Working Paper No. 03-2024

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Abstract: Abstract: Purpose- Next to oxygen, water is counted as a vital resource for sustenance on the planet. The escalating trend of bottled water consumption worldwide indicates an alarming situation concerning plastic production and consumption. This research aims to assess the drinking water preference of youngsters at the Higher Education Institutions (HEIs) of the developing economy of Pakistan to analyze the trends towards environmental sustainability. Design/methodology/approach - A sample of (n=500) students belonging to various public and private sector universities was obtained to fill out a questionnaire that tested the students' preference for reusable bottles vs bottled water using the framework of the Theory of Planned Behavior (TPB). Findings- The structural equation model identifies subjective norms and perceived behavioral control as significant determinants of students' participation in university-led reusable water initiatives. Gen Y and Gen Z students are aware of the sustainability concerns and intend to take proactive steps. HEIs can promote sustainability culture by providing suitable eco-friendly choices to the students which can serve as a basis for sustainable development in the developing economies. Sustainability initiatives on-campus can help to foster environment-friendly attitudes and choices thus reducing the ecological footprint. Originality- Plastic pollution is a growing concern, particularly in developing economies where no one goes the extra mile to cater to the externalities that the environment has to

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The views expressed in this document are those of the author(s) and do not necessarily reflect the views of the Innovation and Technology Centre, or the Lahore School of Economics.

First Printing: June, 2024

Funding: There is no funding for this research.

Compliance with ethical standards: The authors have complied with ethical standards.

Conflict of interest: The authors declare no conflict of interest.

Data availability statement: The data is available on request.

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1. Introduction

The surge in global bottled water consumption is reflected in the remarkable 73% growth from 2010 to 2020 and the Global South represents around 60% of the global sales both in dollars and liters (Bouhlel, et.al. 2023). Beverage corporations marketed bottled water as a 'safe alternative' to tap water and drew consumers' attention to water quality (Opel1999, Wilk 2006). In developing countries, where approximately half of the treated water from plants is unaccounted for and a significant portion of the population faces unmet needs, with the majority lacking access to safe water and adequate sanitation, the market expands more rapidly. Pakistan is positioned at 113 among 135 countries in terms of access to safe drinking water (WASH Data Explorer, 2020). The country with a population of 232 million, recorded that 21 million individuals lacked access to safe drinking water. (Water Aid,2021). The considerable portion of the population facing health challenges stems from either the absence of safe drinking water or the presence of microbiological contaminants in the water supply. Waterborne diseases, particularly diarrhea, have been identified as a leading cause of mortality among infants and children in the country. Alarmingly, one in every five citizens is afflicted by diseases attributed to polluted water (Khalil ,2013). In Pakistan, the provision of clean water to households is typically accomplished through two approaches: the supply of treated water at the point of collection and household water treatment (Akram, 2020). Nevertheless, inadequacies in knowledge, employment of outdated treatment methods and equipment, unskilled labor, and inadequate oversight collectively contribute to the availability of insufficient and substandard drinking water (Kumar et al., 2023). In instances where these challenges persist, bottled water is often regarded as a safer alternative (Reisch et al., 2023).

Nevertheless, Pakistan exhibits one of the highest rates of mismanaged plastic in South Asia. Over 3.3 million tons of plastic are discarded annually in the country, with a significant portion finding its way into landfills, unregulated dumps, or dispersed across both land and water bodies. This widespread mismanagement adversely impacts the

environment and poses risks to public health, as highlighted in the UNDP Report of 2021. On a global scale, the acquisition of one million plastic drinking water bottles per minute is reported, contributing to the substantial environmental challenge. Additionally, an estimated 10 million tons of plastic infiltrate oceanic waters each year, exacerbating the environmental crisis (North and Halden, 2013; Geyer et al., 2017). Consequently, the growing consumption of bottled water is creating debates in terms of public health and environmental sustainability.

Addressing environmental concerns in Pakistan is a multifaceted challenge that extends beyond a single ministry or department, involving diverse sectors and geographical areas[1]. In the current scenario, promoting awareness about greener infrastructure emerges as a pivotal strategy for cultivating resilient communities. Theoretically, the government of Pakistan responds to the mandate of Sustainable Development very positively, as the National Education Policy (2017) recognizes the significance of Educational Sustainable Development as the cornerstone of national development, plays a pivotal role in enhancing human resources and contributes significantly to advancements in population quality and environmental resource management (Ekene et al., 2015). Higher Education Institutions (HEIs), encompassing colleges and universities, bear the responsibility of disseminating sustainability information and addressing issues related to consumption and waste production (Ralph and Stubs, 2014). HEIs must adopt a strategic approach, encompassing the revitalization of teaching methods, research initiatives, and campus management techniques (Reisch et al., 2023).

One on-campus sustainability concern is the consumption of bottled water. To address this issue, bottled water bans have been implemented in several HEIs. The aim is to reduce both bottled water consumption and associated plastic waste (Boulton et al., 2017). However, it has been identified that consumption patterns may not consistently shift, as individuals may continue to purchase bottled water from off-campus locations. Therefore, behavioral changes and social norms need to be altered to inculcate a sense of environmentalism among the students and educational institutions are in a unique position to amend the social norms and help in the promotion of green culture to the students who

[1] Full report can be available at:
https://www.undp.org/sites/g/files/zskgke326/files/migration/pk/797659dde79b4bbc75a47d42fe3755dcb9e717bd269baafcfee68cceaa23c2d2.pdf

attend that institution, which in turn can support in the mind shaping of responsible citizens (Santos and Van der linden, 2016).

