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INVESTIGATING THE INTENTION OF FLAT PROMOTERS TOWARDS STORM WATER MANAGEMENT USING ALTRUISTIC BEHAVIOUR MODEL

R.Rema [1], R. Reno Infanto[2], Sony. P[3], R.K. Madhumathi[4]

[1, 3, 4,] Department of Civil Engineering, Stella Marys college of Engineering
[2]Department of Civil Engineering, Rohini College of Engineering and Technology
Corresponding Author: R. Rema, Assistant Professor, Department of Civil Engineering, Stella Mary's college of Engineering, Aruthenganvilai, Kanyakumari Dist, Tamil Nadu, India, email: rema@stellamaryscoe.edu.in

Abstract
This research explores the advantages of stormwater use for groundwater recharge, and the challenges of urban development such as growing traffic, weather fluctuations, and the increasing demand for sustainable water supplies. It investigates the factors that affect the implementation of stormwater management like personal norms, subjective norms, awareness of consequences, environmental responsibility, environmental concern and the intention to adopt stormwater management, in line with the Altruistic Behavior Model. Structural equation modeling of a sample of 410 reveals strong associations among these factors and stormwater management practices. Importantly, awareness of consequences serves as a moderator for the relationship between environmental responsibility and environmental concern and the relationship between environmental concern and stormwater management. These results indicate that raising awareness can significantly improve uptake of sustainable stormwater management practices and provide important theoretical and social insights.

1. Introduction

Metropolitan areas are expected to be inhabited by the majority of the world's population, which are expected to continue growing. India is expected to have 675 million urbanizes by 2035, leading to an even greater transformation of the urban environment. Impervious surfaces in urban areas cause the rainwater to not be absorbed into the ground, instead, causing an increase in overland flow and risk of flooding (Ferreira et al., 2019). The additional impacts from climate variability increase the risk of flooding and runoff from urbanization and climate change (Hutchins and Miller, 2017). Altered land use and climatic variability are causing traditional stormwater management systems, which are designed for piped conveyance, to be inefficient in dealing with larger storm events and resulting pollutants (Burian, 2013). To counter this, other stormwater management techniques are based on rainwater management, on-site infiltration of rainfall and storage of stormwater runoff in an emergency such as a large storm. Much research has been directed towards development and implementation of these alternatives (Marsalek and Schreier, 2009).

New urban developments, however, lack many innovative stormwater management concepts, and they don't get promoted (Marsalek and Schreier, 2009). The urban stormwater management at the meso-level is a very broad and interdisciplinary field, which has some vague scale boundaries and evaluation standards, as indicated by Xu et al. (2023). In this area, talk typically revolves around hydro-elements, and is mainly about economy, public involvement, ecology and policy. However, the emphasis is placed on practical applications and coupling effects; here, special methods and tools are used in simulation, evaluation and operation studies, but not so much on extensive theoretical research.

The Centre for Science and Environment (CSE) says that there are close to 30% areas in Delhi with groundwater depth of 40 meters below ground, making it among the worlds biggest cities. The report recommends to utilise open spaces such as parks for sustainable management of storm water, taking into account local geology, soil type, post-monsoon groundwater potential, flood zones etc. The total

capacity of the 16,299 parks in Delhi is nearly 3,423 million litres of annual runoff which can help solve the stormwater management problem.

The Greater Chennai Corporation (GCC) Environmental Impact Assessment (EIA) Report 2021 mentions the storm water drainage network of Chennai is 2,071 km long. It is a network of channels that carry rain water to the sea but over the years, the silt deposition has made this network ineffective and has to be desilted and cleaned before the monsoon season. In 1943, 1978, 1985, 2002, and 2005, the city of Chennai has witnessed major floods, which were caused by the alteration of land use, disruption of drainage systems, and slow completion of drainage systems. Lack of public interest has resulted in poor maintenance of the resource, emphasizing education, accountability and sustainable groundwater use. The use of stormwater management (SWMM) can improve both groundwater quality and quantity (Burian, 2013). Pophare et al. (2014) call for action to stop the rampant extraction of groundwater, and they suggest that it is imperative.

This study is a property-level stormwater management system based on the Altruistic Behavior Model. It suggests that there is a relationship between environmental responsibility and Concern over the depletion of groundwater and a plausible solution to avoid a water crisis. This study takes a social-psychological perspective on altruism as proposed by Schwartz (1968) as a model for the motivations behind stormwater management. It implies that people may express moral notions about water management, but not all do. The difficulty is to get people to act upon these convictions. In this study, the Norm Activation Model (1977 Schwartz) applies, which aims to understand how the adoption of rainwater harvesting can be separated into personal norms (moral convictions) and social norms (society's expectations).
Other constructs from previous research are included in the study such as subjective norms, personal norms, awareness of consequences, intention toward storm water management, environmental responsibility and environmental concern. These concepts are drawn and adapted from the works of Lee et al. (2013), Kim & Seock (2019), Perez-Nordtvedt et al. (2008), Yue et al. (2020), and Wong & Wan (2011). In contrast to prior studies, this study is specifically designed to identify the adoption of stormwater management in India, which has already been investing in drought and using groundwater (Pandey et al., 2003),Grig(2024) but has not yet focused on stormwater management. With its critical significance, the objective of this research is to have a holistic understanding of the differences in the adoption of stormwater management practices across India and understand how these differences influence the individual actions and commitments to adopt stormwater management practices.

