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Striving for Sustainability: A Study of Water Consumption Behavior of Households in Lahore Division

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Abstract
Amid the escalating global water scarcity concerns, exacerbated by increasing demand characterized by unsustainable water consumption practices, this study addresses the imperative need to identify the factors that promotes the sustainable water consumption behavior among households. Our research builds upon the theoretical premises of the Theory of Planned Behavior (TPB), proposing a unique model that incorporates consumers' water-saving preferences as a moderating factor to address the intention-behavior gap. In order to accomplish the proposed study objective, we approached 1552 households living in the residential premises of Lahore Division. We applied Partial Least Square – Structural Equational Modelling (PLS-SEM) to empirically analyze the results. Our research reveals that consumer's sustainable water consumption intention and water saving preferences are important factors that promotes the sustainable water consumption behavior among the households. Moreover, the study unveils the moderating role of these preferences in reinforcing the relationship between intention and behavior, effectively bridging the intention-behavior gap. Additionally, our research identifies the indirect influence of consumers' water-saving attitudes and perceived behavioral control on shaping sustainable water consumption behavior. Importantly, the study demonstrates a substantial improvement in the predictive accuracy of TPB with the inclusion of water-saving preferences as a moderating factor. These insights hold significant implications for devising interventions to promote sustainable water consumption behavior among households.
***Keywords*:** Sustainable water consumption behavior; Water saving preferences, Water Crises, Lahore Division

1. Introduction

Water scarcity is an escalating global concern, posing a formidable threat to achieving Sustainable Development. Such threats emanates from an escalating demand fueled by economic development (Abbas et al. 2023; Abbas et al. 2022) and characterized by unsustainable water consumption patterns. Evidence indicates that global water consumption has experienced a fivefold surge in the last decade and is anticipated to persistently grow at an approximate rate of 2% annually (United Nation, 2023). However, at the same time, a rapid decline in the global water storage has been experienced by the rate of 2 cm per year over the last two decades, and this figure is expected to grow in the coming years (World Meteorological Organization, 2023).

Forecast shows that 40% of the world's population will confront severe water scarcity within the next 15 years if economies do not reduce the unnecessary wastage of water. The alarming fact is that, by the end of 2050, an estimated 6 billion people will lack access to sufficient water to meet even their basic needs, and this world will eventually face a decline in food security, escalating environmental deterioration, and the ominous threat of species extinction (Ray Biswas et al., 2023) It is worth mentioning that households constitute a significant share in exacerbating the issue of water scarcity by wasting a substantial share of domestic water in their routine activities. Their unsustainable water consumption practices such as neglecting water leakages, unnecessary water use in gardening, and leaving taps running contribute significantly to the escalating crisis (Si, Duan, et al., 2022). Recognizing the pivotal role of households in exacerbating water scarcity, researchers and academic practitioners emphasize the urgency of investigating factors fostering sustainable water consumption behavior among households.

Human behavior, a dynamic and complex phenomenon, cannot be compelled unless individuals genuinely intend to act. This concept has its roots in the late 19th century, marked by the development of the Theory of Planned Behavior (TPB). According to this theory, individual intention is a fundamental factor that influences their behavior. The theory further states that individual attitude (ATT), subjective norms (SBN), and perceived behavioral control (PBC) plays and important role in fostering the certain intention among the individuals, which eventually gets translated into the actual behavior (Ajzen, 1991). Undoubtedly, TPB has gained immense recognition in recent years within the domain of sustainable water consumption behavior. Researchers indicate that sustainable water consumption behavior (SWCB) is subject to sustainable water consumption intentions (SWCI), influenced by water-saving attitude (WSA), subjective norms (WSSN), and perceived behavioral control (WSPBC) (Russell & Knoeri, 2020; Si, Duan, et al., 2022).

Despite acknowledging the undeniable importance of the TPB framework in predicting sustainable water consumption behavior, some researchers have highlighted its inherent limitations. They argue that the theory exclusively focuses on intentions as a direct predictor of behavior, neglecting other equally important factors. Consequently, they emphasize expanding the basic paradigm of TPB by introducing various mediating and moderating factors (Hua & Dong, 2022). Surprisingly, the potential moderating role of consumer preferences, particularly concerning water-saving preferences, has been largely overlooked by existing researchers.