Till now, very few studies conducted in Pakistan regarding the relationship between the behaviors and social norms of educated youth in shaping their perceptions of environmental sustainability issues (Habib et al., 2021; Bukhari et al., 2022; Hinduja et al., 2023). This study endeavors to fill this gap, presenting a two-fold contribution. Firstly, through an extensive survey encompassing 500 respondents across five select Public and Private Universities in the largest province of Pakistan, we examine the awareness levels of university graduates concerning bottled water bans and their attitudes towards sustainable alternatives. Secondly, employing the framework of the Theory of Planned Behavior (TPB), our research seeks to investigate drinking water preferences among these educated cohorts. Preliminary findings from the study reveal subjective norms as a significant determinant among university graduates regarding sustainable solutions, particularly in the context of reusable water bottle initiatives. Next, the research develops a relationship between perceived behavioral control and actual behavior. Furthermore, our investigation unveils the moderating influence of on-campus refill stations, wherein their availability positively impacts the relationship between one's attitude towards utilizing reusable bottles and the intention to opt for these eco-friendly alternatives.

2. Literature Review

Various quantitative and qualitative studies (e.g., Espinosa-García et al., 2015; Van der Linden, 2015; Ward et al., 2009) consider the factors influencing the preference for bottled water over tap water. The findings reveal that opting for bottled water is an uncertain choice that takes into account a variety of factors, including the quality of tap water, psychological factors specific to an individual (such as subjective beliefs about taste and safety), cost, convenience, lifestyle, and environmental issues (Gleick, 2010; O'Donnell & Rice, 2012).

Regarding these factors, it is significant that information on tap water quality (Espinosa-García et al., 2015) and the readily available filtered tap water (Saylor et al., 2011) is frequently shadowed by the perceived accessibility and availability of bottled water. To evaluate the feasibility of installing Water Bottle Refill Stations (WRSs), Uehara and Ynacay-Nye (2018) carried out a case study in Japan and found that a sizable majority

of students indicated a willingness to use WRSs. Research by Emma et al. (2013) indicates that placing water refill stations in apparent locations on campus may cause students to change their behavior, which would reduce the number of disposable water bottles they use and support university efforts to create greener, more sustainable campuses. It follows that the probability of intending to act is determined by the sense of control, which is a variable formed by the evaluation of outside barriers along with personal expectations of controlling them (Ajzen, 1988).

Within this framework, individuals frequently apply Ajzen's 1991 Theory of Planned Behavior (TPB) to predict their sustainable behavior. While the TPB has been widely used to predict ecologically friendly behavior, few studies have examined its performance when applied to the consumption of water bottles (van der Linden, 2015). Moreover, there is a significant gap in the application of the Theory of Planned Behavior (TPB) in Pakistan to investigate sustainability in the context of a decrease in the consumption of plastic products. However, few relevant studies support this specific focus: Aslam et al. (2019) used the Extended Theory of Planned Behavior to examine customer intentions regarding the use of plastic bags. To evaluate the factors influencing recycling behavior, Khan et al. (2019) expanded on the Theory of Planned Behavior. According to a study by Wang et al. (2022), policies and guidelines put in place by green institutions have a big impact on Pakistani students' inclinations towards using reusable cups. Notably, it was discovered that perceived behavioral control was not significantly impacted by environmental concerns. To examine the variables impacting the country's efforts to clean up plastic garbage, Hameed et al. (2021) explored a range of theories, including the Theory of Planned Behavior (TPB) and Social Influence Theory (SIT). Their results emphasized how consumer attitudes, subjective standards, and perceived behavior control influence consumers' intentions to recycle. Khan et al. (2022) explore attitudes and intentions regarding the exchange of Polyethylene Terephthalate (PET) bottles in Karachi, Pakistan. To the best of our knowledge, there exists no study within the framework of the Theory of Planned Behavior (TPB) that specifically addresses the sustainability issues related to choices in drinking water among educated cohorts in Pakistan. Our research stands apart in terms of geographical focus, specific definitions of constructs, a rigorous methodology, and the inclusion of water fill stations' impact as a moderating variable.

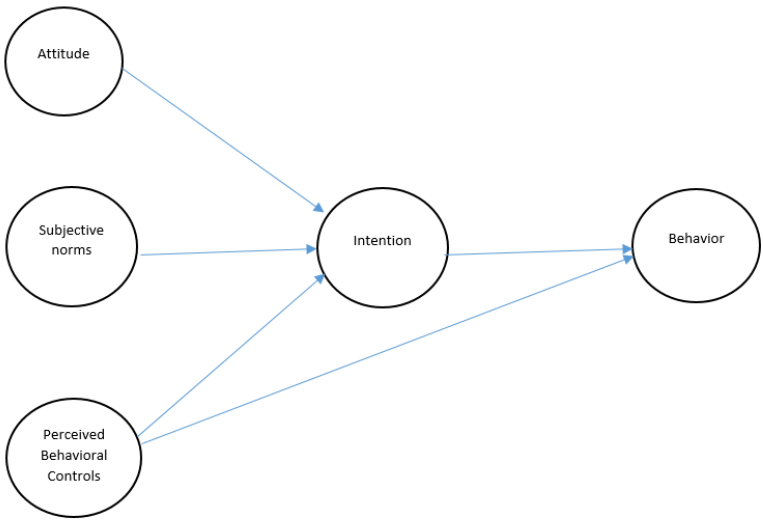
2.1 Statement of the Research Problem:

The 2030 Agenda for Sustainable Development emphasizes a sustainable future. Despite ranking 113th in water quality among 135 countries, Pakistan is the second-largest producer of PET bottles in Southeast Asia. Sindh province established bottled water plants and universities introduced clean water initiatives. However, the elements of a circular economy are invisible in Punjab, impacting universal access to safe drinking water. Our study aims to gather and analyze extensive data to understand student water bottle behavior across various universities from the largest city of Punjab province, Lahore. Examining students' preferences between disposable and reusable water bottles and identifying strategies to reduce bottled water consumption are essential steps in promoting a sustainable lifestyle on campus.

