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Behavioral insights into reusable bag adoption: Evaluating the effectiveness of the theory of planned behavior in Lahore

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Abstract: Reusable bags have been introduced as an alternative to single-use plastic bags (SUPB). While beneficial, this alternative is economically and environmentally viable only if utilized multiple times. This study aims to identify the determinants influencing the use of reusable bags (RB) over single-use plastic bags (SUPB) within the framework of ecological impact reduction, employing the Theory of Planned Behavior (TPB). The focus is on understanding how attitudes (AT), subjective norms (SN), and perceived behavioral control (PBC) collectively guide consumers towards adopting reusable bags as a pro-environmental choice. The focus is on understanding how attitudes (AT), subjective norms (SN), and perceived behavioral control (PBC) collectively guide consumers towards the adoption of reusable bags as a pro-environmental choice. Data were collected through a survey administered to 814 consumers in Lahore, employing both regression analysis and Structural Equation Modeling (SEM) to assess the impact of AT, SN, and PBC on reusable bag consumption (RBC). The TPB framework underpins the hypothesis that these three psychological factors significantly influence the decision to use RBs. Both regression and SEM analyses demonstrated that AT, SN, and PBC positively affect RBC, with significant estimates indicating the strength of each predictor. Specifically, PBC emerged as the strongest predictor of RBC (PBC2, $\beta = 0.533$, $p < 0.001$), highlighting the paramount importance of control perceptions in influencing bag use. This was followed by AT ($\beta = 0.211$, $p < 0.001$) and SN ($\beta = 0.173$, $p < 0.001$), confirming the hypothesized positive relationships. The congruence of findings from both analytical approaches underlines the robustness of these techniques in validating the TPB within the context of sustainable consumer behaviors. The investigation corroborates the TPB's applicability in predicting RBC, with a clear hierarchy of influence among the model's constructs. PBC's prominence underscores the necessity of enhancing consumers' control over using RBs to foster sustainable consumption patterns. Practical implications include the development of policies and marketing strategies that target the identified determinants, especially emphasizing the critical role of PBC, to promote broader adoption of RBs and contribute to significant reductions in plastic waste.

Keywords: theory of planned behavior; reusable bag consumption; sustainable consumption behavior; perceived behavioral control; structural equation modeling

1. Introduction

Plastic pollution is a principal environmental issue that has been afflicting our planet for decades. Improper disposal of plastics poses a myriad of threats to our ecosystems (Lebreton and Andrady, 2019). Annually, approximately 380 million metric tons of plastic are produced, with the production of five trillion plastic bags worldwide being a significant contributor to the plastic pollution crisis (Staff, 2022). The detrimental impacts of plastic waste on the environment are extensively documented, including harm to marine life, the destruction of ecosystems, and the

release of toxic chemicals into our surroundings (Boyd et al., 2009; Suleman et al., 2022). Among waste management challenges, plastic waste stands out as particularly problematic due to its resistance to natural decomposition and its composition of environmentally and biologically harmful materials.

The specific issue of plastic bags, primarily designed for single use, emerges as a critical facet of this environmental challenge. The use of single-use plastic bags (SUPBs) has been identified as a major contributor to plastic debris (Excell et al., 2018). Their pervasive adoption in both domestic and commercial settings lead to a considerable accumulation of plastic waste, thereby exacerbating environmental issues such as pollution and associated health risks (Chen et al., 2021). The environmental peril posed by plastic bags stems from their slow degradation rate, endangering wildlife and contaminating the environment over extended periods (Durak, 2016; Ujeh, 2021). Consequently, in response to the environmental threat posed by the disposal of plastic bags, numerous countries have implemented bans on single-use bags, promoting reusable alternatives as an environmentally benign option.

In view of the environmental challenges posed by single-use plastic bags and the subsequent legislative responses aimed at curbing their use, the shift towards reusable bags presents a sustainable alternative. Reusable bags, crafted from a diverse array of materials such as polypropylene, cotton, jute, and recycled substances, embody versatility through various forms including cloth bags, mesh bags, and foldable options (Sengupta, 2023). Their durability and reusability afford consumers the convenience of transporting groceries and other items without resorting to single-use plastic bags (Warner, 2009). Beyond their cost-effectiveness over time, reusable bags stand out for their environmental benefits, attributed to their prolonged lifespan (Patel, 2023). Nonetheless, the effectiveness of reusable bags in mitigating plastic waste depends on consistent usage patterns. While some individuals integrate them regularly into their shopping routines, others may underutilize or prematurely dispose of them, diminishing their potential environmental and economic benefits (Lehmann, 2011). The real impact of reusable bags unfolds through frequent use. According to one estimate, a modest collection of four or five reusable bags could supplant 520 plastic bags a year, assuming weekly utilization (Gamerman, 2008). This comparison highlights the environmental superiority of reusable bags over their single-use counterparts, reinforcing their role in addressing plastic pollution.

However, it has been observed that reusable bags are frequently utilized in the same manner as single-use plastic bags. This practice essentially negates the benefits of reusable bags, as it results in higher financial and environmental costs compared to single-use plastic bags (SUPBs). Reusable bags offer a lesser environmental impact than SUPBs, but this advantage is contingent upon their being used between three to ten times or more (Stafford et al., 2022). This suggests that the efficacy of reusable bags is directly linked to the frequency of their reuse.

Current literature review reveals a complex gap in our understanding of consumer engagement with bag reuse practices, particularly through the lens of holistic sustainability. While prior studies have extensively documented the environmental ramifications of single-use plastic bags (SUPB) and advocated for reusable bags (RB) as an alternative, there remains a significant gap in examining these practices within a framework that equally weighs economic, environmental, and social sustainability

goals. This oversight narrows the scope of understanding consumer behavior by sidetracking the economic and social considerations that might affect the adoption and consistent use of reusable bags.

Furthermore, although the Theory of Planned Behavior (TPB) provides a robust framework for predicting individual actions based on attitudes, subjective norms, and perceived behavioral control, its application has been predominantly centered on environmental outcomes, with less attention to how economic factors and social influences intersect to shape sustainable consumer practices. This study proposes to fill this gap by exploring the determinants of reusable bag usage not only from an environmental standpoint but within a comprehensive sustainability framework that encompasses economic viability and social acceptability.