2. Theoretical Basis and Hypotheses

2.1. Storm water management

With the increasing population, stormwater management is a key solution to solve problems of extreme flooding, severe water scarcity, and acute water contamination. In essence, stormwater management is the activity of managing surface runoff, particularly important in both rural and urban areas. In urban areas, impermeable surfaces prevent water from being absorbed into the ground and effective stormwater management is crucial. Traditionally, it was mostly about reduction of peak discharges (Beat, 2019). The rapid urbanization and economic development of Indian cities, however, have created a demand for environmentally friendly infrastructure to support the growing population of the urban centres and the construction of major highways, housing and retail malls. Unfortunately, poor urban stormwater management practices such as urban flooding have become a significant challenge due to unplanned developments (Madhumita, 2022).

The findings of this research indicate that inadequate implementation of stormwater management is linked to a lack of environmental responsibility and concern. This empirical study offers a deeper look into the root causes of the low adoption rates by investigating social norms associated with moral behavior and the linkage between personal norms and intention to effectively manage stormwater. The altruistic behavior model is a combination of several components including environmental

responsibility, concern, and awareness of consequences(Figure 1). The holistic study will seek to identify the factors contributing to the limited use of stormwater management technique.

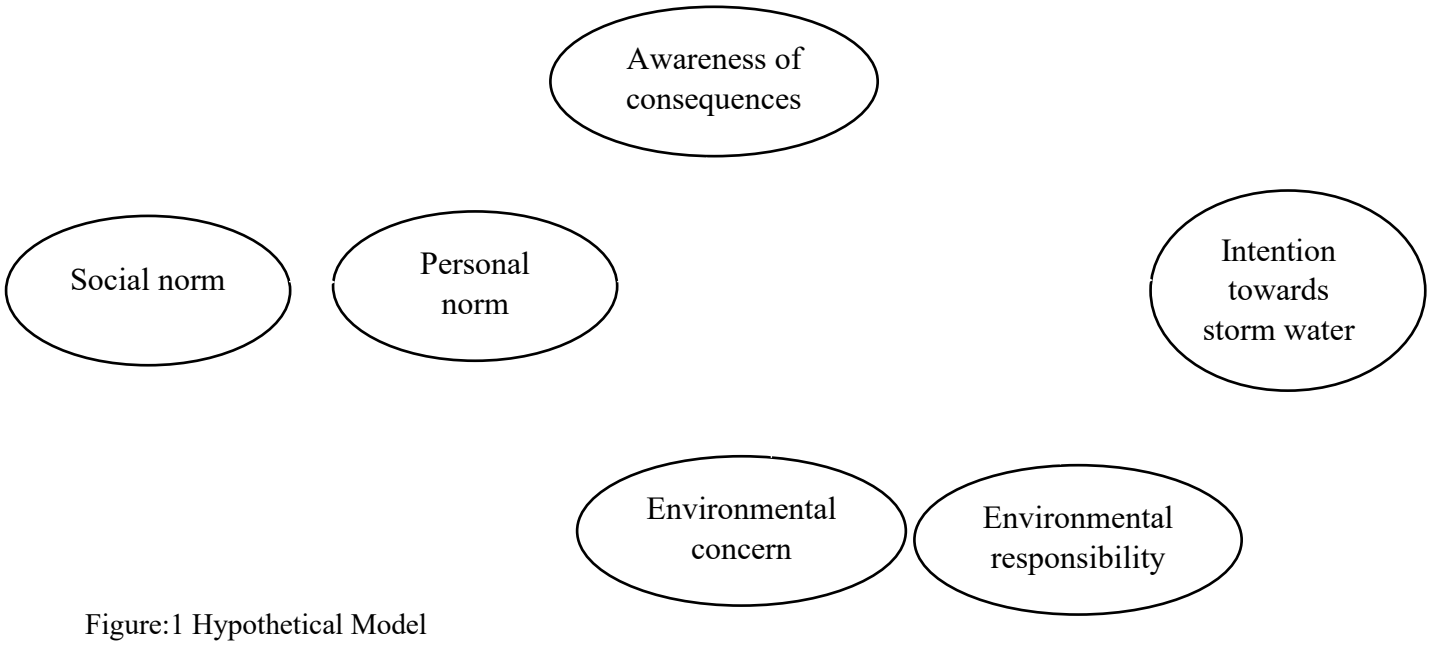

Figure:1 Hypothetical Model

2.2. Social norms (SN)

Social norms are collective standards of appropriate behaviour, which may be formalized as rules and laws, or informal understandings that inform the behaviour of the society (Finnemore, 1996; Lapinski and Rimal, 2005). Social normative effects are essential for human behavioral changes and necessary to key theories of human behavior, according to Pristl et al. (2021). Effective education and awareness-building activities convey messages about individuals' attitudes, beliefs and perceptions of societal norms. According to Eanes and Zhou (2020), incentive programs can decrease the obstacles to behavior adoption and improve individuals' perceived behavioral control.

The study highlights the fact that norms and guidelines can be formal or informal, clear or not and they are not necessarily separate from one another. Rules are considered as a more formalized form of laws (Sandholtz, 2017; Knight and Jack, 1992; Streeck and Thelen, 2005). There can be conflicts between laws and regulations or between norms and laws, for example, where a law may be against a norm, but the norm may be allowed socially. Johnson and Horne (2021) state that attitudes are not synonymous with norms; that is, there may be attitudes based on beliefs, perspectives, and values that are not related to one's actions. The study makes it clear that not all behavior patterns and common behaviors are necessarily norms, because personal preferences, biological responses, and habits are not necessarily norms (Johnson and Horne, 2021; Legros and Cislaghi, 2020).