The importance of consumer preferences in predicting a behavior cannot be overstated. Economists accord substantial importance to consumer preferences in the decision-making processes of individuals (Houthakker, 1950). Preferences involve favoring one thing over another, and when it comes to consumer water-saving preferences, it signifies a preference for water conservation over wastage. In this context, when consumers' water-saving preferences align with their behavioral intentions, a synergistic effect is generated, enhancing the likelihood of households engaging in sustainable water consumption behavior. This, in turn, contributes significantly

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to addressing the prevalent water challenges and stands as a potent policy choice in the realm of sustainable water management. The role of consumer preferences is an unexplored area in existing research (Audi et al., 2020; Malik et al. 2021; Mahmood et al. 2022). Triangulating the above disclosure, it is reasonable to posits that consumer's water saving preferences could serve as a significant moderator, reinforcing the connection between a consumer's sustainable water consumption intention and the subsequent behavior. However, this moderating mechanism remains an uncharted area within current research endeavors. Consequently, the present study makes a unique contribution to the expanding academic literature by integrating consumer's water saving preferences as a significant moderator into the foundational framework of TPB. This scholarly initiative not only addresses the intention-behavior gap but also enhances the model's predictive accuracy. The empirical insights garnered from this study not only poised to deepen our understanding about the factors that help to promote the SWCB, but also help gain a more comprehensive perspective on the intricate dynamics between water-saving preferences and sustainable water consumption behavior, thereby providing valuable policy implications on how aligning these preferences can minimize the water scarcity issue.

2. Literature review and Hypotheses Development

The available body of knowledge is enriched with multitude of studies aimed at comprehending the factors that significantly predict sustainable water consumption behavior (SWCB), which is often interchangeably used with water-saving behavior (WSB), and water-conservation behavior (WCB). Notably, Russell & Knoeri (2020) investigated the determinants of SWCB among UK households, incorporating water-saving habits as a moderating factor under the theoretical framework of TPB. Analyzing data from 1196 households, the study found that individual water-saving intention (WCI) plays a crucial role in shaping SWCB, and water-saving habits further reinforce this relationship. The study also highlighted the substantial influence of water-saving attitudes (WSA), subjective norms (WSSN), and perceived behavioral control (WSPBC) on shaping these intentions. In the similar vein, Shahangian et al. (2021) expanded upon the basic framework of TPB by incorporating moral norm, perceived risk, and familiarity to predict the SWCB among the households of Tehran. The study revealed that SWCI is the primary determinant of SWCB, and familiarity enhances the relationship between SWCI and SWCB. The indirect impact of WSA and WSPBC on SWCB was also noted. Singha et al. (2023) demonstrated that positive attitudes, awareness, sense of responsibility, emotions, and habits play vital roles in fostering responsible consumption behavior among adults, with SWCI mediating this relationship.

Boylu & Gunay (2017) emphasized on the importance of perceived responsibility in bridging the intention-behavior gap. However, Addo et al. (2019) showed that water-scarcity concerns and water-conservation messages are fundamental in translating the SWCI into their actual behavior. The study also discussed the significant contributions of WSA and WSSN in fostering SWCI among individuals. Perren & Yang (2015) found that individual attitude, beliefs, and information exposure are key in promoting water-saving practices at home by bridging the intention-behavior gap. Singha et al. (2022) observed that cultural responsibility bears equal importance in fostering the SWCI among individuals which eventually gets translated into SWCB.

Du et al. (2023) incorporated rational and perceptual factors into the TPB to predict SWCB among adolescents, finding that emotions, positive attitudes, and habits significantly impact their intention and willingness to engage in water-conservation behaviors. Dean et al. (2021) worked on the similar lines and demonstrated the importance of individual intentions, perceptions, life satisfaction, and water literacy in fostering SWCB.

Cerchia & Piccolo (2019) reviewed the exiting studies published on SWCB and developed a holistic framework called SHIFT. This framework signifies the importance of various psychological factors, such as social influence, habit formation, individual intention, feelings and cognition, and tangibility, that plays an important role in promoting the responsible consumption behavior. Si et al. (2022) also developed a comprehensive framework to unravel the factors that helps to promote the responsible consumption behavior. Their research showed that awareness of consequences, sense of responsibility, personal norms, and intentions are some important factors in fostering sustainable consumption behavior.

Zhu et al. (2021) combined TPB with attitude-situation-behavior theory to investigate factors promoting WSB among college students. Results indicated the positive role of psychological factors in influencing SWCB, with situational factors moderating this relationship. Similarly, Avci (2023) integrated norm activation theory with TPB, highlighting the importance of social and moral norms, along with economic and environmental concerns, in cultivating SWCI and subsequent behavior.

Summing up, the existing research on SWCB has approached the topic from various perspectives, identifying multiple factors that directly or indirectly promote SWCB. Overall, intentions are consistently found to be a crucial determinant of behavior, with TPB playing a significant role in shaping these intentions. However, there is room for incorporating additional factors to bridge the intention-behavior gap and enhance the model's explanatory power and predictive accuracy. The present study posits that consumer water-saving preferences can serve as a crucial moderator in bridging this gap.