By integrating economic and social dimensions with environmental considerations, the research aims to offer a comprehensive understanding of the factors that drive or hinder the reuse of reusable bags. This approach not only aligns with a more holistic definition of sustainability but also opens avenues for developing multifaceted interventions that are economically feasible, socially embraced, and environmentally beneficial, thereby advancing our understanding of sustainable consumer behavior in a more integrated and actionable manner.

2. Literature review

The decision to adopt reusable bags is influenced by various factors including awareness, social norms, and individuals' perception of control over their actions. The Theory of Planned Behavior (TPB) elucidates the mechanisms underlying people's attitudes towards objects and their sustainable consumption behaviors, yet there remains a gap in understanding the specific usage patterns of reusable bags and the factors influencing these choices. This section aims to provide an overview of existing literature in this domain.

Research integrating the TPB has shed light on the determinants of purchasing environmentally sustainable products. It has been shown that environmental knowledge positively impacts attitudes towards green products, although the influence of subjective norms on purchase intention appears negligible. Furthermore, a positive correlation between purchase intention and behavior has been observed. Karmarkar and Bollinger (2015) explored how the act of bringing reusable bags affects consumer choices in grocery stores, finding that personal bag use promotes the purchase of both indulgent and environmentally friendly items.

Ertz et al. (2017) applied the TPB to examine the adoption of reusable containers in Western and Asian contexts, incorporating motivational factors into the TPB constructs. The study highlighted the role of attitudes and motivation in shaping intentions, with cultural differences affecting how situational factors influence intentions and behaviors. Arifani and Haryanto (2018) and Muposhi et al. (2021) investigated factors influencing the choice of reusable shopping bags in Indonesia and South Africa, respectively, noting the significant roles of attitude, personal norms, and demographic characteristics in determining usage. Zainudin et al. (2021) incorporated environmental tax factor in basic TPB model to examine its impact on SUPB usage. The results show that a majority of consumers shifted to reusable bag after imposition

of environmental tax on single use plastic bags. In addition, the impact of subjective norms is also found positive in using reusable bags.

Ekasari and Zaini (2020) applying the TPB with an emphasis on moral norms, found a positive relationship between most variables and the intention to use reusable bags, except for subjective norms which negatively affected intentions. Asih et al. (2020) linked environmental consciousness with the use of eco-friendly alternatives, underscoring the need for collaborative efforts in promoting green product initiatives. Subsequent studies by Ekasari et al. (2021) and Muposhi et al. (2021) further explored the attitudes and intentions surrounding reusable bag usage, incorporating additional factors like moral standards, lifestyle, and social influences.

Wang and Li (2022) and Yan et al. (2022) expanded on the TPB by integrating locus of control and environmental concern, revealing indirect effects on consumers' attitudes and intentions. These studies highlight the importance of addressing barriers to promote sustainable purchasing behavior.

Ishak et al. (2023) applied TPB to examine reusable bag usage behavior among Malaysian. The findings indicate that consumer's intention to use reusable bag directly associated with his/her awareness about environmentally friendly bags. In addition, the price and design of these bags are also important determinants to influence consumer intention to use reusable bags.

Wang et al. (2023) examined the impact of environment risk perception on plastic avoidance behavior by considering government trust and environmental locus control as mediating factors. The results indicate that pro environmental awareness encourages plastic avoidance attitude and environmental locus of control partially mediate this association. In addition, the estimate also exhibits that government trust has inverse moderating impact on plastic avoidance behavior which means that higher government trust decreases public passion for environment friendly behavior because such high level of government trusts leads reduces people responsibility to protect environment.

Badawai et al. (2023) analyzed tourists' behavior toward plastic usage with the help of TPB. The study incorporated awareness factor to describe tourists' behavioral intention to in basic TPB model. The results indicate that SN, PBC and awareness about consequences positively affect tourists' intentions to avoid plastic waste. However, the impact of attitude was found insignificant. therefore, the findings propounded that educating people about the environmental consequences of plastic can be proved successful in reducing plastic usage.

Despite the insights offered by the TPB on environmentally friendly products, a notable research gap is the lack of focus on the frequency of reusable bag which is essential aspect of sustainability that remains underexplored. This gap suggests that the full impact of reusable bags on sustainability and consumer behavior dynamics may not be fully captured without examining reuse patterns. Addressing this, the current study aims to fill this void by meticulously investigating the frequency of reusable bag reuses, thereby providing a comprehensive understanding of their role in sustainable consumption.

3. Methodology

The Theory of Planned Behavior (TPB) is a psychological model that predicts deliberate behavior based on three key components: perceived behavioral control, subjective norms, and attitudes towards the behavior. This model suggests that an individual's behavior is determined by their intention to perform the behavior, which in turn is influenced by these three factors. In this section, we formulate hypotheses based on the TPB to explore the determinants of reusable bag consumption (RBC).

Reusable Bag Consumption (RBC) is the outcome variable in our study. RBC, integrated into the TPB framework for our model, assesses the actual behavior of individuals regarding reusable bag use. Specifically, it seeks to quantify the average number of times a person uses a single reusable bag before discarding it or obtaining a new one. This measure will help gauge the effectiveness of reusable bags as an environmentally friendly alternative to single-use plastic bags. A higher frequency of use per reusable bag indicates more efficient utilization and a corresponding reduction in the consumption of single-use plastic bags, thus diminishing environmental impact. As illustrated in **Figure 1**, attitude towards reusable bags encapsulates the individual's personal evaluation and feelings about using reusable bags.
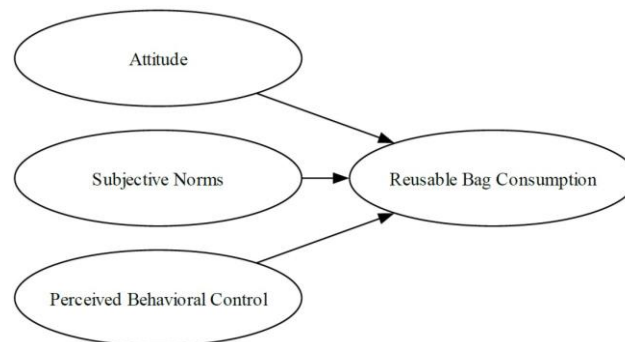

Figure 1. Conceptual framework.