These findings highlight the potential of social norms as internal drivers to make people adopt stormwater control measures on their properties. Several ideas emerge when social norms are associated with intentions towards stormwater management, environmental responsibility, environmental concern, and awareness of consequences. The study probably addresses how these relate and interact with people's choices of storm water control measures.

H1a. The awareness of consequences is positively influenced by social norms.
H1b. Social norms have a positive influence on individual’s environmental responsibilities.
H1c. Social norms have positive influences on individual’s environmental concern.
H1d. The intention to manage storm water is positively influenced by social norms.

2.3. Personal norms (PN)

Moral responsibilities are key drivers in shaping individuals' moral intentions, particularly in situations where their personal interests conflict with those of the public (Lam, 1999). Personal norms, or morality, encompass the comprehensive ideals individuals develop as obligations and acts of generosity when navigating socially awkward situations. Interwoven into core ethical concepts, personal norms significantly influence decision-making (Schwartz, 1977). Lindenberg & Steg (2007) and other scholars argue that individuals are driven to environmentally friendly actions by inner motivations rooted in conscience or morality. Personal norms have a significant impact on altruistic behaviour, as described by Schwartz (1977). The personal norms are influenced by one's values, ability to predict the outcomes of one's decisions and level of accountability Stern (2000) . Pro-environmental attitudes and behaviors have been demonstrated to be influenced by personal norms (Mehmetoglu, 2010; Stern & Dietz, 1994). Numerous investigations have attempted to comprehend the impact of individual standards on eco-friendly actions including the case of choosing an environmentally friendly mode of transport (Doran & Larsen, 2016) and the purchase of environmentally friendly clothing (Kim & Seock, 2019). A study carried out by Wynveen and Sutton (2015) proposes that people can help reduce climate change by changing their personal behaviours, such as by planting trees, or by purchasing 'energy efficient' products. Likewise, in a study for centennials of India, Shanmugavel and Solayan (2021) also found positive relationship between personal norms and preference for buying environmental friendly products. The significance of personal norms in motivating people to implement stormwater management practices on their land is demonstrated here.To examine the connection between personal norms and the inclination to learn about stormwater management (SWMM), along with factors like environmental responsibility, environmental concern, and the adoption of stormwater management practices, the following hypotheses are posited. These hypotheses form the foundation for investigating and comprehending the impact of personal norms within the realm of stormwater management.
H2a. The awareness of consequences is positively influenced by personal norms.
H2b. Personal norms have a positive influence on individuals' environmental responsibilities.
H2c. Personal norms have positive influences on individual's environmental concern.
H2d. The intention to manage storm water is positively influenced by personal norms.

2.4 Awareness of consequences (AC)

The theory of planned behavior (Ajzen, 1991), the value-belief-norm (VBN) theory, the norm-activation model (Schwartz & Howard, 1981), and various other social behavior theories emphasize the significance of awareness of consequences (AC) beliefs as influential factors (Stern, 2000). Consequently, information-based AC beliefs grounded in specifics are expected to manifest. While understanding beliefs about consequences is crucial within the VBN theory, there have been discussions about the accuracy and consistency of measures assessing these aspects (Hansla et al., 2008). The egoistic environmental concern scale and self-improvement values have a positive correlation (Schultz, 2001). Stern et al. (1995) also found that, in addition to other AC measures, AC was positively correlated with biospheric and socially altruistic attitudes. Burger (2008) emphasizes the importance of developing programs to raise awareness about the origins of environmental degradation and to clean up the environment. Numerous academics have established a relationship between knowledge and awareness (Trevethan, 2017; Kapadia, 2014), indicating that individuals gaining knowledge through awareness initiatives contribute to a more sustainable future (Holfelder, 2019). According to research by Tamar et al. (2020), knowledge encourages more environmentally friendly behavior, although other studies argue there is no linear relationship between knowledge and consciousness (e.g., Raghuvanshi, 2016; Kamil, 2015; Rinaldi & Devi, 2021). In this context, the study assumes that understanding the effects is a crucial component in the implementation of stormwater management. Additionally, the study proposes that the adoption of stormwater management (SWMM) mediated the relationship between social and personal norms by raising awareness of consequences. The assumptions outlined above likely form the basis for testing and understanding the intricate interplay between awareness of consequences, social and personal norms, and the adoption of stormwater management practices.
H3a. SWMM adoption is positively influenced by awareness of consequences.
H3b. Awareness of Consequences mediates the relationship between personal norms and adoption of SWM.

H3c. Awareness of Consequences mediates the relationship between social norms and adoption of SWM.
H3d. Awareness of Consequences has a positive influence on environmental responsibility.
H3e. Awareness of Consequences has a positive influence on environmental concern.