Notably, consumer preferences have been studied across multiple theoretical and applied areas and bear significant importance in determining a particular behavior. The academic body of knowledge is abounded with numerous studies that emphasize the importance of consumer preference in shaping the behavioral outcome and decision-making choices of individuals. For instance, Bettman et al. (1998) asserted that decision making is a multifaceted phenomenon, wherein the presence of well-defined preferences facilitates the decision making process. Novemsky et al. (2007) also highlighted the influential role of consumer preferences in shaping consumer behavior and choices. Hauser et al. (2014) showed that consumers make their decisions based on their preferences. Chovanová et al. (2015) also propagated the same. Their research showed that consumer decision making choices are reflected in their preferences.

O'Hara & Stagl (2012) examined the influence of consumer endogenous preferences on consumer behavior and its implications for sustainable development. Their key findings emphasized the crucial role that consumer preferences play in motivating individuals

to adopt sustainable consumption practices, thereby making a positive contribution to sustainable development. Similarly, Roy (2020) highlighted the significance of consumer preferences in promoting sustainable consumption behavior among households.
Summarizing the above literature, it becomes evident that consumers water-saving preferences can play an influential role in shaping the SWCB. Notably, when individuals express a preference to conserve water over wastage, water-conservation effectively becomes their deliberate choice, making them more likely to engage in SWCB. Furthermore, it's worth noting that when water-saving preferences align with their water-saving intentions, it signifies that consumers not only possess the intention to save water but also prioritize water conservation over wastage. This alignment results in a heightened inclination to participate in SWCB. Therefore, considering this perspective, it is reasonable to propose that consumer's water saving preferences play a significant role in strengthening the relationship between SWCI and SWCB, that pertains to bridge the intention-behavior gap. Hence, in the light of prevailing literature, we derive following hypotheses:
H_{1a}: *Water saving attitude are significant indirect predictors of sustainable water consumption behavior.*
H_{1b}: *Water saving subjective norms are significant indirect predictors of sustainable water consumption behavior.*
H_{1c}: *Water saving perceived behavioral control are significant indirect predictors of sustainable water consumption behavior.*
H_2: *Sustainable water consumption intentions are significant direct predictors of sustainable water consumption behavior.*
H_3 *A significant relationship exists between water saving preferences and sustainable water consumption behavior*.
H_4 *Consumer water saving preferences can serve as a moderating factor in addressing the intention-behavior gap*.
Accordingly, the conceptual framework of the study is presented in figure 1.