3.1. Attitude towards reusable bag consumption

Recent studies affirm a positive relationship between consumer attitudes and the reuse of reusable bags. Yan et al. (2022) demonstrate that consumer values directly shape attitudes towards reusable bags, influencing their usage. Timyan and Sadachar (2020) link positive attitudes towards brands and the intentional reuse of branded reusable bags, highlighting attitudes' impact on behavior. Similarly, Arias and Trujillo (2020) show that attitudes embodied as perceived consumer effectiveness can encourage reusable bag adoption, suggesting attitudes' role in fostering sustainable behaviors. Moreover, Zaman et al. (2023) reveal that ethical self-identity and attitudes predict consumer behavior towards biodegradable bags, underscoring the broader influence of attitudes on sustainable consumption. Together, these studies support the hypothesis that positive attitudes towards environmental values and ethical considerations significantly influence the reuse of reusable bags.

Hypothesis 1: There is a positive relationship between attitude and reuse of reusable bag.

3.2. Subjective norms towards reusable bag consumption

Subjective norms, as a component of the Theory of Planned Behavior (TPB) have been identified as a pivotal factor influencing the reuse of reusable bags. Wang and Li (2022) confirm the positive influence of subjective norms on consumers' intentions to bring reusable bags for shopping, highlighting the role of social influence in shaping pro-environmental behaviors. Similarly, Chang and Chou (2018) observe a positive impact of subjective norms on both the intention to use and the actual frequency of reusable bag usage, further substantiating the link between societal expectations and individual actions. Ekasari (2020) enhances this perspective by revealing how subjective norms, alongside attitudes and perceived consumer effectiveness, significantly sway consumers' intentions to use reusable bags, indicating the persuasive power of social norms. Ekasari (2020) supports these findings, identifying subjective norms as a strong predictor for the behavioral intention to use reusable bags. Together, these studies form a coherent narrative that validates the hypothesis of a positive relationship between subjective norms and the reuse of reusable bag consumption, illustrating how the expectations of others can drive individuals towards more sustainable consumption patterns.

Hypothesis 2: Subjective norms have a positive relationship with reuse of reusable bag.

3.3. Perceived behavioral control towards reusable bag consumption

Perceived behavioral control has been consistently shown to exert a positive effect on the reuse of reusable bags, as evidenced by multiple studies within the framework of the Theory of Planned Behavior (TPB). Arias and Trujillo (2020) highlight how perceived consumer effectiveness, a proxy for perceived behavioral control, significantly encourages the adoption of reusable shopping bags, thereby facilitating pro-environmental recycling behaviors. This is echoed by Wang and Li (2022), who found that perceived behavioral control was the strongest predictor of intentions to bring reusable bags for shopping among Chinese consumers, surpassing even attitudes and subjective norms in its influence. Similarly, Timyan and Sadachar (2020) identify perceived convenience, an aspect of perceived behavioral control, as crucial for the actual reuse of Lululemon's reusable shopping bags. Chang and Chou (2018) further validate these findings by demonstrating that perceived behavioral control, alongside consumers' attitudes, directly impacts the intention to bring one's own shopping bags, reinforcing the notion that individuals are more likely to engage in behaviors they feel they have control over.

Hypothesis 3: Perceived behavioral control positively affects reuse of reusable bag.

These hypotheses serve as the foundation for investigating the factors that influence reusable bag consumption, utilizing the TPB as a guiding framework. The Theory of Planned Behavior (TPB) was selected for its comprehensive framework that captures the psychological determinants of pro-environmental behavior, notably attitudes, subjective norms, and perceived behavioral control (PBC). This model was deemed particularly apt for our study on reusable bag (RB) usage due to its proven applicability in predicting environmental behaviors. The decision to exclude the

'intentions' variable was a deliberate methodological choice, premised on our focus on actual behavior rather than predisposition to behavior. This approach aligns with our objective to empirically identify the determinants influencing the use of RBs over single-use plastic bags (SUPB) within an ecological impact reduction framework. Our research contributes to the existing body of knowledge by providing empirical evidence from a new geographical context, Lahore, and by underscoring the paramount importance of PBC as the strongest predictor of RBC. This highlights the necessity of enhancing consumers' control over using RBs to foster sustainable consumption patterns. Furthermore, our study enriches the dialogue on the applicability of TPB in the domain of sustainable consumer behaviors by demonstrating the congruence of findings from both regression analysis and Structural Equation Modeling (SEM), thereby offering robust evidence of the model's predictive capability in encouraging pro-environmental choices. By exploring these relationships, this study aims to contribute valuable insights into promoting more sustainable consumption behaviors.

3.4. Data

In this research, we employed a robust multistage random sampling approach to collect data from individuals regarding their use of single-use plastic bags versus reusable shopping bags within the Lahore district, utilizing a detailed questionnaire survey. Initially, our selection process involved randomly choosing two towns (Allama Iqbal and Gulberg) from the nine towns that comprise the district (Wikipedia, 2023). Within these towns, we then randomly selected 16 markets to serve as our primary sampling units. To ensure a broad and representative sample, we proceeded to randomly select individuals within these markets (**Figure 2**). The final stage of sampling involved the random selection of individuals who were present, consented to participate in the study, and completed the questionnaire survey, ensuring that each individual in the markets had an equal probability of being included.
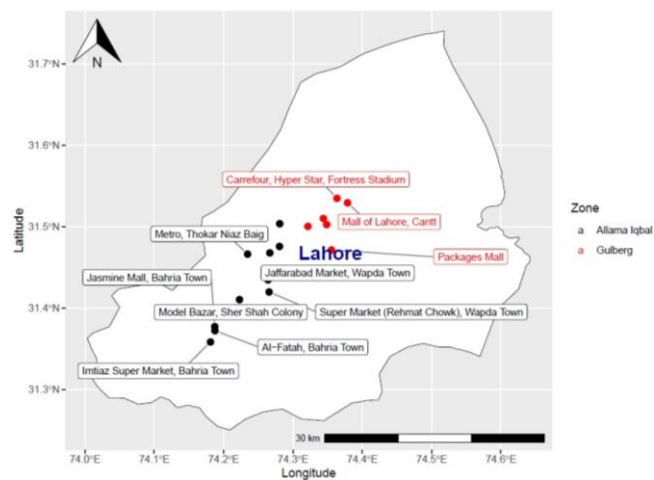

Figure 2. Markets in the study area.

