and opportunities have a weak impact on actual behavioral change to adopt RWH. This indicates that providing increased opportunity is not important for social marketers seeking to enhance the positive intentions of adopting RWH. These findings are of great importance to social media strategists and government policymakers

It is important to note that although if the TPB model's predictive capacity to account for a sizable portion of the variance in a variety of behaviors has been empirically demonstrated, using it to explain RWH adoption behavior in a social marketing context improves the explaining ability of our model. Thus, conceptually speaking, this study answers calls for an expanded social marketing model that can aid in offering a thorough grasp of the subtleties surrounding complicated social concerns. Additionally, the following management implications of the study: It is true that many interventions meant to promote environmentally beneficial behavior have failed, and that it has proven to be an extremely difficult task for the government and environmentalists to discourage waste activities that have negative effects on the environment, especially in India.

The study's conclusion is that there is a chance to modify the behavior of Indian apartment dwellers through the use of social marketing. From this angle, managers and those responsible for the implementation of social marketing intervention initiatives on RWH adoption can benefit from the insights and suggestions provided by our study.

1.61 Limitations and Future Research

The studies are bounded by certain limitations. First, it only targeted residents of one city in India, Bengaluru. However, it limits to understand the perception of common people with lower socioeconomic standards in India, as Bengaluru is one of the fastest growing cities with generally high socioeconomic standards. Second, despite the fact that the TPB model could forecast changes in RWH adoption behavior, it has come under scrutiny for incorporating opportunities while omitting to address the need to lower inhibitors (barriers) in order to promote long-lasting behavior change. Therefore, additional factors should be included to the model in future research to close this gap. However, these restrictions restrict the study's generalizability rather than making it weak. Future study endeavors may investigate mixed research methodologies to comprehend the process of behavior modification among residential property owners. Once more, there are opportunities for other moderating factors that could affect behavior change toward adoption to be investigated in future research. The model created in this work can be tested in several situations, like the preservation of water resources and forests.

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APPENDIX

QUESTIONNAIRE

Dear Sir/Madam, I am conducting research on the factors that influence or inhibit individuals to install Rainwater harvesting structures in their house. I would highly appreciate if you can spare your time and participate in this survey. Please be assured that the data obtained by means of this questionnaire shall remain confidential and will be employed only for academic purposes. Regards, Divya Kiran Dsouza

Section I

1. Gender: Male □ Female □
2. Age (years): 25-45 □ 46-65 □ 66-75 □ >75 □
3. Educational qualification:
   Undergraduate □ Graduate □ post-graduate □ Above post-graduate □
4. Property type:
   Individual house □ Multi-storied Flat □ Apartment society □
5. Ownership type: Rental □ Own House □

Section II

6. Please indicate your agreement with the following statements related to the social media marketing approach

SDA: Strongly Disagree; DA- Disagree; N-Neutral; A-Agree; SA-Strongly Agree

Sl #	Statements	SDA	DA	N	A	SA
Social media marketing strategies (Godey et al., 2016)						
1.	The campaigns for RWH in social media provide customized and personalized information.					
2.	Social media provides detailed information about the water scarcity condition in our area and the requirements of RWH.					
3.	Social media provides sufficient information on RWH installation and maintenance.					
4.	I came to know about the personal, economic, and environmental benefits of RWH via social media advertising and campaigns.					

Sl #	Statements	SDA	DA	N	A	SA
5.	I came to know about various RWH products via social media.					
6.	I get direct information from the RWH users which provides me real-time feedback.					
7.	Social media selling has several benefits like promotional codes, and super-saver sales.					

7. Please indicate your agreement with the following statements related to the different factors influencing Rainwater Harvesting

SDA: Strongly Disagree; DA- Disagree; N-Neutral; A-Agree; SA-Strongly Agree

Sl #	Statements	SDA	DA	N	A	SA
Beliefs about RWH						
1.	RWH can diminish the water scarcity problem.					
2.	RWH is good for the environment and ecosystem.					
3.	RWH is good for water conservation.					
4.	RWH helps in lowering water bills.					
5.	Rainwater preservation will help in mitigate all the water related problems in my house.					
6.	Building RWH system in my house, I can contribute to the society.					
Attitudes about RWH (Marcos et al., 2021)						
1.	It is a good idea to implement RWH in houses.					
2.	It is important to install RWH in one's house.					
3.	Everyone should adopt the RWH system in their houses for water conservation.					
4.	Even if there are other supplementary water source, we need to preserve rainwater.					
5.	I think using RWH can save my water bills.					
6.	I think wasting rainwater is wrong.					
Subjective norms (Ajzen, 1991; Xu et al., 2022)						