2.5. Environmental responsibility (ER)

Environmental responsibility is recognized as a crucial attribute that empowers individuals to comprehend and address environmental issues, encouraging pro-environmental choices and contributing to societal change (Nagarajan and Rema, 2022). Described as "an inherent human behavior arising from an individual's environmental concern demonstrated through their commitment to the safety and well-being of the environment" (Wong et al., 2018), environmental responsibility involves addressing environmental issues through routine activities that preserve the environment (Choudri et al., 2017). According to Studies, basic environmental education may have an influence environmental responsibility (Edsand & Broich, 2020). Expressions of environmental responsibility are manifested as actions that involve keeping the environment clean, using energy more efficiently, voicing criticism against environmental injustice (Nagarajan and Rema, 2022). The importance of corporate responsibility towards the environment has also been highlighted (Sindhi & Kumar, 2012). Previous research has found a link between environmentally responsible behaviour and pro-environmental behaviour. Yue et al. (2020) demonstrated that environmental responsibility was a significant factor in environmentally conscious behavior and green purchasing decision, while Zheng et al. (2020) examined the effect of environmental responsibility on green behavior. According to Sigit et al. (2019) there is a linear relationship between environmental responsibility and pro-environmental behavior, while Kumar (2019) has confirmed the non-linear relationship between environmental responsibility and the intention of green shoppers. Based on this, the following hypothesis was proposed: Environmental responsibility and implementation of stormwater management are well correlated. Based on this idea, it is hypothesized that there is a relationship between the three elements—environmental responsibility, interest in learning more about stormwater management, awareness of consequences, and implementation of stormwater management practices. These are probably basic assumptions for evaluating the effects of environmental responsibility in the context of stormwater management.
H4a. Awareness of consequences is positively influenced by environmental responsibility.
H4b. Environmental responsibility has a positive impact on environmental concern.
H4c. Environmental responsibility mediates the relationship between personal norms and adoption of Storm water management.
H4d. Environmental responsibility mediates the relationship between social norms and adoption of Storm water management.

2.6. Environmental concern (EC)

This research assumes that as environmental knowledge increases, so does degree of environmental concern, which we define as the understanding of environmental issues and a desire to take action to address them (Hu and Self, 2010). Previous research has shown a consistent link between environmental concern and pro-environmental behaviour (e.g., Willuweit, 2009). Numerous studies have delved into the connection between environmental concern and pro-environmental behavior. For this research, it is assumed that such a pro-environmental behavior is the adoption of stormwater management. Previous studies have shown that people who are more concerned about the environment are more likely to act quickly when a current environmental issue arises and to be engaged in actions that help the environment (McDonald et al., 2015). Zhuang and Riaz (2021) have shown that the level of environmental concern has a significant effect on green purchase intentions. Nagarajan & Chidambaram (forthcoming) separated the direct and indirect effects of environmental concern on the EV purchase intention. However, Minton and Rose (1997) looked at the relationship between environmental concern and environmental responsibility. Tseng & Lee (2020) showed that they can have a positive impact on customers' willingness to buy green products. Previous research has shown that consumers' willingness to pay for an environmentally friendly product can be affected by their environmental concern (Pratiwi and Pratomo, 2018). The following theories are proposed by this study in light of the discussions.
H5a. Environmental concern has a positive impact on awareness of consequences.

H5b. Environmental concern mediates the relationship between personal norms and awareness of consequences
H5c. Environmental concern mediates the relationship between social norms and awareness of consequences.

2.7. Moderating variable: intention towards Storm water management (ISWM)

Acknowledging the influence of information and the need for new knowledge in the information era, as mentioned by Ajzen et al. (2018), is an interesting aspect. This view suggests that attitudes toward the participation in an activity can be influenced by the knowledge of the activity. Consumer socialization theory suggests that people learn their knowledge from a number of sources (Ward, 1974). Many studies have highlighted the importance of environmental awareness on the individuals' involvement in pro-environmental behaviours (Latif et al., 2013; Liu et al., 2020). Masud et al. (2015) highlighted the significance of the climate change challenges in regard to mitigation efforts, and Perez-Nordtvedt et al. (2008) indicated that the purpose of learning influences the level of understanding of what is learned. However, limited research on the impact of learning for environmental responsibility and concern exists in the academic literature. This study acknowledges that the moderating effects of Integrated Stormwater Management (ISWM) can offer valuable lessons for academics, authorities and environmentalists to better understand the rationale and intentions of users of stormwater collection to support sustainable groundwater. For this reason, the study concludes that environmental responsibility and environmental concern are significant factors that shape intentions of stormwater management and that education, information and awareness is important in shaping individual attitudes and behaviors. The assumption proposed most likely serves as the foundation for examining the modifying effects of ISWM, and the implications for encouraging sustainable groundwater use.
H6a. The impact of environmental responsibility on the adoption intention towards storm water management is positively moderated by the intention to acquire storm water management.
H6b. The impact of environmental concern on the adoption intention towards storm water management is positively moderated by the intention to acquire storm water management.

2.8. Suggested Research Design

Altruism, defined as an action taken with the aim of assisting another, is associated with various forms of prosocial behavior (Cochran et al., 2016). Researchers have utilized and confirmed the efficacy of the Altruistic Behavior Model in forecasting prosocial behaviors (e.g., Zhou et al., 2017; Holbrook et al., 2012). Although the Altruistic Behavior Model primarily emphasizes personal norms, Schwartz (1977) suggests that social norms play a significant role in sustainable water use practices such as stormwater management. Researchers, like Ajzen (1991) have proposed integrating pertinent factors that comprehensively elucidate anticipated behavior (e.g., Kukafka et al., 2003; Schuz et al., 2017). The Norm Activation Model (NAM) has been recognized as a highly effective theoretical framework in evaluating pro-environmental behavior, supported by its predictive capability (Van der Werff & Steg, 2015; Liu et al., 2017). Initially focused on benevolent behavior in a narrow context, Schwartz's (1973) NAM has since been expanded to consider pro-environmental behavior in all its manifestations (Syed-Abdullah, 2020). The scholars have suggested that the Altruistic Behavior Model (Doris et al., 2020) can be strengthened by integrating moral principles. Based on recommendations from previous studies, personal and societal norms have been added to the Norm Activation Model, which also includes environmental responsibility and awareness effects (Han, 2014; Hopper & Nielsen, 1991). In an attempt to investigate people's intention to file environmental complaints, which is regarded as a pro-environmental behavior, Zhang et al. (2017) validated the ability of NAM. This study makes the assumption that personal and social norms can impede aspirations, which is why there is an intention to learn more about stormwater management. Given the above, the proposed hypothetical model in Fig. 1 is likely the basis of testing and understanding the complex relationship between altruistic behavior, personal and social norms, and the intention to learn about stormwater management.