To ascertain the adequacy of our sample size for the intended statistical analyses, we utilized the GPower software (version 3.1.9.7), setting our effect size (f^2) at 0.05, alpha error probability at 0.01, and power ($1 - \beta$ error probability) at 0.95. This

preliminary analysis indicated a need for a sample of 617 participants. However, acknowledging the design complexities introduced by our multistage sampling method, we calculated a design effect (Deff) of 1.32, using an intra-cluster correlation coefficient (ICC) of 0.01 (Westgate, 2016) and an average cluster size (m) of 33, which is reflective of the number of individuals sampled per market. Consequently, our initial sample size was adjusted to 814 individuals. This adjustment takes into account the non-independence of observations within clusters, ensuring that the sample size remains robust for the multilevel nature of our SEM analysis, thus preserving the study's statistical validity and the reliability of its findings. A survey questionnaire used in order to gather information from consumers in a metropolitan area of Lahore. The questionnaire comprises three distinct sections. Participants provide their age, gender, occupation, and level of education in the first section. The second section delves into the TPB constructs, encompassing components like AT, SN, PBC, and RBC. All survey items are assessed using a standardized five-point Likert scale, facilitating a consistent and comparable measurement across responses. This structured approach ensures a comprehensive exploration of both participant demographics and the key psychological factors influencing reusable bag usage within the framework of the TPB. All constructs and their corresponding measurement items are located in the Appendix section.

3.5. Estimation strategy

3.5.1. Structural equation modeling (SEM)

We used Structural Equation Modeling (SEM) for the data analysis in our study, particularly for exploring the nuanced dynamics among attitudes (AT), subjective norms (SN), perceived behavioral control (PBC), and reusable bag consumption (RBC) as posited in the Theory of Planned Behavior (TPB). This approach is appropriate for dissecting the intricate relationships between the directly measured variables (AT, SN, PBC, and RBC) and the underlying psychological constructs they represent.

By integrating the hypotheses developed from the TPB regarding how these variables interconnect, SEM constructs a comprehensive model that maps out both observable and latent dimensions of consumer behavior towards reusable bag usage. The model not only estimates the direct associations among our observed variables but also delves into the latent psychological mechanisms that drive these behaviors.

Using SmartPLS software, we aim to scrutinize the fit of our conceptual model against the collected data, leveraging fit indices such as the Normed Fit Index (NFI) and the Standardized Root Mean Square Residual (SRMR). These indices will be instrumental in assessing the model's goodness of fit, with values closer to the ideal indicating a robust alignment between our theoretical constructs and the empirical evidence.

3.5.2. Regression analysis

We supplemented the Structural Equation Modeling (SEM) with regression analysis in exploring the use of reusable bag consumption (RBC) to provide a comprehensive understanding of the underlying dynamics. While SEM offers a holistic view of the relationships between constructs within the Theory of Planned

Behavior, regression analysis allows for the precise estimation of the impact of individual variables associated with latent constructs such as attitudes (AT), subjective norms (SN), and perceived behavioral control (PBC) on RBC. A general regression econometric model can be specified as in which each latent variable includes all of the associated variables:

$$RBC_i = \beta_0 + \beta_1 AT_i + \beta_2 SN_i + \beta_3 PBC_i + \varepsilon_i$$

where RBC_i represents the outcome variable, reusable bag consumption, which reflects the actual behavior of individuals regarding the usage of bags. The term AT_i denotes attitude, reflecting an individual's overall evaluation of using reusable bags. SN_i stands for subjective norm, which predicts how an individual perceives social pressure or norms regarding bag usage. PBC_i is perceived behavioral control, capturing the individual's perception of the ease or difficulty in adopting the habit of using reusable bags.

4. Results

4.1. Descriptive statistics

Table 1 reveals some interesting insights into the sample's attitudes and behaviors regarding reusable bag usage. The mean age of the 814 respondents is 31.6 years, with around 68% being male. On average, they have received nearly 14 years of education. Interestingly, the respondents seem to have a relatively positive attitude towards using reusable bags, with mean scores of 4.3 and 4.5 (out of 5) for the importance of using reusable bags and their perception of reusable bags being good for the environment, respectively. The subjective norms regarding reusable bag usage appear to be moderate, with a mean score of 3.6 for the importance of following friends/family opinions, but lower means of 1.9 and 1.1 for whether their friends and family think they should use reusable bags or if they feel pressure to do so. Regarding the types of reusable bags people use (RBC3), 20.39% reported using cloth bags, 19.16% paper bags, 25.80% opted for reusable plastic (polypropylene) bags, 22.48% use jute bags, and 12.16% chose other types of bags.

Table 1. Descriptive statistics.

Variables	N	Mean	SD	Min	Max
Age	814	31.611	8.260	17	65
Gender: Male %	814	67.690	-	-	-
Gender: Female %	814	32.310	-	-	-
Education level (years)	814	13.991	2.818	5	21
AT1: How important it is for you to use RB instead of SUP?	814	4.305	0.851	1	5
AT2: To what extent is RB good for environment?	814	4.491	0.859	1	5
AT3: Does use of RB make a positive statement about your personal values?	814	2.921	1.562	1	5
SN1: How important it is to follow the opinion of friends/family about use of RB?	814	3.614	1.102	1	5
SN2: To what extent your friends and family think you should use RB?	814	1.892	1.246	1	5
SN3: Do you feel pressure from friends and family to use RB?	814	1.072	0.492	1	5
PBC1: How often do you have access to reusable bags when you go shopping?	814	3.603	0.971	1	5

Table 1. (*Continued*).