2.2 Theoretical Framework and Hypothesis Development:

Ajzen's (1991) Theory of Planned Behavior (TPB) stands as a cornerstone in behavioral science, offering invaluable insights into the understanding and anticipation of diverse behaviors. Building upon Ajzen and Fishbein's (1980) Theory of Reasoned Action (TRA), The Theory of Planned Behavior (TPB) is a significant advancement in theoretical models intended to clarify human behavior. Figure 1 shows the theoretical framework.

Figure 1: Theoretical Framework



2.2.1 Behavior and Intention:

Pro-environmental behavior can be understood in two ways: by its actual impact and by the intention behind it. According to Stern (2000), behavior that affects the environment positively, like changing the availability of materials or energy or the balance of ecosystems, is called impact-oriented environmental behavior. On the other hand, intent-oriented environmental behavior is driven by people's beliefs and motives. Sometimes, individuals may not directly impact the environment but show their interest in benefiting it. It shows how people adjust their actions in response to messages about environmental issues (Tsfati & Cohen, 2003; Wei, Lo, & Lu, 2010).

In this study, intent-oriented environmental behavior, such as students participating in university-led reusable water bottle initiatives, is seen as a form of pro-environmental behavior in personal settings. The Theory of Planned Behavior (TPB) suggests that intention is the most significant predictor of behavior because people typically do what they intend to do. Intention plays a crucial role in influencing and promoting the adoption or execution of any practice. It is strongly correlated with behavior, as supported by previous research (Gollwitzer, 1999; Brickell et al., 2006;

Klöckner, 2013). This correlation forms the basis for the hypothesis discussed below**.**

H1: Students' willingness to carry reusable water bottles is positively related to students' participation in university-led reusable water bottle initiatives.

2.2.2 Attitudes, Subjective Norms, and Perceived Behavioral Control:

According to the Theory of Planned Behavior (TPB), the factors closest to predicting intention are Attitude (A) and Subjective Norms (SN). Attitude refers to how favorably or unfavorably a consumer evaluates the behavior in question. Subjective Norms pertain to the consumer's beliefs about whether important others, such as peers, approve or disapprove of the behavior. Recognizing that obstacles often affect human behavior, Ajzen (1991) introduced a third factor in TPB: Perceived Behavioral Control (PBC). This factor relates to a person's perception of how easy or difficult it is to perform the behavior in question.

In the context of pro-environmental behavior, researchers have argued that a positive attitude leads to behavioral intention, as observed in practices like recycling and reusing plastic waste (Khan et al., 2019) and recycling solid waste (Huang et al., 2021). Tonglet et al. (2004) similarly found a significant positive correlation between attitudes and intentions to recycle. However, findings from Davis et al. (2006) suggest that attitudes may not always be statistically significant. Consequently, the results are mixed, prompting the preliminary formulation of the following hypothesis:

H2: Students' attitude toward drinking water choices positively impact their willingness to carry reusable water bottles.

The primary source of social influence stems from significant individuals in an individual's life, such as family members, friends, and neighbors (Cialdini et al., 1991). People often conform to social norms because they seek approval from relevant others and aim to avoid criticism from them (Comber and Thieme, 2013). Many researchers have suggested that individuals are more likely to perform a certain task if they feel pressure from their social environment (Han et al., 2010; Wang et al., 2014; Shalender and Yadav, 2018). In developing economies like Pakistan,

where cultural ties are strong, this influence appears to be even more significant. A recent study by Akhound et al. (2022) demonstrates that factors such as attitude at home, subjective norms (SN), and descriptive norms positively influence the intention to save energy in the workplace, while the impact of attitude and perceived behavioral control (PBC) was found to be insignificant. Based on these findings, the following hypothesis is formulated:

H3: Subjective norms towards drinking water choices positively impact students' willingness to carry reusable water bottles.

Perceived behavioral control is a composite of an individual's perceived ability and beliefs about control. Ajzen (1991) proposed that perceived behavioral control, aimed at overcoming obstacles that could hinder an individual's performance, has a dual effect on both behavioral intention and behavior. Research by Numata and Managi (2012) suggests that if consumers perceive the overall quality of reusable containers to be comparable to or better than other types of containers in terms of cleanliness or safety, they may be more inclined to consider using reusable containers. Similarly, a study by Myriam et al. (2017) indicates that perceived behavioral control exerts the strongest influence on intentions regarding the consumption of reusable containers. In this study, we view barriers to drinking tap water (Amber et al., 2011) as a proxy for measuring perceived behavioral control. Therefore, we hypothesize an inverse relationship between perceived behavioral control and intention/behavior. This leads to the formulation of the following hypothesis:

H4: Perceived behavioral controls towards drinking tap water inversely impact students' willingness to carry reusable water bottles.

Consequently,

H5: Perceived behavioral controls towards drinking tap water inversely impact students' participation in university-led reusable water bottle initiatives.

2.2.3 Availability of On-Campus Refill Stations

To encourage the sustainability mindset and ecological awareness, another interesting variable that may potentially impact the behavioral

changes to make a transition towards reusable water bottles is the availability of Water Refill Stations. If the stations are not available on campus the frequency of students using reusable bottles declines. There is a need to take the initiative to make it more convenient for people to use reusable water bottles through the strategic installation of filtered water bottle stations (Chudwick et al., 2013; Uehara and Ynacay-Nye, 2018; Curralo et al., 2022; Bethurem et al., 2021). Henceforth, the following hypotheses are developed.

H6: The availability of on-campus refill stations moderates the relationship between the factors influencing student intention towards reusable water bottles and student participation in university-led reusable water bottle initiatives.