Sl #	Statements	SDA	DA	N	A	SA
1.	The people surround me are interested to collect and preserve rainwater for water conservation.					
2.	My peers and neighbors are installing RWH in their home which inspires me.					
3.	My family and friends will be happy if I install RWH in my home					
4.	Most people close to me think about environmental benefit of RWH and it motivates me.					
5.	If I install RWH in my home, I will be appreciated by my social media peers.					
6.	Adopting RWH unit in my house is what most people in my social network think I should be doing					

8. Please indicate your agreement with the following statements related to your intention to use Rainwater harvesting services in the residence

SDA: Strongly Disagree; DA- Disagree; N-Neutral; A-Agree; SA-Strongly Agree

Sl #	Statements	SDA	DA	N	A	SA
Behavioral Intention (Ajzen, 1991)						
1.	I want to use Rainwater Harvesting in the future.					
2.	I would like to continue utilizing Rainwater Harvesting in the future.					
3.	I recommend rainwater harvesting adoption to my surrounding people.					
4.	I want to use Rainwater harvesting for water conservation					
5.	The rainwater harvesting unit is very necessary for mankind and useful for the environment					

9. Please indicate your agreement with the following statements related to the actual adoption behavior

SDA: Strongly Disagree; DA- Disagree; N-Neutral; A-Agree; SA-Strongly Agree

Sl #	Statements	SDA	DA	N	A	SA
Actual behavioral change to adopt rainwater harvesting (Tweneboah-Koduah et al., 2020)						
1.	Rainwater harvesting is very useful for my life					
2.	I have installed a Rainwater harvesting unit in my residence.					
3.	I know for better water conservation; I need to store and utilize rainwater.					
4.	I have joined the campaigns to make others aware of installing it					
5.	Being a responsible citizen, it is my duty to maintain rainwater harvesting system in my house					
6.	I will bear the cost of rainwater harvesting in my house.					

10. Please indicate your agreement with the following statements related to the motivators, barriers, opportunity and ability to install Rainwater harvesting unit.

    SDA: Strongly Disagree; DA- Disagree; N-Neutral; A-Agree; SA-Strongly Agree

Sl #	Statements	SDA	DA	N	A	SA
Motivation (Binney et al., 2006)						
1.	I look forward for installing RWH unit in my house.					
2.	I belief using RWH in my home will be beneficial for me.					
3.	I have arranged space for installations of RWH in my house.					
4.	I want to contribute towards society by installing RWH unit in my house.					
5.	Spending money in installing RWH is worthwhile.					
6.	I am convinced about the environmental benefit of rainwater storage.					
Barriers (Sheikh, 2020)						
1.	The installation cost is very high.					

Sl #	Statements	SDA	DA	N	A	SA
2.	I don't feel any requirement of storing rainwater.					
3.	I feel the quality of the rainwater is not good.					
4.	It does not rain adequately in my place so that I can install a RWH unit.					
5.	I don't have enough space to install the RWH unit.					
6.	I have adequate water from different sources, so I don't feel any urge to install RWH unit in my house.					
7.	I don't have enough resources to build RWH by my own.					
8.	I don't have any knowledge on RWH.					
9.	I don't know about any government aid which will help me to build RWH structure.					
10.	I don't feel water conservation is such a priority.					
Ability (Binney et al., 2006; Tweneboah-Koduah et al., 2020)						
1.	I can take care of the regular maintenance that RWH unit needs.					
2.	I am able to pay for the maintenance cost of the RWH unit.					
3.	I possess a good level of knowledge of storing rainwater via RWH.					
4.	I got financial support from the government to pay for any damages in the RWH unit.					
5.	It is important for my neighbors in my local area to have a coordinated plan for maintaining RWH.					
6.	During dry time, I can manage my household's water requirement through other sources.					
7.	I can spare enough space for RWH unit to be installed.					

Sl #	Statements	SDA	DA	N	A	SA
Opportunity (Binney et al., 2006; Tweneboah-Koduah et al., 2020)						
1.	It is easy to get information on RWH installations.					
2.	I have spare time for the maintenance of RWH.					
3.	I know where to seek help when I am stuck with any problem regarding RWH.					
4.	The government provides adequate support for installing RWH units.					
5.	The RWH company provides support for regular maintenance of the tank, pipes associated with RWH					
6.	There are subsidies for RWH unit purchase and installation.					
7.	The government provides supervisors to check on the RWH units in the locality in a regular manner.					

APPENDIX A

SURVEY COVER LETTER

Divya Kiran DSouza
DBA Student
Swiss School of Business and Management Geneva
divya3@ssbm.ch

Subject: Request for Participation in Research Survey

Dear Sir/Madam,

I am a DBA student at Swiss School of Business and Management Geneva, currently conducting research for my thesis on the factors that influence or inhibit individuals from installing rainwater harvesting structures in their homes.