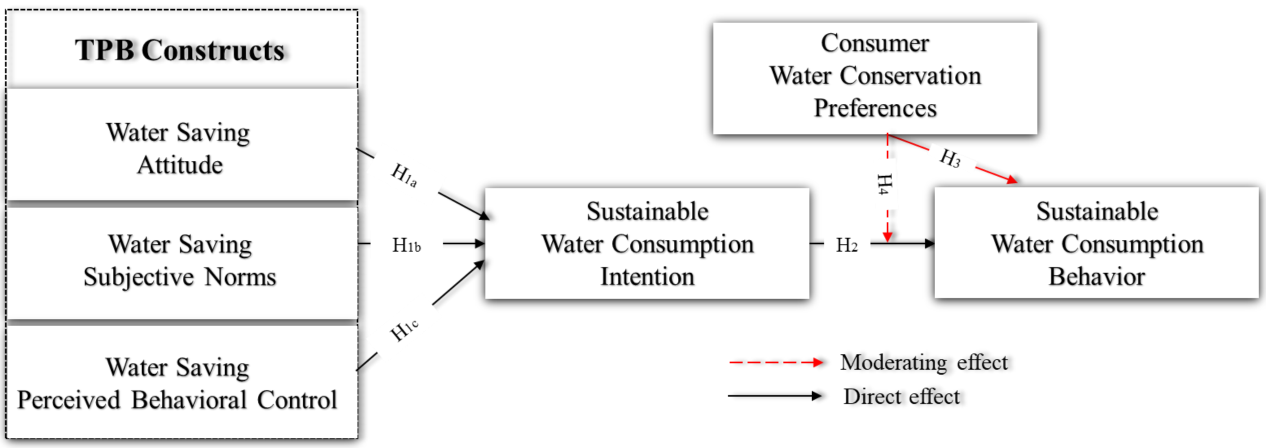

Figure 1: Conceptual Framework

3. Econometric Methodology

3.1. Targeted Population and Sampling Framework

In order to accomplish the proposed study objective, the present study targets the households living in the residential properties of Lahore division of Punjab, Pakistan. The rationale behind selecting households as the targeted population lies in their pivotal role as the primary unit of domestic water use. However, after acknowledging the impracticality of collecting data from the entire spectrum of households, we target the sample respondents for the data collection. We utilized a stratified random sampling technique to gather data from the targeted respondents. In this regard, we have categorized the population of entire Lahore Division in four strata, namely District Lahore (stratum 1), District Sheikhupura (stratum 2), District Nankana Sahib (stratum 3), and District Kasur (stratum 4), owing to the analogous nature of the analysis unit. Subsequently, the analysis unit is randomly selected from each delineated stratum. To determine the appropriate sample size, we have adhered to the Krejcie & Morgan (1970) table, which indicated that a random sample of 384 respondents from each stratum is imperative to ensure sufficient statistical robustness in the estimations. Cumulatively, this necessitates a total of 1536 respondents.

3.2. Data Gathering

The present study gathers the data through a questionnaire survey that were designed on a 7-Point Likert Scale. The survey instrument was adapted from the existing studies by making necessary amendments where needed. It is worth mentioning that the survey instrument underwent a pilot testing phase, involving 50 conveniently available households, prior to the formal distribution of the questionnaire for final data collection (In, 2017). Following the pilot study, we make judicial refinements in our questionnaire survey and eliminate certain items that falls below the reliability and validity thresholds, resulting in the finalization of a survey instrument comprising 41 closed-ended questions.
Distribution of questionnaires to targeted respondents was executed through both online and offline modalities. Online dissemination involved the sharing of a dedicated URL with participants to optimize convenience and expedite responses. Concurrently, traditional methods were accommodated by personally providing paper copies of the questionnaire. Cumulatively, data was collected from 1,783 respondents. After following a careful screening process that aimed to rectify questionnaires with excessive missing values and outliers, a total of 1,552 questionnaires were deemed suitable for subsequent data analysis. Table 1 provides the key insights of the survey instrument, while all the survey items are detailed in Appendix.

Table 1: Key Insights of the survey instrument

Construct Name	Scaling Parameter	Total Items	Omitted Items	Remaining Items	Reference Source	Notational Form
Water-saving Attitude	7-Point Likert scale	9	WSA1 WSA6	7	(Shahangian et al., 2021; Si, Duan, et al., 2022)	WSA
Water-saving Subjective Norms	7-Point Likert scale	8	WSSN8	7	(Si, Duan, et al., 2022)	WSSN
Water-saving Perceived Behavioral Control	7-Point Likert scale	8	WSPBC4	7	(Shahangian et al., 2021; Si, Duan, et al., 2022)	WSPBC
Sustainable Water Consumption Intention	7-Point Likert scale	9	SWCI6	8	(Si, Duan, et al., 2022)	SWCI
Water-saving Preferences	7-Point Likert scale	6	WSP1	5	(Jia et al., 2022)	WSP
Sustainable Water Consumption Behavior	7-Point Likert scale	8	SWCB3	7	(Shahangian et al., 2021)	SWCB

Note: The total items represent the complete number of associated questions within the survey instrument. The omitted items refer to those corresponding items that were excluded from the survey instrument due to their loading values falling below the minimum threshold of 0.5. The remining item indicates the count post-pilot study. Notably, out of the initial 48 items, 41 indicators were ultimately selected for the final data collection.

3.3. Data Analysis Technique

Partial Least Square – Structural Equational Modelling (PLS-SEM) is employed to empirically investigate the study results, and it stands out for its advanced capabilities in assessing the reliability and validity of constructs featuring multiple items. Additionally, it enables the examination of intricate relationships within the structural model (Hair et al., 2012). Distinguished as an advanced statistical technique, PLS-SEM seamlessly integrates confirmatory factor analysis and structural path analysis, enabling the simultaneous evaluation of both measurement and structural models (Hair et al., 2021). Through its measurement model, the reliability and validity of the data are rigorously established using confirmatory factor analysis. Concurrently, the structural model plays a pivotal role in meticulously testing hypothesized relationships among crucial study variables, employing a robust bootstrapping process (Hair et al., 2012).

It is interesting to note that, when compared to earlier first-generation methodologies such as multiple regressions, Structural Equation Modeling (SEM) provides a more nuanced explanation of the observed variance in dependent variable(s). This is achieved by concurrently considering both direct and indirect effects, signifying a substantial improvement over traditional approach (Thakkar, 2020). Furthermore, SEM transcends the limitations of its predecessors, furnishing robust statistical power to explore diverse relationships between constructs (Hair et al., 2021).