Variables	N	Mean	SD	Min	Max
PBC2: How easy do you think it is to remember to bring RB when shopping?	814	2.861	1.286	1	5
PBC3: To what extent do you have control over the use of RB?	814	3.124	1.136	1	5
RBC1: How often do you use reusable bags when shopping?	814	3.553	1.014	1	5
RBC2: How many reusable bags do you own?	814	3.414	1.473	1	5
RBC4: How many times do you use one reusable bag?	814	2.043	1.226	1	5

Note: Variables AT1 and SN1 have five categories including Very unimportant, Unimportant, Neutral, Important, and Very important. Variables AT2, AT3, SN2, SN3, and PBC3 have five categories including Not at all, Slightly, Moderately, quite a lot, and A lot. Variables PBC1 and RBC1 have five categories including Never, Rarely, Occasionally, Frequently, and Always. Variable PBC2 has five categories including Very difficult, Difficult, moderately difficult, Easy, and Very easy. Variables RBC2 and RBC4 have five categories including 1, 2, 3, 4, and 5+. Variable RBC3 has five categories including Cloth, Paper, Reusable plastic (polypropylene), Jute, and Other.

Perceived behavioral control is mixed, with a mean of 3.6 for having access to reusable bags while shopping, but lower means of 2.9 and 3.1 for ease of remembering to bring reusable bags and perceived control over their usage, respectively. Interestingly, the self-reported reusable bag usage behavior seems to be higher than the subjective norms and perceived behavioral control scores might suggest. The mean score for frequency of using reusable bags while shopping is 3.6 (out of 5), and the average number of reusable bags owned is 3.4. However, the means for the type of reusable bags used (2.9) and the number of times a single reusable bag is used (2.0) are relatively lower.

4.2. Structural equation model

The evaluation of constructs within the model was rigorously conducted, leveraging Confirmatory Factor Analysis (CFA) to assess construct validity and employing reliability analysis metrics to ensure the reliability of the constructs, as posited by Lewis (2017). Internal consistency in reliability analysis is measured by Cronbach's alpha and composite reliability. The degree to which a collection of things is measuring a single underlying concept may be determined using both metrics. As per Hair et al. (2012), 0.70, reliability indicators provide reliability statistics that above the minimum requirements. For most research purposes, it is generally agreed upon that a Cronbach alpha of 0.60 or above is appropriate, hence every Cronbach Alpha Coefficient was higher than 0.6 (Ahmad et al., 2016) the construct dependability is thus proven.

Factor loadings, a pivotal aspect of CFA, varied within the standard range of −1 to 1, indicating a substantial relationship between observable variables and latent components; with all loadings exceeding the threshold of 0.4 (**Table 2**), establishing a strong validity for the model's constructs (Pett et al., 2003).

Reliability, encapsulated through internal consistency, was measured by Cronbach's alpha and composite reliability (CR). These metrics validated the repeatability and internal consistency of the constructs, with every Cronbach's alpha coefficient surpassing the minimum acceptable value of 0.6, thus affirming construct dependability. The CR values further corroborated these findings, exceeding the benchmark of 0.70, which signifies a high level of reliability for the constructs under

study.

Table 2. Reliability and validity of latent variables.

Constructs and their related items	Cronbach's α	CR	AVE	F.L.s
Attitude (AT)	0.759	0.863	0.682	-
AT1	-	-	-	0.914
AT2	-	-	-	0.908
AT3	-	-	-	0.623
Subjective Norms (SNs)	0.682	0.777	0.55	-
SN1	-	-	-	0.817
SN2	-	-	-	0.862
SN3	-	-	-	0.49
Perceived Behavior Control (PBC)	0.759	0.862	0.675	-
PBC1	-	-	-	0.813
PBC2	-	-	-	0.805
PBC3	-	-	-	0.846
Reusable bag consumption (RBC)	0.686	0.705	0.467	-
RBC1	-	-	-	0.895
RBC2	-	-	-	0.782
RBC3	-	-	-	-0.089
RBC4	-	-	-	0.671

Note: Cronbach's alpha (α) (> 0.7) (Taber, 2018), composite reliability ($CR > 0.7$) (Feng et al., 2017), AVE: Average variance extracted (> 0.5) (Nasution et al., 2020), FLs: Factor loadings (> 0.5) (Eraslan Yalcin and Kutlu, 2019).

Convergent validity was assessed to ensure that different measures of the same construct are correlated. It was demonstrated through the average variance extracted (AVE) criteria, with a standard of 0.50 or higher as an indicator of satisfactory convergent validity. Despite an exception with the Reusable bag consumption (RBC) construct, all other constructs met this criterion, thereby not undermining the overall convergent validity, further supported by CR values above 0.70. This comprehensive analysis confirms the robustness of construct validity and reliability within the research framework, as evidenced by the detailed metrics provided in the referenced table, illustrating a thorough and rigorous evaluation process characteristic of top-tier journal standards.

The assessment of discriminant validity within the model was meticulously carried out using several rigorous methods to ascertain the distinctiveness of the constructs. The Fornell and Larcker criterion played a pivotal role in this evaluation, requiring a comparison between the square root of the Average Variance Extracted (AVE) for each construct and the correlations among constructs. The square roots of AVEs were consistently higher than the inter-construct correlations, providing substantial evidence of discriminant validity within the model, as detailed in the corresponding table (See **Table 3**).

The Heterotrait-Monotrait (HTMT) ratio, another pivotal metric, was utilized to validate discriminant validity. Despite the ongoing debate regarding the appropriate

threshold for the HTMT ratio—ranging from 0.85 as suggested by Kline (2011) to a more lenient criterion of .90 proposed by Teo (2008)—the model's HTMT ratios fell within acceptable bounds, affirming discriminant validity across the constructs. The results, presented in the corresponding table (See **Table 4**), further substantiate the model's discriminant validity.

Table 3. Discriminant validity: Fornell-Larcker criterion.

Factors	AT	SN	PBC	RBC
AT	0.826	-	-	-
SN	0.398	0.742	-	-
PBC	0.475	0.435	0.822	-
RBC	0.533	0.489	0.708	0.684

Table 4. Heterotrait-Monotrait ratio (HTMT).