3. Research Methodology

3.1. Research design and sample

The envisioned hypothetical scenario was explored through a l research methodology, utilizing a non-probability sampling was employed to collect essential study data. In August 2023, the data was gathered in India, at a conference with the theme "water security for sustainable development and equity." A total of 420 individuals responsible for local stormwater management were informed of the study's objectives and asked to complete a structured questionnaire. But 410 valid datasets were used, which was found to be adequate for this research. The sample demographic characteristics are shown in table 1.

Table 1 Demographics of the sample

Aspects		Frequency (N = 410)	Percentage (%)
Identity	Male	296	72
	Female	114	28
Age	22–25	3	0.73
	26–35	73	17.80
	36–40	128	31.21
	41–45	108	26.34
	46–50	48	11.70
	51–55	45	10.97
	>56	5	1.21
Academic Background	Bachelor of Engineering	181	44.15
	Master of Engineering	224	54.63
	Others	5	1.21

3.2. Measurement

The questionnaire used in the study consists of 22 items which are included in 6 components. The validated metrics used in previous studies were carefully selected and used in this study to eliminate potential biases and be aligned with the objectives of the study. Modifications were made on select items to make them more consistent with the environment of stormwater management. A Likert scale with a range of 1 (strongly disagree) to 7 (strongly agree) was used to evaluate the items. The scale was chosen to provide a comprehensive and detailed assessment of the participants' responses.

3.3. Data analysis

In this study, the technique of data analysis used was AMOS software, SPSS 23.0 software and MS Excel software. Anderson and Gerbing's (1988) two-stage approach of structural equation modeling (SEM) was used to evaluate the hypothesized model. Firstly confirmatory factor analysis (CFA) was used to ensure construct reliability. The structural model was then tested using the results of the sample of 410 participants obtained from a total of 420 participants in line with the recommendations of Kibuacha (2021) that the structural model should be tested with sample data. The study applied SEM to compare samples with items used and the loading of the samples in the CFA with the recommendations of Hair et al. (2017). Since the skewness and kurtosis values were less than 2 and not greater than 4, it was decided to use SEM. The results indicated no real issues with univariate normal distribution and hence the use of SEM was supported (George, 2011). The use of Model 2 is for the hypotheses H3b, H3c, H4c and H4d that specify that the relationship between Personal Norms and Adoption Intention to Stormwater Management is significant, and the relationship between Social Norms and Adoption Intention to Stormwater Management is significant. Both H6a and H6b suggest the interconnection between environmental responsibility and environmental concern, which would impact on the consequences awareness, respectively.For hypotheses H6a and H6b, interaction between

environmental responsibility and environmental concern is hypothesized to affect awareness of consequences, respectively. These analytical techniques enabled the study to examine the relationships and mediating factors between the variables proposed in this study in a comprehensive way.

4. Results

4.1. Characteristics and demographics of the respondents

The respondents in this study were made up of 28% women and 72% men as presented in Table 2 below. As to age, 17.8% of the respondents fall in the age group 26-35 years. Furthermore, the respondents are professionally qualified, that is 98.78% of them possess professional degrees like B.E. or M.E. These demographic details give insights into the demographics of the participants of the study, indicating gender representation, the age distribution of the sample and the educational background of the participants.

Table 2 Measurement Model findings

Items	Mean (SD)	Loadings	Average variance extracted, Mean shared variance & Average shared variance	Composite Reliability
SN1 SN2 SN3 SN4	5.32(1.13) 5. 42(1.14) 4.87(0.85) 4.72(0.73)	0.772*** 0.782*** 0.730*** 0.867***	0.623, 0.272 &0.220	0.865
PN1 PN2 PN3	5.01(1.01) 5.40(1.19) 4.17(0.67)	0. 906*** 0.683*** 0.739***	0.639, 0.296 &0.234	0.837
AWC1 AWC 2 AWC 3	5.96(1.18) 5.01(1.01) 4.90(1.50)	0.762*** 0.862*** 0.742***	0.624, 0.225&0.215	0.821
ER1 ER2 ER3 ER4	5.32(1.13) 5.07(1.33) 4.90(0.95) 4.87(0.85)	0.954*** 0.962*** 0.847*** 0.837***	0.813, 0.387 &0.264	0.940
EC1 EC2 EC3 EC4	4.22(0.63) 4.34(0.65) 4.25(0.64) 4.21(0.63)	0.890*** 0.900*** 0.899*** 0.831***	0.775, 0.373 &0.327	0.948
ISWM 1 ISWM2 ISWM3 ISWM4	4.98(0.93) 4.89(0.86) 4.78(0.78) 3.04(0.64)	0.767*** 0.723*** 0.745*** 0.893***	0.615, 0.389 &0.355	0.852
***Denotesvaluessignificantat99%confidencelevel.				