Your participation in this survey would be greatly appreciated and will contribute significantly to the success of this research. The survey should take only a few minutes of your time.

Please be assured that all responses will be treated with strict confidentiality and used solely for academic purposes. Participation is entirely voluntary, and you may choose to withdraw at any stage without any consequences.

If you have any questions regarding this study, feel free to contact me at divya3@ssbm.ch.

Thank you for your valuable time and support.

Sincerely,
Divya Kiran DSouza
DBA Student ID: 60611

APPENDIX B

INFORMED CONSENT

Title of the Study

The implementation of a social marketing approach for rainwater harvesting and preservation

Divya Kiran DSouza
DBA Student
Swiss School of Business and Management Geneva
divya3@ssbm.ch

Purpose of the Study: You are invited to participate in a research survey that aims to explore the positive and negative factors that affect individuals' decisions to install rainwater harvesting systems in their homes. This research is being conducted as part of my DBA Research Study at Swiss School of Business and Management Geneva.

Voluntary Participation: Your participation in this survey is entirely voluntary. You may choose not to answer any question and may withdraw from the survey at any time without any penalty or explanation.

Confidentiality: All responses collected will be kept strictly confidential and used solely for academic purposes. No personal identification information will be recorded. Data gather through this survey will be reported in an aggregated form only.

Duration: The questionnaire will take approximately 10 minutes to complete.

Risks and Benefits: There are no known risks associated with participating in this survey. While there is no direct benefit to you, your input may help inform sustainable water management policies and awareness programs in the future.

Consent: By completing and submitting this questionnaire, you are confirming that:

- You are 18 years of age or older.
- You have read and understood the information above.
- You voluntarily agree to participate in this research.

If you have any questions or concerns about the study, please contact:

Divya Kiran Dsouza – divya3@ssbm.ch

APPENDIX C

INTERVIEW GUIDE

Title of the Study

The implementation of a social marketing approach for rainwater harvesting and preservation

Divya Kiran Dsouza
DBA Student
Swiss School of Business and Management Geneva
divya3@ssbm.ch

Introduction to the participant:

Hello, my name Divya Kiran Dsouza, and I'm conducting this interview as part of my DBA research at Swiss School of Business and Management Geneva. My study focuses on understanding the factors that influence or inhibit individuals from installing rainwater harvesting systems in their homes.

Your participation is voluntary, and your responses will remain confidential. This interview will take around 10-15 minutes. With your permission, I may record this session for accuracy in data analysis.

Do I have your consent to begin?

Section I: Demographic Information

Could you please tell me your age group and gender?

What is your highest level of education?

Do you own or rent your current residence?

What type of property do you live in - individual house, apartment, society?

Section II: Perceptions of Social Media Marketing

Have you come across any rainwater harvesting campaigns or advertisements on social media?

How effective do you find social media in providing detailed or customized information about RWH?

Have online campaigns helped increase your awareness of RWH benefits or installation options?

Do you trust feedback from RWH users shared through social media platforms?

Section III: Beliefs and Attitudes Toward RWH

What are your personal beliefs about the benefits of rainwater harvesting?

Do you think RWH can solve water-related problems in your area or home? Why or why not?

How important is water conservation to you personally?

Would you describe installing RWH as a civic duty or personal choice?

Section IV: Social Influence and Norms

Do your neighbors, friends, or family support or talk about rainwater harvesting?

Have others' actions (like installing RWH) influenced your opinion or intention?

Do you feel any social pressure either positive or negative about adopting RWH?

Section V: Intention and Behavior

Do you plan to install an RWH unit in your home in the near future? Why or why not?

Have you already installed an RWH system? If yes, what motivated you? If not, what prevented you?

Have you ever participated in any awareness or advocacy campaign related to water conservation or RWH?

Section VI: Motivators, Barriers, and Enablers

What would motivate you to install an RWH unit?

Do you believe that such an installation would benefit you personally or environmentally?

What are the major challenges or concerns that discourage you from installing RWH?

Do you feel informed enough to make a decision regarding RWH?

Do you feel confident in maintaining an RWH system?

Are you financially and logistically capable of installing one?

Is it easy to get help or information about installing RWH in your locality?

Are there government schemes, subsidies, or services you are aware of that support RWH adoption?

Section VII: Suggestions and Wrap-up

In your opinion, what can the government, NGOs, or community groups do to promote RWH in residential areas?

What type of support or incentive would encourage more people to adopt it?

Is there anything else you would like to share about your views on water conservation or RWH?

Closing Statement:

Thank you very much for your time and valuable insights. Your responses will help better understand the practical challenges and motivations related to rainwater harvesting and could contribute to more effective policies and awareness campaigns.