Factors	AT	SN	PBC	RBC
AT	-	-	-	-
SN	0.567	-	-	-
PBC	0.61	0.623	-	-
RBC	0.723	0.794	0.889	-

The structural model assessment conducted in this study focused on the statistical significance of path coefficients to understand the relationships between the constructs involved. Utilizing Structural Equation Modeling (SEM), the analysis leveraged indices such as the Normed Fit Index (NFI) and the Standardized Root Mean Square Residual (SRMR) to evaluate the model's fit. The SRMR value, as suggested by Hu and Bentler (1999) was below the threshold of 0.08, specifically at 0.047, indicating a satisfactory model fit. Similarly, the NFI, an incremental fit measure introduced by Bentler and Bonett (1980), yielded a value of 0.913. According to Lohmöller (1989), NFI values above 0.9 are indicative of acceptable fit, confirming the adequacy of the proposed SEM model (See **Table 5**).

Table 5. Goodness of fit.

Index	Saturated model	Estimated model
SRMR	0.047	0.047
NFI	0.913	0.913

Hypothesis testing within the model further elucidated the dynamics between the constructs (**Figure 3**). The first hypothesis (H1) posited that Attitude (AT) significantly and positively affects Reusable Bag Consumption (RBC), which was confirmed with a beta coefficient of 0.211, a *t*-value of 8.120, and a *p*-value of less than 0.001, indicating a significant positive impact. The second hypothesis (H2) suggested that Subjective Norms (SN) significantly and positively influence RBC, which was supported by a beta coefficient of 0.173, a *t*-value of 6.355, and a *p*-value of less than 0.001. The third hypothesis (H3) asserted that Perceived Behavioral Control (PBC) significantly and positively affects RBC, validated by the strongest beta

coefficient among the hypotheses at 0.533, a *t*-value of 21.568, and a *p*-value of less than 0.001 (See **Table 6**).
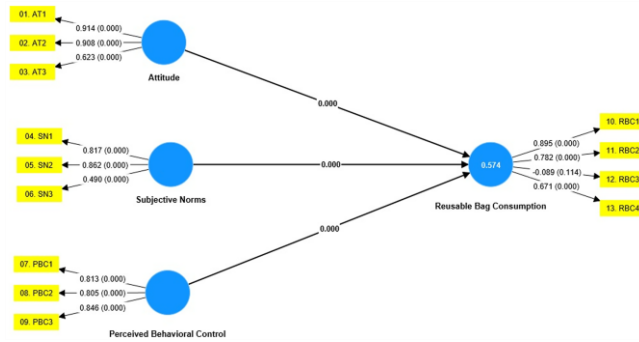

Figure 3. Estimated structural equation model.

Table 6. Hypothesis testing: Direct relationship.

Hypothesis	β	S.E.	*T* statistics	*P* values
H1: AT → RBC	0.211	0.026	8.12	0.001
H2: SN → RBC	0.173	0.027	6.355	0.001
H3: PBC → RBC	0.533	0.025	21.568	0.001

These findings underscore the significant positive relationships between the constructs of attitude, subjective norms, perceived behavioral control, and reusable bag consumption, affirming the proposed hypotheses. The robustness of the model fit, coupled with the conclusive hypothesis testing, demonstrates a comprehensive and methodologically sound analysis characteristic of high-tier academic research.

4.3. Regression analysis

Utilizing the Theory of Planned Behavior (TPB) as a framework, this analysis delineates how attitudes, subjective norms, and perceived behavioral control influence the usage of reusable bags (**Table 7**). Notably, educational attainment markedly augments the propensity to utilize reusable bags, with a significant relationship underscored in Model 1, highlighting that gender plays a pivotal role, with females more inclined towards reusable bag usage compared to males ($\beta = 0.626, p < 0.001$).

The attitude towards reusable over single-use plastic bags (SUP) exhibits a positive influence on usage frequency ($\beta = 0.373, p < 0.05$), yet other attitudinal facets (AT2 and AT3) do not significantly impact behavior. Subjective norms, particularly the perceived pressure from friends and family (SN3), significantly encourage reusable bag usage ($\beta = 0.608, p < 0.05$). Perceived Behavioral Control (PBC) variables, notably the access to and the ease of remembering reusable bags, demonstrate strong positive effects on usage ($\beta = 0.874, p < 0.001$ for PBC1 and $\beta = 0.404, p < 0.001$ for PBC2), emphasizing the importance of logistical and habitual factors.

In Model 2, age shows a significant positive effect on the ownership of reusable bags ($\beta = 0.051, p < 0.001$), with the significance of education and gender remaining consistent. Changes in the significance of subjective norms and perceived behavioral control variables suggest nuanced effects on reusable bag ownership and

usage frequency.

Table 7. Effect of attitudes, subjective norms, and perceived behavioral control on reusable bag consumption models (RB1, RB2, and RB4).

Outcome variables	RBC1	RBC2	RBC4
Age	0.010	0.051***	0.006***
	(0.90)	(5.43)	(3.47)
Education	0.136***	0.145***	−0.033***
	(6.23)	(6.33)	(−5.44)
Gender	0.626***	0.891***	0.105**
	(4.19)	(5.31)	(2.70)
AT1	0.373*	0.429*	0.066
	(2.17)	(2.07)	(1.32)
AT2	0.212	0.129	0.007
	(1.47)	(0.99)	(0.13)
AT3	0.088	0.044	−0.001
	(1.12)	(0.48)	(−0.06)
SN1	0.064	0.019	0.081***
	(0.64)	(0.21)	(3.34)
SN2	0.103	0.192*	0.044**
	(1.12)	(2.57)	(3.03)
SN3	0.608*	0.037	0.082**
	(2.35)	(0.23)	(2.65)
PBC1	0.874***	0.009	−0.022
	(5.85)	(0.05)	(−0.91)
PBC2	0.404***	0.244**	0.132***
	(5.40)	(3.16)	(8.38)
PBC3	0.730***	0.218*	0.069**
	(6.68)	(2.12)	(3.01)
_cons	-	-	−0.402*
	-	-	(−2.18)
cut1	4.448***	5.864***	-
	(5.88)	(9.28)	-
cut2	9.786***	7.237***	-
	(10.83)	(12.77)	-
cut3	12.984***	8.552***	-
	(12.59)	(15.42)	-
cut4	15.345***	9.033***	-
	(13.77)	(16.01)	-
N	814	814	814
ll	−733.595	−1022.892	−1200.097
chi2	-	-	1768.389
p	-	-	0.000

t statistics in parentheses, *p < 0.05, (**) p < 0.01, (***) p < 0.001.