4. Empirical Results

4.1. Assessment of Measurement Model

We begin our analysis by analyzing the measurement model of the study (presented in figure 2) which is used to validate the reliability and validity of indicators and constructs. The outcomes of the measurement model are reported in table 2 3, respectively. Table 2 reports the findings of different key metrices, such as loading values, Cronbach's alpha (CBa), Composite Reliability (CR), and Average variance explained (AVE) to test the indicator reliability and convergent validity. Notably, the specified minimum threshold for loading values is 0.5 (Hair et al., 2019). However, certain indicators like WSA4, WSA7, SWCI1, SWCB1 fall short of this threshold for outer loading values, leading to their exclusion from our latent constructs. The established minimum threshold for the CBa and CR is 0.7 (Hair et al., 2019), and for AVE it is 0.5 (Jr. et al., 2017). The result shows that all the latent constructs outperform the set minimum benchmarks for CBa, CR, and AVE, affirming the reliability and validity of the data. Another interesting findings of our is that the values of VIF does not exceeds from the values of 5, which indicates the absence of multicollinearity in the data (Alam et al., 2023).

Moving forwards towards the results of table 2, which reports the results of discriminant validity using two different criteria, such as Forner Larker Criteria, and HTMT ratio. According to the Forner Larker criteria, a latent construct is considered to have discriminant validity if the square root of the AVE (bolded in the diagonal) exceeds its corresponding inter-construct correlations. Conversely, as per the HTMT ratio, latent constructs demonstrate validity when the HTMT coefficient consistently falls below 0.9 for all pairs of constructs (Hair et al., 2019). Both criteria play a vital role in ensuring the discriminant validity of the latent constructs. The outcomes reported in table 3 meet both criteria, confirming the presence of discriminant validity in the data.

Table 2: Reliability and Validity

Latent Construct	Items	Loading Values	Items deleted	CBa	CR	AVE	VIF
WSA	WSA2	0.838	WSA4 WSA7	0.854	0.895	0.631	2.679
	WSA3	0.830					2.632
	WSA5	0.746					1.624
	WSA8	0.784					1.730
	WSA9	0.770					1.652
WSSN	WSSN1	0.718	NONE	0.889	0.913	0.602	2.226
	WSSN2	0.855					3.134
	WSSN3	0.791					2.646
	WSSN4	0.815					2.729
	WSSN5	0.758					1.939
	WSSN6	0.772					2.047
	WSSN7	0.711					2.169
WSPBC	WSPBC1	0.753	NONE	0.899	0.921	0.624	1.895
	WSPBC2	0.806					2.346
	WSPBC3	0.824					2.332
	WSPBC5	0.753					1.796
	WSPBC6	0.843					2.600
	WSPBC7	0.819					2.319
	WSPBC8	0.725					1.906
SWCI	SWCI2	0.701	SWCI1	0.893	0.916	0.611	1.598
	SWCI3	0.791					2.055
	SWCI4	0.831					2.402
	SWCI5	0.767					2.084
	SWCI7	0.772					2.100
	SWCI8	0.841					2.611
	SWCI9	0.759					1.813
WSP	WSP2	0.809	NONE	0.885	0.916	0.686	1.996
	WSP3	0.857					2.389
	WSP4	0.802					2.158
	WSP5	0.870					2.812
	WSP6	0.800					2.001
SWCB	SWCB2	0.625	SWCB1	0.895	0.921	0.662	1.311
	SWCB4	0.858					2.335
	SWCB5	0.886					1.360
	SWCB6	0.851					2.878
	SWCB7	0.831					2.286
	SWCB8	0.803					2.113

Note: WSA4, WSA7, SWCI1, SWCB1 have been excluded from the latent constructs as they did not meet the established threshold. Source: Author's Calculation

Table 3: Discriminant Validity

Panel A: Forner Larker Criteria						
	SWCB	SWCI	WSA	WSP	WSPBC	WSSN
SWCB	0.814					

	SWCB	SWCI	WSA	WSP	WSPBC	WSSN
SWCI	0.609	0.782				
WSA	0.429	0.667	0.795			
WSP	0.763	0.621	0.455	0.828		
WSPBC	0.595	0.798	0.657	0.606	0.790	
WSSN	0.561	0.607	0.577	0.568	0.709	0.776
Panel B: HTMT Ratio						
	SWCB	SWCI	WSA	WSP	WSPBC	WSSN
SWCB						
SWCI	0.678					
WSA	0.489	0.761				
WSP	0.794	0.696	0.522			
WSPBC	0.664	0.686	0.746	0.680		
WSSN	0.630	0.668	0.653	0.634	0.793	