4.2. Assessment of measurement model

Several methods were used for the reliability and validity of the measurement model. Previously, Cronbach's alpha coefficient was determined to check the internal consistency of each construct, where the values of the internal consistency of each construct are above 0.77 as recommended by Bujang et

al. (2018). The second form of validation was convergent validity, which was performed by checking that all items loadings were > 0.65, and the average variance extracted (AVE) was > 0.56 for all constructs and was satisfactory demonstrating content validity of all constructs (Barati et al., 2019). The AVE was found to be above both Maximum Shared Variance (MSV) and Average Shared Variance (ASV) indicating good discriminant validity (Barati et al., 2019). In addition, composite reliability values of more than 0.8 were considered to be strong consistency. The results in Table 3 supported the uniqueness of constructs as the values of the diagonal were higher than the off-diagonal values (correlation matrices). The overall measurement model was acceptable in terms of reliability and validity. Following the recommendations of Hooper et al. (2008) and Leong et al. (2012), measures of the indices such as the 2/df, goodness of fit index (GFI), adjusted goodness of fit index (AGFI), comparative fit index (CFI) and root mean square error of approximation (RMSEA) were used to assess uni-dimensionality and reduce measurement bias. All these indices were in the recommended ranges as given in Table 3 indicating that the measurement model was satisfactory.

Table 3 Inter-correlation and √AVE values

Constructs	Cronbach's α	EC	PN	SN	AWC	ER	ISWM
EC	0.954	0.910					
PN	0.839	0.543	0.858				
SN	0.874	0.621	0.437	0.847			
AWC	0.887	0.534	0.308	0.465	0.994		
ER	0.954	0.524	0.475	0.496	0.327	0.998	
ISWM	0.872	0.589	0.530	0.567	0.524	0.603	0.887
Note 1: The diagonal values represent the √AVE.							

4.3. Common method bias analysis

Harman's single factor analysis was used to minimize potential common method bias (CMB) in the study's self-report data. This is the approach that is recommended in cases where all the variables are measured through standardized instruments as suggested by Jordan and Troth (2020) and Kamakura (2010). To determine the existence of factors among all 22 items, exploratory factor analysis (EFAs) was carried out with SPSS 23 with unrotated factor solution. The results revealed that only 39.87% of the variation, which is significantly lower than the usual 50%. This results is consistent with the results of Aguirre-Urreta and Hu (2019), who concluded that the data did not significantly exhibit common method bias.

The analysis findings lend support to the conclusions of the study, indicating that common method bias is unlikely to have an influencing the interpretation of results (Wong et al., 2015).

4.4. Structural model evaluation

The results of hypothesis testing in phase 2 SEM can be seen in Table 4. The analysis results showed that there were significant relationships in Model 1 which supported some of the hypotheses. H1a was supported by strong personal norms–intention to engage in stormwater management association ($\beta = 0.239$; $p < 0.001$). Similarly, personal norms were significantly linked to environmental responsibility ($\beta = 0.298$; $p < 0.001$) and environmental concern ($\beta = 0.272$; $p < 0.001$), supporting H1b and H1c, respectively. Moreover, a positive association was found between personal norms and adoption intention of stormwater management ($\beta = 0.123$; $p < 0.05$), validating H1d, as well as H2a, H2b, H2c, and H2d.

Social norms also exhibited significant relationships with intention toward stormwater management (β = 0.375; p < 0.001), environmental responsibility (β = 0.132; p < 0.001), environmental concern (β = 0.357; p < 0.001), and adoption intention of stormwater management (β = 0.289; p < 0.001). These findings align with H3a, H3b, and H3c. Additionally, awareness of consequences showed significant associations with the intention to implement stormwater management (p = 0.001), environmental responsibility (p = 0.05), and environmental concern (p = 0.05), confirming H4a and H4b. Environmental responsibility demonstrated a strong positive association with the intention to implement stormwater management (β = 0.372; p < 0.001) and environmental concern (β = 0.198; p < 0.001), validating H5. Finally, environmental concern significantly predicted the intention to embrace stormwater management (β = 0.213; p < 0.05), supporting H6.

Furthermore, variance inflation factor analysis indicated no multicollinearity issues, with values below 10 (Table 4), aligning with Brace et al.'s (2000) criterion. The hypothetical model exhibited excellent fit indices: GFI = 0.928, AGFI = 0.910, CFI = 0.938, and RMSEA = 0.068 (ideal > 0.900, X2/df = 2.871, ideal < 3.0), indicating good model fit. Predictive validity was also demonstrated, with estimated variances for intentions toward stormwater management, environmental responsibility, environmental concern, and awareness of consequences.

Table 4 Results of hypotheses testing

Endogenous constructs	Exogenous constructs	Standardized Estimates	VIF
Intention towards storm water management	PN	0.239***	2.614
Environmental Responsibility	PN	0.298***	2.321
Environmental concern	PN	0.272***	1.468
Awareness of consequences	PN	0.132**	1.913
Intention towards storm water management	SN	0.357***	1.617
Environmental Responsibility	SN	0.289***	2.372
Environmental concern	SN	0.372***	1.674
Awareness of consequences	SN	0.198***	2.183
Awareness of consequences	ISWM	0.213***	2.338
Environmental responsibility	ISWM	0.184**	2.413
Environmental concern	ISWM	0.274***	2.675
Awareness of consequences	ER	0.325***	2.512

Environmental concern	ER	0.236***	1.768
Awareness of consequences	EC	0.142**	2.614
*** denotes p < 0.001; ** denotes p < 0.05			

4.5. Analyzing the direct and indirect effect (model 2)

The total, direct and indirect effects stated in Model 2 were tested in this study with AMOS using 3000 bootstrapped samples at a 95% significance level as reported in Table 5 (Preacher & Hayes, 2008). First, the indirect relationship between personal norms and the adoption intentions of stormwater management, and the subjective norms and intentions of stormwater management was explored. The results indicated both personal norms and subjective norms had a positive impact on awareness of consequences and stormwater management adoption intentions. Furthermore, there was a partial complementary mediation effect such as a direct positive association between personal norms and adoption intentions, as well as between subjective norms and adoption intentions.