Model 3's Poisson regression analysis further confirms the ongoing influence of demographic factors, albeit with smaller coefficients, indicating variations in the count of reusable bag uses associated with age and gender differences. Notably, the perceived importance of friends and family's opinions (SN1, $\beta = 0.081, p < 0.001$; SN2, $\beta = 0.044, p < 0.01$) and the ease of remembering to bring bags (PBC2, $\beta = 0.132, p < 0.001$) significantly enhance bag reuse frequency, underlining the substantial impact of social norms and habitual control over environmental behaviors.

Table 8. Effect of attitudes, subjective norms, and perceived behavioral control on reusable bag consumption models (RB3).

Outcome variable: RBC3	Polypropylene	Cloth	Paper	Jute	Other
Age	0.000	0.000	−0.019	−0.013	−0.017
	(.)	(0.04)	(−1.94)	(−0.90)	(−1.70)
Education	0.000	−0.026	0.009	−0.089	0.024
	(.)	(−0.52)	(0.10)	(−1.44)	(0.48)
Gender	0.000	0.510	0.359	0.053	0.194
	(.)	(1.90)	(1.24)	(0.21)	(1.33)
AT1	0.000	0.127	−0.535**	−0.198	0.126
	(.)	(0.41)	(−2.72)	(−0.95)	(0.55)
AT2	0.000	0.378	0.341**	0.507*	0.306
	(.)	(1.87)	(3.23)	(2.50)	(1.40)
AT3	0.000	0.322**	0.061	0.204	0.076
	(.)	(3.03)	(0.38)	(1.47)	(1.00)
SN1	0.000	−0.412*	0.045	0.107	−0.134
	(.)	(−2.02)	(0.27)	(0.43)	(−0.45)
SN2	0.000	0.509***	0.087	0.317**	0.342
	(.)	(4.69)	(0.66)	(2.93)	(1.44)
SN3	0.000	0.803*	0.141	−0.114	0.564*
	(.)	(2.29)	(0.47)	(−0.24)	(2.07)
PBC1	0.000	0.204	0.235	0.042	−0.302
	(.)	(0.76)	(0.75)	(0.12)	(−1.54)
PBC2	0.000	0.104	−0.082	−0.227***	−0.007
	(.)	(0.84)	(−1.46)	(−3.51)	(−0.07)
PBC3	0.000	−1.221***	−0.190	−0.477	−0.585*
	(.)	(−4.57)	(−0.77)	(−1.78)	(−2.01)
_cons	0.000	−0.961	0.207	0.660	−0.511
	(.)	(−0.60)	(0.10)	(0.33)	(−0.28)
N	814	-	-	-	-
Ll	−1173.849	-	-	-	-

t statistics in parentheses, *p < 0.05, (**) p < 0.01, (***) p < 0.001. Note: Polypropylene is the base outcome.

Table 8 gives the estimates of a multinomial logit model which examines the

preferences for Cloth, Paper, Jute, and other materials against a baseline of Polypropylene bags. The findings indicate no significant effect of Age and Education on the overall choice of reusable bag types, except for a notable negative association between Age and the preference for Paper over Polypropylene bags ($\beta = -0.019, p < 0.05$), suggesting a demographic skew towards younger individuals favoring paper bags. Gender demonstrates a significant inclination towards Cloth bags over Polypropylene ($\beta = 0.510, p < 0.05$), highlighting gender differences in material preference, with female consumers more likely to opt for cloth.

Attitudinal factors reveal distinct influences on material choice: the belief in the importance of using reusable bags negatively affects the selection of Paper bags ($\beta = -0.535, p < 0.01$), indicating those valuing reusable bags are less inclined towards paper. Conversely, attitudes regarding the environmental benefits of reusable bags positively impact the preference for Cloth, Paper, and Jute, with significant effects observed for Paper ($\beta = 0.341, p < 0.01$) and Jute ($\beta = 0.507, p < 0.05$), suggesting that environmental considerations drive the choice of these materials. Furthermore, the positive personal statement associated with using reusable bags significantly favors Cloth over Polypropylene ($\beta = 0.322, p < 0.01$), reflecting the influence of personal values on material selection.

Subjective norms also significantly affect material choice: the influence of friends and family shows a negative association with Cloth over Polypropylene ($\beta = -0.412, p < 0.05$), whereas approval from these social circles significantly increases the preference for Cloth ($\beta = 0.509, p < 0.001$) and Jute ($\beta = 0.317, p < 0.01$), indicating the pivotal role of social approval. Additionally, perceived pressure to use reusable bags enhances the likelihood of choosing Cloth ($\beta = 0.803, p < 0.05$) and other materials ($\beta = 0.564, p < 0.05$), underscoring the influence of social norms.

Perceived behavioral control reveals that the ease of remembering to bring reusable bags negatively influences the choice of Jute over Polypropylene ($\beta = -0.227, p < 0.001$), suggesting practical considerations affect material preferences. Similarly, perceived control over using reusable bags significantly deters the selection of Cloth ($\beta = -1.221, p < 0.001$) and other materials ($\beta = -0.585, p < 0.05$) compared to Polypropylene, indicating convenience and availability concerns.

5. Discussion

The study's regression and Structural Equation Modeling (SEM) analyses provide compelling evidence supporting the Theory of Planned Behavior (TPB) in the context of reusable bag consumption (RBC). Both analytical approaches reveal a positive relationship between attitudes (AT), subjective norms (SN), and perceived behavioral control (PBC) towards the adoption of reusable bags. Specifically, regression results demonstrated significant positive impacts of AT on RBC ($\beta = 0.211, p < 0.001$), aligning with SEM findings that corroborate the direct influence of AT, SN, and PBC on individuals' intentions and behaviors towards reusable bag usage. This synergy between regression and SEM outcomes underscores a unified narrative: positive attitudes, social influences, and control perceptions significantly drive environmental-friendly practices.