Source: Author's Calculation

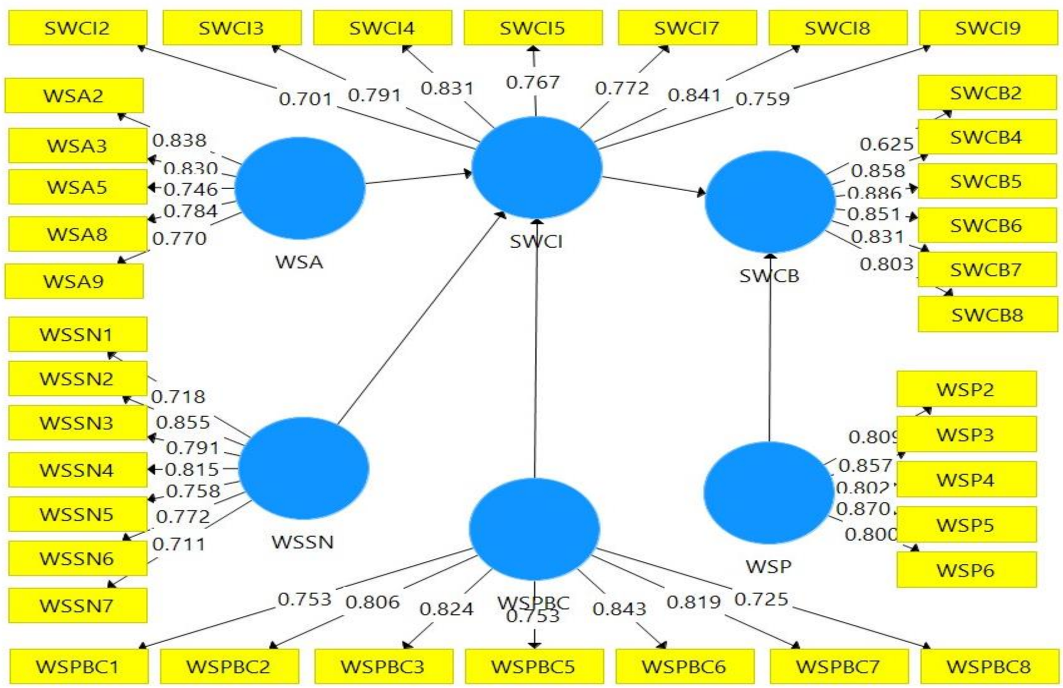

Figure 2: Measurement Model

4.2. Assessment of Structural Model

Upon confirming the validity of the measurement model, we progress towards the assessment of structural model. In doing so, first we checked the explanatory power, and predictive efficacy of our structural model and then we moved forward towards the path analysis to estimate the empirical results. The outcomes are reported in tables 4 and 5, respectively.

4.2.1. Model's explanatory power and predictive accuracy

As mentioned, we have expanded upon the foundational paradigm of TPB by incorporating consumer's WSP as a moderating factor to enhance its predictive accuracy. Therefore, it becomes increasingly urgent to test does the inclusion of WSP really makes any difference. To test this empirically, we performed two iterations on our structural model: one excluding WSP as a moderator and the other incorporating WSP as a moderator. We used four different criteria to test the explanatory strength of the model. The outcomes are reported in Panel A of table 4. The outcomes indicate superior performance of the model with WSP serving as a moderator, as it exhibits high explanatory power and predictive efficacy in comparison to the foundational model. This is evident by the higher R2 and Q^2predict values, vis-à-vis lower RMSE and MAE values in the extended model (Ali et al., 2023). However, another noteworthy finding are reported in the panel B of table 4, which exhibits that the inclusion of WSP holds large effect on the model's explanatory power, as the value of ($\boldsymbol{f^2}$) exceeds the threshold of 0.35 (Cohen, 2014).

Table 4: Model's Explanatory Power and Predictive Accuracy

Test Statistic	Basic TPB Model (Without WSP as moderator)	Extended TPB Model (With WSP as moderator)
Panel A: Model's Predictive Accuracy		

R-square*	0.453	0.659
Q^2predict	0.422	0.649
RMSE	0.761	0.593
MAE	0.632	0.438
Panel B: Effect Size (f^2)		
Test statistic	Value	Effect Size
Effect Size (f^2)**	0.6023	Large

Note: * we have reported the R-square values of our dependent variable (SWCB), ** we have calculated the effect size based on the R-square of our dependent variable; Source: Author's calculation

4.2.2. Path Analysis

After confirming the model's explanatory and predictive capabilities of our extended model, we proceeded to assess the established relationships among the relevant study variables. For this purpose, we conducted a bootstrapping process on a total of 5000 samples. The results are presented in Table 5.