Moreover, the indirect effect of environmental responsibility on the relationship between personal norms and intentions to adopt stormwater management was explored. Results showed a direct significant positive relationship between personal norms and adoption intention, and an indirect positive relationship between personal norms and adoption intention through the mediating variable of environmental responsibility, which means that the concept of partial successful comparable mediation was supported.

After the direct and indirect relationships involving personal norms, subjective norms, social norms and adoption intentions for stormwater management were analyzed, environmental concern was also found as an indirect variable in these relationships. Action effects and indirect effects of the research have been proved to be positive, which leads to the proof of partial comparable mediation.

The results point to the complex dynamics affecting adoption intention for stormwater management and underscore the importance of study of the direct and mediated pathways in environmental decisionmaking. The study addresses these relationships in order to further the theoretical frameworks, which can inform the creation of effective strategies for encouraging sustainable stormwater management practices.

Table 5 Results of Mediation Analysis

	Effects	**Effectof ISWM onAWC**	**Effectof ERonAWC**	**Effectof ECon AWC**
PN	TotalEffects	0.312***	0.333***	0.323***
	(std.error,lowerbound,upper	(0.085,	(0.027,	(0.037,
	bound)	0.492,0.230)	0.408,0.220)	0.466,0.109)
	Directeffect	0.284***	0.189***	0.290***
	(std.error,lowerbound,upper	(0.075,	(0.085,	(0.077,
	bound)	0.326,0.193)	0.426,0.128)	0.307,0.027)
	Indirecteffect	0.037***	0.135***	0.141***
	(std.error,lowerbound,upper	(0.062,0.143,	(0.033,	(0.073,0.200,
	bound)	0.013)	0.212,0.079)	0.055)

SN	TotalEffects	0.416***	0.461***	0.436***
	(std.error,lowerbound,upper	(0.015,	(0.059,	(0.095,
	bound)	0.575,0.355)	0.579,0.346)	0.597,0.384)
	Directeffect	0.304***	0.312***	0.310***
	(std.error,lowerbound,upper	(0.074,	(0.072,0.469,	(0.017,
	bound)	0.435,0.262)	0.241)	0.474,0.166)
	Indirecteffect	0.112***	0.149***	0.116***
	(std.error,lowerbound,upper	(0.003,0.188,	(0.031,	(0.084,
	bound)	0.007)	0.222,0.100)	0.267,0.038)
*** denotes significant at 99% confidence level; n = 400; bootstrap iterations = 3000				

4.6. Analyzing the moderating influence of intention towards storm water management (model 3)

The study proposes the hypotheses H6a and H6b in which the relationship between ER and EC and their effect on the intention to adopt a stormwater management practice is assumed to be moderated by awareness of the intentions of stormwater management. The product term (IV X Moderator) was used to test moderation. Awareness of consequences was found to significantly moderate the relationship between the environmental responsibility and the intention to adopt stormwater management ($\beta = 0.528$; $p < 0.001$), and the environmental concern and the intention to adopt stormwater management ($\beta = 0.666$; $p < 0.001$). This led to the acceptance of both H6a and H6b.

These results suggest that the relationship of the positive constructs of environmental responsibility and environmental concern to the intention to implement stormwater management is strengthened with increased awareness of the negative consequences of the use of stormwater management practices. In other words, increased knowledge of the consequences of stormwater management increases the desire to practice it, and this information and education is critical to environmental stewardship.

Furthermore, the findings suggest that education on the environmental impacts can have a meaningful impact on the promotion of sustainable stormwater infrastructure. Visually described in interaction graphs (in Appendix A) are the moderating effects of awareness, which shows the significance of educational and informational campaigns in environmental management strategies.

The study highlights the importance of introducing comprehensive awareness programs within the framework of environmental policies to enhance the link between environmental responsibility, concern and the implementation of sustainable practices. Awareness of the consequences can help to facilitate the uptake of stormwater management practices and thus improve environmental outcomes; this can be done by encouraging stakeholders to become aware of the consequences.

5. Discussions

The Norm Activation Model and the Altruistic Behavior Model, which are frequently employed to examine pro-environmental behavior, serve as the foundation for this study. One of the essential aspect of this work is the incorporation of key concepts such as Personal Norm (PN), Social Norm (SN), Environmental Responsibility (ER), and Environmental Concern (EC) into the stormwater field. Interestingly, the study also brings in the novel aspect of the use of Awareness of Consequences to forecast intention to adopt stormwater management practices. This research is different from most that has been done on stormwater management as it has concentrated on the processes and outcomes rather than socioeconomic status and recognition. The study suggests that an in-depth exploration of stormwater research is missing and a consciousness of consequences is needed. The study findings

address this gap by revealing the important role that personal and social norms play in influencing environmental responsibility and concern, which in turn influences people's intentions to implement stormwater management (Lile, et al., 2014; Nusche, 2008; and Li et al., 2022). The study provides valuable value by revealing the importance of Personal Norm (PN) as a predictor of the use of stormwater management. Besides, it also sets that personal norms have an impact on environmental responsibility and concern. In addition, environmental responsibility and concern are found to be important predictors for the desire to adopt stormwater management practices. Importantly, these factors affect the relationship between personal norm and social norm in the case of stormwater management. The findings of the study are extended from and corroborated with the existing studies, including Lam (2006) study on water conservation. It highlights how societal norms affect individuals' understanding of the consequences, environmental responsibility, and concern that ultimately guide their decision-making and actions in the realm of stormwater management. Overall, this research work is a significantly advances to understanding the complex relationship among factors that are associated with pro-ecological behavior, especially regarding the use of stormwater.