3. Methodology

3.1 Sample selection

The data collection process used convenience and snowball sampling techniques (Roy and Ahmed, 2016, Chowdhury et al., 2019), known for their efficacy in providing comprehensive insights and facilitating rapid data acquisition (Shorten & Moorely, 2014). The utilization of convenience sampling stemmed from the financial constraints of the study too. The questionnaire items and constructs utilized were aligned with the methodologies outlined by Qian (2018) and Graydon et al., (2019). The study population comprised five universities, consisting of two public sector institutions, namely the University of the Punjab and Government College Lahore, along with three private sector universities: Lahore School of Economics, Lahore University of Management Sciences, and University of Central Punjab. We chose these universities because they have the highest number of graduates from Lahore and its neighboring areas. An online sampling strategy was implemented from May 23 to August 23 to ensure a quick response rate until a satisfactory sample size of $n = 500$ was achieved.

3.2 Instrument Development

The questionnaire encompassed demographic questions alongside items about students' perceptions and preferences regarding their choices of drinking water. The latent constructs, namely Attitude, Subjective Norms, Perceived Behavioral Control, and Intention, were formulated following

the framework outlined by Qian (2018), wherein students' participation level in University-Led Reusable Bottle Initiatives served as the observed behavioral variable. These constructs were conceptualized within the framework of the Theory of Planned Behavior (TPB). A total of 21 indicators were employed to measure the aforementioned constructs, utilizing a 5-point Likert Scale ranging from 1 for 'strongly disagree' to 5 for 'strongly agree'. While reverse coding was implemented in certain instances, the original scale was maintained for all items.

3.3 Data analysis

Survey responses collected via Google Forms were analyzed using SPSS software (IBM Corp. © 2016, Version 24, Armonk, NY). The question concerning "Ownership of reusable water bottles" was assessed through two nominal categories (Yes/No) in Table 1. A chi-square test was conducted to examine differences in reusable water bottle ownership across demographic variables such as gender, age, education, and university type. The survey included 500 participants, with a gender distribution of 60% female and 40% male students. The majority of respondents fell within the 18-25 age bracket (85%) and were pursuing Bachelor's degrees (75%). Additionally, an equal proportion of students from public and private sector institutions participated in the survey (50:50 ratio). The majority of respondents who reported owning reusable water bottles were females (73%). Consequently, a significant chi-square statistic was observed in the gender distribution ($\chi^2 = 62.895***$, $p < 0.01$). There was no significant difference across various age categories ($\chi^2 = 6.308$, $p > 0.05$) and levels of education ($\chi^2 = 2.072$, $p > 0.05$) concerning water bottle ownership. However, a significant difference was found in the behavior of students owning reusable water bottles based on whether they attended Public or Private sector universities ($\chi^2 = 33.811***$, $p < 0.01$) (Semerjian et al., 2020; Bukhari et al., 2022).

Similarly, in Table 2, responses to question regarding bottled water consumption frequency were categorized into four ordinal groups: "hardly ever," "once or twice per week," "3 to 5 days per week," and "almost daily," coded as 1 through 4 respectively. A one-way analysis of variance (ANOVA) was conducted to assess the relationship between bottled water consumption in the past week and demographic variables such as gender, age, education, and university type (Qian, 2018). The analysis revealed that the mean frequency of bottled water consumption

among males (M = 3.06, SD = 1.115; see Table 2) was significantly higher compared to females (M = 2.576, SD = 1.239). Across all age groups, the average frequency of bottled water consumption ranged from twice to three times per week. Similarly, there was no significant difference in bottled water consumption frequency observed across different education levels. However, a significant difference was observed in the frequency of bottled water consumption between students attending private-sector universities compared to those in public-sector universities (F = 7.17***, p < 0.01) (Semerjian et al., 2022). Overall, Tables 1 and 2 provide consistency in responses across demographic factors including gender, age, education, and university affiliation.

Table 1: Demographic profile in context of reusable water bottle ownership

	Not own a reusable water bottle		**Own a reusable water bottle**			
	N	**(%)**	***n***	**(%)**	**Chi-square**	**p-value**
Gender						
Female	61	36.3	241	73	62.895***	0.000
Male	107	63.7	89	27		
Age						
18 - 25	141	83.9	289	87.6	6.308	0.098
26-35 Years	24	14.3	36	10.9		
36-45 Years	0	0	4	1.2		
46 Years and above	3	1.8	1	0.3		
Education						
Bachelors	133	79.2	242	73.3	2.072	0.355
Masters/MPhil	31	18.5	79	23.9		
Ph.D. or above	4	2.4	9	2.7		
University Type						
Government	54	32.1	197	59.7	33.811***	0.000
Private	114	67.9	133	40.3		
Total	168	33.7	330	67.3		

Note: The null hypothesis of Chi square statistic assumes that there exists no relationship between two nominal variables. ***Significant at $p < 0.01$

Table 2: Demographic profile in context of drinking bottled water frequency

	n	Mean	SD	Minimum	Maximum	F-test	*p-value*
Gender							
Female	302	2.576	1.239	1	4	19.29***	0.000
Male	196	3.056	1.115	1	4		
Age							
18-25	430	2.786	1.206	1	4	0.45	0.714
26-35 Years	60	2.617	1.236	1	4		
36-45 Years	4	3	1.414	1	4		
46 Years or above	4	2.5	1.732	1	4		
Education							
Bachelors	375	2.84	1.206	1	4	2.92	0.055
Masters/M.Phil	110	2.54	1.209	1	4		
Ph.D or above	13	2.54	1.266	1	4		
University Type							
Government	251	2.62	1.254	1	4	7.17***	0.0076
Private	247	2.91	1.154	1	4		

Note: Frequency of bottled water was measured on a scale of 1 to 4, where 1 represents hardly ever, 2 corresponds to once or twice per week, 3 indicates three to five days a week, and 4 represents almost daily consumption. The null hypothesis of F-test assume equality of means in bottled water consumption across all categories. ***Significant at $p < 0.01$

3.4 Latent Variables Construction:

Following the guidelines outlined by Fishbein et al. (2010) and the factor construction methodology proposed by Qian (2018), we initially considered seven dimensions: Safety and Hygiene, Availability, Affordability, Personal Habits, Family Habits, Environmental Concern, Barriers to Reusable Bottles, and Intention. Students were asked to assess the degree of influence these factors had on themselves using a 1–5 scale. The indicators utilized in constructing these dimensions are detailed in Table 3.