The outcome of the study unveils the Positive and significant influence of WSA (0.245), and WSPBC (0.622) on the SWCI. The study also brings light to the positive role of SWCI (0.292) on SECB. Our result also uncovers a significant indirect impact of WSA (0.072) and WSPBC (0.182) on SWCB. The outcomes of the study are seamlessly aligned with the theory of planned behavior, and with those studies which posits that individual intentions are a direct (Ajzen, 1991; Si, Duan, et al., 2022), and individual attitude and perceived behavioral control as an indirect predictor of behavior (La Barbera & Ajzen, 2020; Shahangian et al., 2021; Singha et al., 2022b; Wang et al., 2014). Undoubtedly, intentions are the foremost precursors to actual behaviors. When individuals possess a genuine intention to conserve water resources, they are more likely to translate these intentions into concrete actions by engaging in sustainable water consumption behavior (Ajzen, 1991). It is worth mentioning that a positive attitude and perceived behavior control towards water-saving emerges as powerful motivational force in shaping this intention among the individuals. Notably, a positive WSA instills a sense of importance and personal relevance among individuals, while WSPBC enhances confidence in their ability to enact water-saving actions which eventually shapes individuals' sustainable water consumption intentions, driving them to actively engage in water-saving behaviors. Hence, in the light of above arguments, H_{1a}, H_{1c}, and H_2 are accepted. However, it is worth mentioning that the findings of our study do not supports H_{1b}, as we do not find any significant connection between WSSN and SWCB, nor we found the significant indirect impact of WSSN on SWCB, represented by the insignificant p-values in the path 2 and 9, respectively. Although our results are counter intuitive with the broader strand of literature but can be justified by recognizing the contextual nuances and the intricate nature of human behavior

Table 5: Path Analysis

Path	Model	Coeff.	t statistic	P value
Path 1	WSA → SWCI	0.245***	9.489	0.000
Path 2	WSSN → SWCI	0.021	0.839	0.402
Path 3	WSPBC→SWCI	0.622***	25.145	0.000
Path 4	SWCI → SWCB	0.292***	13.025	0.000
Path 5	WSP → SWCB	0.589***	28.393	0.000
Path 6	WSP*SWCI→SWCB	0.067***	4.135	0.000
Path 7	WSA → SWCI → SWCB	0.072***	7.435	0.000
Path 8	WSPBC → SWCI → SWCB	0.182***	11.732	0.000
Path 9	WSSN → SWCI→SWCB	0.006	0.833	0.405

Note: WSA is water saving attitude, WSSN is water saving subjective norms, WSPBC is water saving perceived behavioral control, SWCI is sustainable water consumption intentions, WSP is water saving preferences, SWCB is sustainable water consumption behavior, *** is the significance of results at the level of 1%

Moving forward, we found a noteworthy positive impact of WSP (0.589) on SWCB, vis-à-vis a significant moderating role of WSP (0.067) in strengthening the relationship between SWCI and SWCB which is the most important finding of our study. This moderating impact is graphically illustrated in figure 3. Results suggest that WSP bears significant importance in impacting the SWCB among the households. Results further suggest that the individuals are more prone to translate their sustainable water consumption intentions into their actual behavior if they prefer the conservation of water over its wastage. Undoubtedly, if an individual prefers to conserve the water over its wastage, he will be more likely to engage in sustainable water consumption behavior, which will narrow down the intention-behavior gap. The findings of our study are seamlessly align the studies who discussed the role of consumer preferences in determining a behavior and decision making choices of individuals (Hackbarth et al., 2022; Sharma & Christopoulos, 2021). Hence, H_3 and H_4 of the study is accepted.