5.1. Theoretical contributions

This empirical investigation provides an significant contribution to existing literature on the motives behind implementing stormwater management practices, which is essential to help solve the problem of too much and too little rain. The research finding offers background information as to the reasons for environmental stewardship and environmental concern, and how this influences intentions to implement stormwater management strategies by decision-makers.

Personal and societal norms both play an important role in environmental responsibility and concern, and are reliable indicators of the intention to implement stormwater management, according to the study. A significant theoretical contribution of this study is the investigation of the moderating role of an awareness of consequences between personal norms, environmental responsibility and concern. This draws to our understanding these dynamics.

Furthermore, this research emphasizes the role of environmental responsibility, environmental concern, and personal norms in the relation between social norms and the intention to adopt stormwater management. The study's findings are significant to the corpus of environmental science and management literature.

Finally, This research advances our theoretical knowledge of the multifaceted relationships between personal and societal influences that affect intentions to implement stormwater management practices. This research highlights the role of critical variables in mediating and moderating the effects, and can be used to help develop strategies that promote environmental stewardship and support sustainable stormwater management practices.

The study also underscores the need to think about storm water as a resource, developing sustainable urban planning, and encouraging community action and a shared sense of responsibility through community initiatives and a comprehensive public awareness program.

5.2. Societal implications

Environmental Responsibility is an important concept for environmental awareness and responsibility, which is difficult to develop. This study discusses a few strategies that can improve these qualities. The results provide valuable information that can help inform public opinion and inform decision making regarding sustainable groundwater use.

The factors that are studied include personal norms, social norms, personal consequences, environment concerns, and environmental responsibility, in order to explain attitudes towards stormwater management. The factors are all important in shaping decisions for implementation of stormwater management practices. This research is important because stormwater plays a role in sustaining groundwater and other programs have been conducted that highlight the importance of stormwater management strategies.

Governmental as well as non-governmental actors must participate in and influence public attitudes to sustainable groundwater. The research work emphasizes the importance of environmental responsibility and concern as key factors influencing people's intentions in stormwater management. Policymakers

are encouraged to share persuasive messages about stormwater management with the public so that stormwater management becomes a personal norm.

For instance, the Ministry of Housing and Urban Affairs has proposed to consider the use of different drainage indices for the assessment of drainage systems, which will enable the quantification of the sustainability of existing drainage systems. This study will provide valuable insights for promoting sustainable groundwater practices and will encourage active participation from both the public and private sectors. The evaluation of the proposed indices will be critical in the development of the best stormwater plan for each ward, sector, area, and/or state, and eventually to a national plan. These assessments can complement restoration projects like the recovery and restoration of natural drainage, restoration of lakes, wetlands, major tributaries, and the incorporation of environmentally sound stormwater management practices.

Stormwater should be considered a resource to be protected, not controlled. Creating an accepted social norm for stormwater management depends on a range of activities to encourage sustainable planning, innovative design approaches, reasonable regulations, meaningful stakeholder engagement, and increased awareness—all driven by political commitment. To respond to water stress in contemporary cities, there is a pressing need for action and a holistic water security planning that includes measures to encourage environmental responsibility, personal ethics and environmental awareness.

Television, print and social media public service announcements can be a powerful aid to publicizing the effects of an environmentally responsible and concerned populace. These mediums have a large reach which can be used effectively for social messaging. Moreover, community-based projects may be of significance in encouraging stormwater management practices and to instill a sense of community ownership and action at the grassroots level.

These measures, when implemented as a strategy, can help transform society towards a more sustainable stormwater management, contributing to water security and preserving environmental resources for future generations.

6. Conclusions

The aiml of this research is to enchance public awareness and understanding of sustainable stormwater management. Motivated by concerns over groundwater overuse leading to excessive runoff and flooding, as well as water scarcity for drinking, agriculture, and industrial needs, the research investigates the determinants of intentions towards stormwater management. Based on the Altruistic Behavior Model and the literature, the study investigates some factors influencing these intentions. The findings illustrate that personal norms, social norms, awareness of consequences, environmental responsibility (ER), and environmental concern (EC) are all factors that have significant impacts on adoption of stormwater management practices. Specifically, the awareness of consequence of stormwater management is affected by environmental responsibility and environmental concern. Also, environmental responsibility, awareness, and concern are important mediators between personal norms, social norms, and adoption of stormwater management practices.

To conclude, this study gives good insights into the factors that influence adoption of stormwater management practices. Recognizing these factors can help decision makers and stakeholders to effectively promote sustainable stormwater management, a solution that can alleviate water scarcity problems and mitigate runoff and flooding effects. Promoting environmental responsibility, awareness and concern within the field of public education and policy can be greatly supported in efforts to increase these vital practices.

6.1. Limitations and future research directions

There are certain limitations to this study that deserve to be noted. Intially, the sample used for this study includes respondents who took part in the Indian event IWW 2023, limiting our ability to generalize from these results across a broader segment of India's population. Although the sample is based on every region of the country, there should be some residential bias. Future research endeavors could aim for more comprehensive sampling, encompassing individuals from diverse socioeconomic backgrounds across cities, towns, and villages. Additionally, the study focuses on variables such as personal norms, social norms, awareness of consequences, environmental responsibility (ER), and environmental concern (EC) to explain adoption intentions for stormwater management. Future

research may benefit from including other factors, such as the cost associated with stormwater management or specific needs related to stormwater management. Exploring alternative prediction models and technologies could enhance our understanding of the adoption intention of stormwater management. Additionally, future studies might investigate the relationship between environmental knowledge and stormwater management technology, taking into account the evolving impact of rebound effects.

Declarations

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