Table 3. Hypothesized Constructs' relationship with outcome variable

General and Specific Sub-Factors	**Expected impact on University-Led Reusable Bottle Initiatives**
Safety and Hygiene	
Tap water is generally safe to drink directly.	negative
Bottled water is considered safer than tap water.	positive
Availability	
Bottled water easily available on campus.	positive
Affordability	
I purchase bottled water because I can afford it.	positive
Water quality is influenced by price	positive
Personal and Family Habits	
I have a preference for bottled water when making a purchase.	positive
I drink water from a reusable bottle at home.	positive
My family members carry personal reusable water bottles to work.	positive
My family members buy disposable water bottles at work.	negative
I am more likely to be influenced if someone uses a reusable water bottle in my circle	positive
Environmental concern	
The use of disposable bottled water contributes to plastic pollution.	positive
Consuming less bottled water is a step toward eco-friendly behavior.	positive
Behavioral changes lead to environmental protection.	positive
The use of reusable bottles is a sustainable alternative for environmental protection.	positive
Reusable bottled water helps reduce plastic pollution.	positive
Barriers to reusable bottles	
Reusable bottles may contain harmful chemicals or germs.	negative
Reusable bottles require time and effort to clean.	negative
At times, reusable bottles are inconvenient to carry around.	negative
Intention	
I'm willing to carry a reusable water bottle every day.	positive
I'm willing to carry a reusable water bottle if provided by the University for free.	positive
I'm willing to drink filtered tap water on campus for free.	positive

Note: Only the factors that are significantly correlated with University-Led Reusable Bottle Initiatives are reported. All the items are measured on 1–5 scale, from "strongly disagree" to "strongly agree".

Subsequently, principal component analysis (PCA) was conducted to capture the maximum possible variance among the items. Results (not reported) indicate that over 60% of the variation was extracted in all cases.

Only the first principal component, representing the highest variance, was retained. Furthermore, correlational analysis was performed with the outcome variable as outlined in Table 4. A significant correlation was observed for each dimension. Moreover, the analysis confirmed the assumed direction of the relationship with the outcome variable (Qian, 2018).

Table 4. Correlational analysis between constructs and behavior

TPB Framework	Latent variables[1]	Correlation to Behavior	*p-value*
Attitude	Safety and Hygiene	-0.175	0.000
	Availability	0.214	0.000
	Affordability	0.242	0.000
Subjective Norms	Personal Habits	0.182	0.000
	Family Habits	0.203	0.000
	Environmental concern	0.681	0.000
Perceived Behavioral Control	Barriers to reusable bottles	-0.273	0.000
Intention	Intention	0.444	0.000

Note: For multi-item constructs, only the first principal component, representing the highest variation, was retained through principal component analysis. Approximately 60% of the variation is explained in all cases.

4. Structural Equation Modeling

The analysis conducted in this paper utilized SmartPLS 4.0 (Ringle et al., 2024) within the covariance-based structural equation framework. In context of Theory of Planned Behavior, the research model considers the constructs such as Attitude, Subjective Norms, and Perceived Behavioral Controls which significantly influence both Intention and Behavior. The theory assumes that intention towards adopting sustainable changes is contingent upon attitudes, social norms, and behavioral controls, thereby shaping behavioral practices. Hence, intention serves as a mediating factor between attitudes, social norms, behavioral controls and behavioral practices. Using latent variable path analysis, the study also considers the presence of water refill stations on campus as a moderating factor. The purpose is to examine the effects of on-campus green infrastructure on Attitude, Subjective Norms, and Perceived Behavioral Control, and subsequently, its impact on students' participation in university-led reusable water bottle initiatives.

4.1 Measurement Model

The analytical methods recommended by Hair et al. (2010) were employed to assess the reliability and validity of the measurement model. Composite reliability (CR) was utilized to examine the extent to which latent variables were effectively measured by the constructs. It is conventionally recommended that CR values exceed 0.7 (Henseler, Ringle & Sinkovics, 2009; Salman et al., 2014). The findings presented in Table 5 indicate that while the composite reliability of our constructs falls slightly below the recommended threshold of 0.7, it remains within an acceptable range (Hair et al., 2014). Furthermore, to assess discriminant validity, the average variance extracted (AVE) was computed. According to Hair et al. (2010), an AVE value greater than 0.5 is considered satisfactory. With the exception of the "attitude" construct, all other constructs met this threshold. Finally, literature suggests that a factor loading of 0.4 or higher is acceptable (Anderson & Tatham, 2014). All items within our constructs demonstrated factor loadings exceeding this threshold. Hence, we conclude the adequacy of the measurement model for further analysis.