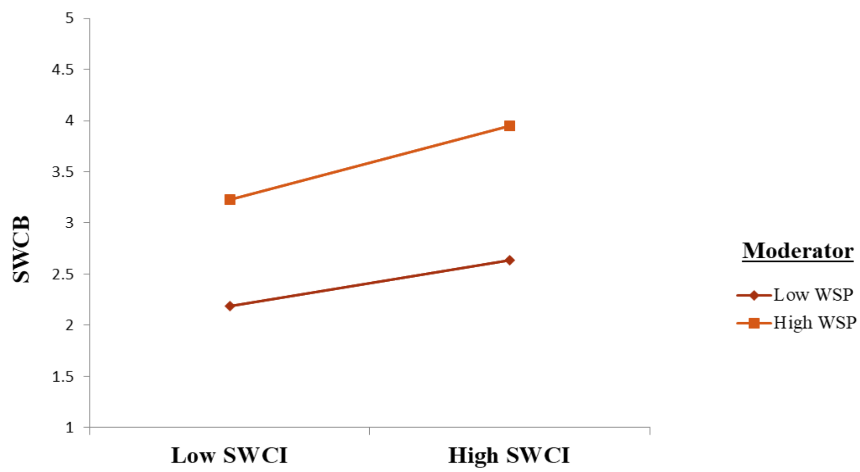

Figure 3: Graphical Illustration of Moderating Effect

5. Conclusion and Policy Suggestions

In the context of the escalating global water scarcity crisis, marked by a perilous combination of increasing demand and diminishing reserves that pose a critical threat to sustainable development, the unsustainable water consumption practices of households emerge as substantial contributors to the problem. As such, the pressing need to promote sustainable water consumption behavior within households remains a persistent concern for both researchers and policymakers. Literature is evident that numerous researchers have endeavored to identify factors promoting sustainable water consumption behavior under the theoretical underpinnings of (Ajzen, 1991).

While Ajzen's (1991) theoretical framework has been a foundational tool in exploring this issue, its limitations in fully capturing the nuanced relationship between intention and behavior have prompted researchers to seek extensions. Despite various attempts to enhance Ajzen's framework by introducing different mediating and moderating factors, the role of consumer preferences has been notably absent from existing research endeavors. Acknowledging the pivotal influence of consumer preferences in shaping decision-making choices and behavioral outcomes, we posit that their inclusion as a moderator in the foundational framework of Ajzen (1991) can bridge the intention-behavior gap and significantly enhance the model's predictive power.

Against this backdrop, our study makes a noteworthy contribution to the existing literature by introducing consumer water-saving preferences as a crucial moderating factor into the basic framework of Ajzen (1991). By doing so, we not only address a literature gap but also gain a more comprehensive perspective on the intricate dynamics influencing sustainable water consumption behavior within households by identifying factors that help to promote SWCB among households. To accomplish this objective, we target the households living in the residential properties of Lahore division and employed PLS-SEM to empirically analyze the results.

The key findings of our study mark a substantial improvement in Ajzen's (1991) foundational framework with the inclusion of WSP as a moderator. The outcome of the study unveils that along with SWCI, WSP also play a pivotal role in influencing SWCB. Our study reveals a noteworthy moderating impact of WSP in reinforcing the connection between intention and behavior. Additionally, our results indicate that WSA and WSPBC exert a significant indirect impact on SWCB. Notably, the empirical insights from our study present some actionable policy suggestions.

Given the positive influence of WSP on SWCB, policymakers should consider implementing a targeted Water Saving Preferences Promotion Program. This initiative could involve financial incentives or subsidies for adopting water-saving technologies, collaborating with local retailers for discounts on water-efficient products, and launching an educational campaign to underscore the benefits of WSP. Additionally, recognizing the significant impact of WSA and WSPBC on SWCB, policy interventions should include a Public Awareness Campaign cultivating positive attitudes and a Residential Water Management Assistance Program offering free home water audits and online resources to enhance perceived control. Moreover, instituting a Water-Saving Certification Program could incentivize households with reduced water tariffs or tax benefits based on positive WSA and high levels of WSPBC. These targeted policies, aligned with the specific findings of our study, aim to create a conducive environment for sustainable water practices and address the critical issue of water scarcity at its roots.

While our study provides valuable insights into sustainable water consumption behavior within households, it is essential to acknowledge certain limitations that may impact the generalizability and interpretation of the findings. The geographical focus on residential properties in Lahore division limits the broader applicability of our results. The cross-sectional design offers a static perspective, and the reliance on self-reported data introduces potential biases, such as response and social desirability biases. Furthermore, the cultural context of Lahore division may have influenced the observed behaviors, necessitating caution in extending the findings to diverse cultural settings. Moving forward, future research endeavors could address these limitations and contribute to the evolving understanding of sustainable water consumption behavior. Longitudinal studies would offer a dynamic view of behavior changes over time. Cross-cultural investigations across different regions could unveil the influence of cultural factors on water-saving preferences and behaviors. Intervention studies testing targeted strategies derived from our identified factors would enhance practical applicability. Exploring the impact of technology and conducting multi-level analyses could provide innovative insights. Additionally, comparative frameworks beyond Ajzen's model may deepen the comprehension of the complex dynamics at play in sustainable water consumption behavior. Embracing these directions will contribute to a more nuanced understanding of the determinants and evolution of water-related behaviors.

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