Table 5. Constructs validity and reliability

Constructs/Indicator	**Factor Loadings (> 0.4)**	**Cronbach α (> 0.6)**	**CR (> 0.7)**	**AVE (> 0.5)**
Attitude				
ATTSH1: Tap water is generally safe to drink directly.	-0.453	0.593	0.678	0.492
ATTSH2: Bottled water is considered safer than tap water.	0.593			
ATTAV1: Bottled water easily available on campus.	0.419			
ATTAF: I purchase bottled water because I can afford it.	0.536			
ATTAF2: Water quality is influenced by price	0.452			
Subjective Norms				
SNPH1: I have a preference for bottled water when making a purchase.	0.441	0.754	0.724	0.510
SNPH2: I drink water from a reusable bottle at home.	0.466			
SNFH1: My family members carry personal reusable water bottles to work.	0.439			
SNFH2: My family members buy disposable water bottles at work.	-0.401			

Constructs/Indicator	Factor Loadings (>0.4)	Cronbach α (>0.6)	CR (>0.7)	AVE (>0.5)
SNFH3: I am more likely to be influenced if someone uses a reusable water bottle in my circle	0.497			
SNEN1:The use of disposable bottled water contributes to plastic pollution.	0.698			
SNEN2:Consuming less bottled water is a step toward eco-friendly behavior.	0.747			
SNEN3: Behavioral changes lead to environmental protection.	0.773			
SNEN4: The use of reusable bottles is a sustainable alternative for environmental protection.	0.772			
SNEN5:Reusable bottled water helps reduce plastic pollution.	0.722			
Perceived Behavioral Control				
PBC1: Reusable bottles may contain harmful chemicals or germs.	0.617	0.647	0.647	0.591
PBC2:Reusable bottles require time and effort to clean.	0.749			
PBC3:At times, reusable bottles are inconvenient to carry around.	0.480			
Intention				
INT1:I'm willing to carry a reusable water bottle every day.	0.638	0.620	0.676	0.554
INT2:I'm willing to carry a reusable water bottle if provided by the University for free.	0.724			
INT3:I'm willing to drink filtered tap water on campus for free.	0.464			

4.2 Direct Relationship

The hypotheses testing procedure is carried out using a bootstrapping sampling method comprising 5000 samples. As recommended by Hair et al. (2010), the structural model was evaluated using "goodness-of-fit" measures, including chi-square/df, root mean square error approximation, the GFI (Goodness-of-fit index), the IFI (Incremental-Fit Index), and the Tucker-Lewis coefficient (TLI). A model is well-fitted when comparative fit indices are greater than or equal to 0.80. Moreover, the root mean square error approximation (RMSEA) should be $\leq$ 0.08, and the chi-square/df should be $<$ 5. Our analysis indicates a satisfactory model fit, with all values meeting the threshold requirements as presented in Table 6.

Additionally, the recommended critical values of the t-test were applied. The path coefficient values signify the influence of independent variables on the dependent variable. Except the impact of attitude on intention, all other structural paths exhibited high significance levels (indicated by p-values), thus confirming the proposed hypotheses. Furthermore, the analysis reveals that subjective norms ($\beta = 2.612^{***}$, $p < 0.01$) has the highest impact on intention across all structural relationships. Similarly, prior studies have consistently shown that subjective norms serve as direct precursors to environmentally friendly intentions (Chan, 1998; Povey et al., 2000, Chu & Chiu, 2003). After this, our analysis unveils a highly significant impact ($\beta = 0.887$, $p < 0.01$) of students' intentions toward reusable water bottles on their engagement with university-led reusable water initiatives. This underscores Pakistani graduates' willingness to support initiatives or programs initiated by universities to promote the use of reusable water bottles. This finding is consistent with research conducted among Japanese graduates (Uehara et al., 2018).

Moreover, the inversely significant impact of Perceived Behavioral Control on Intention ($\beta = -0.395$, $p < 0.01$) and Behavior ($\beta = -0.512$, $p < 0.01$) highlights the significant role of concerns regarding water quality and cleanliness in shaping students' intentions and subsequent behaviors concerning university-led reusable water bottle initiatives. Our findings closely align with those of Whalen (2023), who revealed that the presence of water bottle refilling infrastructure and a culture of sustainability on campus have led to a positive shift in student experiences with reusable water bottle usage and refilling.

Table 6: Direct Relationships Hypothesis Testing —SEM path analysis

Direct Relationship	Estimate	SE	CI bound	T statistic	p-value	Decision
H1: Intention → Behavior	0.887***	0.081	(0.665, 1.139)	10.993	0.000	Accepted
H2: Attitude → Intention	-0.129	0.091	(-0.33, 0.071)	1.421	0.156	Rejected
H3: Subjective norms→ Intention	2.612***	0.528	(1.901, 4.492)	6.380	0.000	Accepted
H4: Perceived Behavioral Control → Intention	-0.395***	0.097	(-0.176, -0.784)	4.085	0.000	Accepted
H5: Perceived Behavioral Control → Behavior	-0.512**	0.080	(-0.79, -0.30)	6.380	0.000	Accepted

Model fit: Chisqr/df = 3.282, RMSEA = 0.062, GFI,0.888, TLI = 0.817, CFI = 0.840

4.3 Mediating Relationship

The mediation analysis of the model was conducted in Table 7, utilizing direct and indirect effects within a confidence interval testing procedure. In bootstrap models, it is noteworthy that a significant total effect is not a prerequisite for establishing a mediation effect. This is because it is feasible to have a significant specific indirect effect even when the total effect is not significant (Preacher and Hayes, 2008). Among the three determinants, the indirect effect of attitude on behavior was found to be insignificant ($\beta = -0.115$, $p > 0.01$), whereas the indirect effects of subjective norms ($\beta = 2.316^{***}$, $p < 0.01$) and perceived behavioral control ($\beta = 0.350^{***}$, $p < 0.01$) on students' participation in university-led reusable water bottle initiatives were highly significant. This suggests that social influence plays a pivotal role in shaping students' intentions in Pakistan (Dhar et. al., 2015; Shalender and Yadav, 2018), thereby reinforcing their involvement in university-led reusable water bottle initiatives.

Likewise, concerns regarding safety, hygiene, and cost exert a notable influence on students' preferences, thereby influencing their involvement in university eco-friendly initiatives (Qian, 2018; Bukhari et al., 2022). However, surprisingly, attitudes towards sustainable practices do not affect students' intentions, consequently influencing their behavior regarding university led reusable water bottle initiatives (Habib et al., 2021). This underscores the habitual behavior of Pakistani graduates and their belief that individual actions may not significantly contribute to addressing environmental concerns.

Table 7: Mediating Relationship Hypothesis Testing

Mediation analysis	Direct Effects	Indirect Effects	Total Effects
Attitude → Behavior		-0.115	-0.129
		(-0.302,0.065)	(-0.333, 0.071)
Attitude → Intention	-0.116		-0.115
	(-0.294,0.064)		(-0.302, 0.065)
Intention → Behavior	0.645***		0.887***
	(0.552,0.727)		(0.665, 1.139)
Subjective norms→ Behavior		2.316***	2.316***
		(1.6262,3.980)	(1.626,3.980)
Subjective norms→ Intention	1.046***		2.612***
	(0.930,1.176)		(1.901,4.492)
Perceived Behavioral Control →	-0.350***	0.350***	-0.162
Behavior	(-0.5, -0.210)	(0.161, 0.606)	(-0.348,0.005)
Perceived Behavioral Control →	0.371***		0.395***
Intention	(0.175,0.617)		(0.176, 0.784)

Note: ***significance at 1 percent level $p < 0.01$

4.4 Moderation analysis:

To examine the impact of the moderating variable (Availability of Refill Stations), we conducted separate regression analyses for two groups defined by the moderator variable. Subsequently, a comparison of the beta coefficients (effect sizes) was conducted using t-tests. The bootstrap results were obtained, and the path coefficients were analyzed. Table 8 displays the path coefficients of the moderating variable. It is evident from the results that the availability of on-campus refill stations enhances the relationship between various constructs within the TPB framework.

In comparison to the group of students who reported the unavailability of water refill stations on campus, we conclude that the presence of water refill stations on campus appears to have a stronger and significant influence on students' intention ($\beta = 0.936^{***}$, $p < 0.01$), subjective norms ($\beta = 2.882^{***}$, $p < 0.01$), and perceived behavioral control ($\beta = -0.787^{***}$, $p < 0.01$) concerning university-led reusable water bottle initiatives, hence H6 is supported. Figures 2 and 3 show the pathways.

The finding indicates that the presence of water refill stations within the campus environment enhances convenience and accessibility, thereby facilitating student engagement with university-promoted initiatives. Consequently, this finding underscores the significance of investing in and expanding on-campus infrastructure, such as water refill stations, to foster sustainable behaviors among students (Chudwick et al., 2013; Uehara and Ynacay-Nye, 2018).

Table 8: Hypotheses Testing for Moderating Variable-Refill stations availability on campus

Direct Relationship	**Water fill stations not on campus ($n_1 = 263$)**		**Water fill stations on campus ($n_2 = 236$)**		
	Estimate	**Standard error**	**Estimate**	**Standard error**	**t-statistic[1]**
Attitude → Intention	-0.170	0.132	-01.62	0.308	n.a
Intention → Behavior	0.853***	0.10	0.936***	0.177	6.5317***
Subjective norms→ Intention	2.550***	0.649	2.882***	1.089	4.185***
Perceived Behavioral Control → Intention	0.179	0.123	0.606	0.624	n.a
Perceived Behavioral Control → Behavior	-0.372***	0.125	-0.727***	0.262	19.6266***

Note: [1] The null hypothesis of t-test for difference between two means assume equality of means (equal variances).
*** represents significance at 1 percent $p < 0.01$.

Figure 2: Refill Stations On-Campus

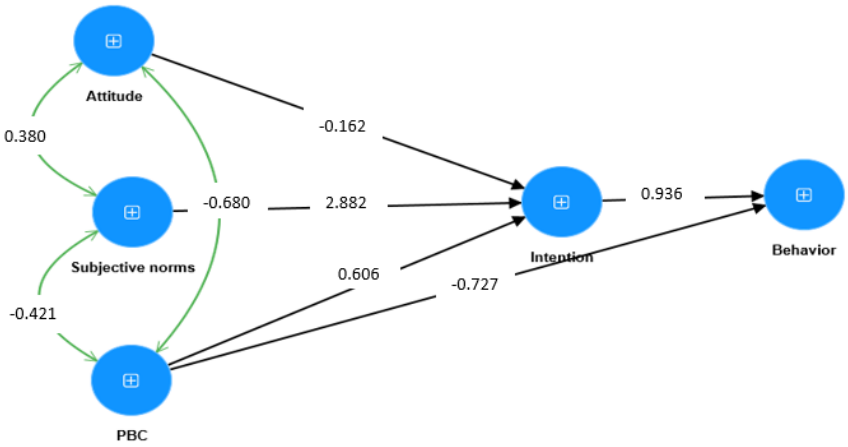
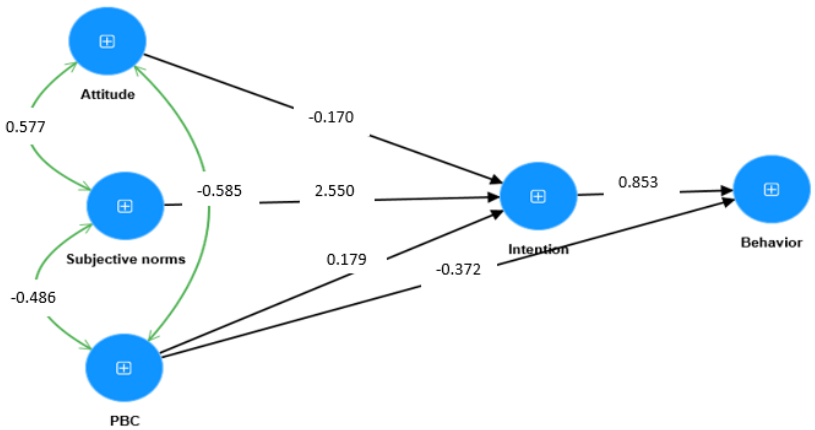


Figure 3: Refill Stations Not Available On-Campus



5. Discussion

A stimulating analysis by Qian (2018), shows that in developed countries where people are highly educated and more conversant and where tap water availability is substantial, bottled water is still widely used. Therefore, Governments and Institutions need to adopt a proactive approach and curb the negative externality on the environment through public education on the overconsumption of single-use bottles/ bottled

water. The overconsumption of bottled water on campuses potentially costs more energy and adversely burdens the environment (Bethurem et al., 2021; Curralo et al., 2022).

Higher education institutions are hubs of youth. Johnson and Courter (2020), suggest that universities should recognize the essential role and may customize educational approaches to reach students from diverse backgrounds. If the students tend to carry their bottles, this may potentially impact the behavioral changes to drink from a reusable bottle instead of opting for a disposable or single-use bottle (Fedi et al., 2021; Curralo et al., 2022). A study by Bethurem et al., (2021) shows that the institution carried out an initiative to give away free reusable bottles to students and as a result, the use of water refill stations was significantly increased, which indicates that the availability of reusable bottles impacts the behavior. One practical example of Allegheny College promoting water literacy among students is the provision of Reusable, BPA-free stainless steel water bottles to all incoming first-year students and the installation of water filtration and refill stations (Choate et al., 2018). Moreover, embedding environmental cognizance in the general education curriculum could help in the promotion of water literacy and sustainable behavior of the students which can turn them into responsible citizens (Levy and Marans, 2012; Mahler, 2019).

As per the World Health Organization (WHO), Pakistan lies in 80th number among 122 countries concerning water quality. Pakistan's bottled water market was valued at USD 274.6 million in 2018 and is estimated to reach USD 451.57 million by 2024. It is expected to witness a compound annual growth rate (CAGR) of 10.46% during the forecast period of 2022 to 2027 (Sohail et al., 2022). Various bottled water plants have been set up across various parts of the country. For instance, in 2017, four bottled water plants were set up in Karachi, which indicates an increase in demand. As per capita, household income is rising, people living in urban areas have become more aware of consumer preferences while buying water bottles. Moreover, the contamination of drinking water from the taps has resulted in a surge in bottled water sales. There is a change in the spending pattern of consumers, as they are inclined toward more convenient sources of water and food to save time.

Higher Education Institutions have the prospect of equipping the student body with responsible and sustainable water consumption behavior. The role of universities is integral in improving water literacy among the

students which in turn not only helps to generate support for environmental initiatives but also makes students able to critically analyze emerging environmental concerns (Harnish et al., 2017). Referring to the demographics of this research survey in Table 1, it is interesting to register that the majority of youngsters in the age bracket of (18-25) own a reusable water bottle. This phenomenon could be termed a sustainable behavioral approach toward drinking water choice because it may be driven by other factors primarily subjective or social norms. The responses to the survey bring up many attention-grabbing dimensions.

The students are directed to use bottled water on account of two major concerns i.e., safety and availability. The respondents of the survey claimed that the majority believe that the quality of water is influenced by the price to be paid. The general understanding of the respondents is that tap water is unsafe to drink whereas, bottled water is safe as compared to tap water. Therefore, students either opt for bottled water or carry a reusable bottle that contains filtered water and/or bottled water. The second prominent factor is the availability of both, bottled water and filtered water refill stations. Bottled water is easily reachable on campus and is handy thus resulting in more frequent usage by the students. If this option is limited, students are naturally directed towards using reusable bottles. The majority of students are more likely to use reusable bottles if the refill stations are available on campus.

The respondents were also asked questions about the consumption and effects of single-use throwaway bottles and the results demonstrate that, awareness persists among students as they feel guilty upon using a single-use plastic bottle for once and throw it away. The majority of the respondents agree to the fact that these single-use bottles may contribute to plastic pollution and waste generation. According to the respondents, the lowered consumption of bottled water could be a step towards sustainable consumption and the majority is interested in carrying a reusable bottle every day. Many youngsters believe that the biggest benefit of drinking water from a reusable bottle is 'less waste generation' followed by 'it saves money' and 'ease and convenience'. On the other hand, the biggest benefit of drinking water from bottled water comes out to be 'good quality of water' followed by it being 'convenient to buy' and 'germs free'. The moderation analysis emphasizes the availability of refill stations on campus which can significantly promote the usage of reusable bottles. If the HEIs take a wider approach to providing clean, filtered, and good quality water to students it can lead to reduced consumption of

bottled water (Levy and Marans, 2012) thus, significantly reducing plastic waste generation but this practical step requires collaborative efforts by the HEIs as well as the Government.

6. Conclusion

The results of the study shed light on how behavioral changes can be induced by focusing on social and personal norms collectively called subjective norms to care more for the environment and opt for environment-friendly choices and decisions. The customization and design of educational policies can be directed to enact subjective norms thus, favoring and promoting sustainable behavioral changes. The results from this study can be used to facilitate the on-campus sustainability solutions such as the availability of refill stations providing good quality of drinkable water so that the student body may discourage the use of bottled water. Also, it may help to guide the development of strategies to lessen the ecological footprint of bottled water consumption at the universities. There is a need to integrate practical sustainable practices in the HEIs to reduce the culture of throwaway bottles and to foster a sustainable future.

7. Limitations

The study comprised data of students, obtained for Lahore only. A large-scale survey of various cities may help to get a broader picture of water consumption within the country and may help practitioners develop relevant policies. It is also interesting to investigate how environmental awareness and education play a part in promoting sustainable behavior among students.

8. Funding

The authors declare that no funding was received for this research.

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The Lahore School of Economics was established in 1993 as a private, non-profit university with the goal of developing world class teaching and research in Pakistan. The objectives of the LSE are to prepare young Pakistanis to undertake research in economics, finance, banking, business management, industry, and development, in order to deepen their understanding of, and be able to productively contribute to, the major issues and policies that impact Pakistan and Asia at large.

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