The consistency across both regression and SEM analyses accentuates the critical

role of AT in fostering pro-environmental behavior, affirming that individuals with a favorable disposition towards reusable bags are more likely to use them. This is congruent with prior studies (Wang and Li, 2022; Yadav and Pathak, 2016) that have identified a strong attitudinal influence on sustainable consumption patterns. Such findings highlight the necessity of cultivating positive environmental attitudes among consumers to enhance RBC.

Moreover, the significant role of SN and PBC, as revealed in the analyses, suggests that the social environment and perceived ease of engaging in a behavior profoundly affect individuals' actions. The impact of social norms and control perceptions on RBC underscores the importance of a supportive social milieu and the need for interventions to increase awareness and accessibility of reusable bags.

Additionally, the study underscores the effectiveness of social advertising in modifying AT towards reusable bag usage. As evidenced by Muralidharan and Sheehan (2016), social ads, irrespective of their framing (gain or loss), can significantly influence individuals' attitudes and, consequently, their behavior. This suggests that well-crafted messages emphasizing the benefits of reusable bags or the consequences of not using them could serve as potent tools in environmental advocacy.

The integration of Structural Equation Modeling (SEM) and regression analysis in our investigation into the impact of subjective norms (SN) on reusable bag consumption (RBC) yields a coherent narrative, both analytical methods pointing towards a conclusive affirmation of the positive influence of SN on RBC. Specifically, the regression analysis presents a significant positive correlation between SN and RBC, demonstrated by a coefficient value of $\beta = 0.173$ and a *t*-value of 6.355 ($p < 0.001$). This finding is mirrored in the SEM results, which also highlight a statistically significant pathway from SN to RBC, thus substantiating the hypothesis of SN's favorable impact on the usage of reusable bags.

This concordance between SEM and regression findings underscores a pivotal aspect of environmental behavior: The role of social influence in shaping individual actions towards sustainability. Both methodologies corroborate the notion that perceptions of social approval and expectations significantly contribute to the adoption of pro-environmental practices such as reusable bag use. This alignment is particularly noteworthy, reinforcing the reliability and validity of the observed effect of SN on RBC across different statistical analyses.

The moderate effect size indicated in the regression analysis, coupled with the SEM findings, suggests that while SN is an important determinant of RBC, its influence is part of a broader interplay of factors affecting environmental behavior. This insight aligns with the literature, where studies have shown varying degrees of SN's impact on pro-environmental actions, reflecting the complex nature of social influences across different contexts and demographics.

The demographic profile of respondents in our study, predominantly female, including housewives and working women, further elucidates the nuanced relationship between SN and RBC. This demographic specificity resonates with findings from Volva and Djamaludin (2018), where SN's influence was notably stronger among housewives, suggesting that social norms may exert differential effects based on social roles and responsibilities.

Both regression and Structural Equation Modeling (SEM) methodologies yield a unanimous conclusion regarding the significant influence of Perceived Behavioral Control (PBC) on the consumption of reusable bags (RBC). The findings across both analytical strategies not only demonstrate a strong positive correlation between PBC and RBC but also indicate PBC as having the most substantial effect among the TPB components, with a notable path weight of 0.533 and statistical significance (β = 0.533; t = 21.568, p < 0.001). This convergence of results from both regression and SEM analyses provides a robust validation of the hypothesis that PBC significantly enhances the likelihood of reusable bag usage, consistent with the broader literature within the TPB framework (Wang and Li, 2022).

The identified paramountcy of PBC in influencing RBC underlines the critical role of individual perceptions of ease and control over the act of using reusable bags. Factors such as accessibility, convenience, and memory influence significantly contribute to this perception, suggesting that interventions aimed at enhancing PBC could significantly elevate RBC levels. This aligns with the theoretical proposition that individuals are more inclined to engage in a behavior when they perceive a higher degree of control over its execution.

Moreover, the substantial predictive power of PBC over other TPB components, as observed in this study and supported by Chang and Chou (2018) and Hasan et al. (2015), emphasizes the need for targeted strategies that address the practical aspects of reusable bag usage. Enhancing accessibility to reusable bags, simplifying their use, and embedding the practice into daily routines could serve as effective measures to bolster PBC and, by extension, RBC.

The survey data revealing usage patterns of reusable bags presents a critical insight: a significant portion of respondents report minimal reuse of their bags, with 46.93% using them only once. This pattern underscores a gap between the adoption of reusable bags and their optimal utilization, which is essential for realizing their environmental benefits over single-use plastic bags. The insights from Stafford et al. (2022) highlight the environmental efficacy of reusable bags contingent upon their repeated use, suggesting a critical area for intervention.

Furthermore, the research emphasizes that the environmental and economic advantages of reusable bags are only realized through their repeated use. It suggests that policy measures should focus not only on promoting reusable bag adoption but also on their sustained use, through strategies such as incentives for repeated use, educational programs, and the production of more durable bags.

While the findings offer valuable insights, several limitations warrant attention for future research. The study's cross-sectional design limits the ability to track long-term behavior changes regarding reusable bag use. A longitudinal approach could provide deeper insights into the variables affecting long-term usage. Additionally, the reliance on self-reported data raises concerns about potential social desirability bias, suggesting the utility of field experiments or observational methods in future studies to garner more accurate data. Lastly, the geographic focus on Lahore restricts the generalizability of the findings. Expanding the research to include diverse regions within Pakistan could enhance the applicability and relevance of the conclusions drawn.

6. Conclusion

This study, utilizing a sample of 814 consumers from a metropolitan area in Lahore and grounded in the Theory of Planned Behavior (TPB), provides substantial evidence supporting TPB's applicability in predicting reusable bag consumption (RBC). The investigation yields three core insights: First, a favorable attitude (AT) towards reusable bags significantly correlates with their increased use, underscoring the need for fostering positive perceptions to boost adoption. Second, the influence of subjective norms (SN) on RBC highlights the power of social endorsement in encouraging reusable bag usage, suggesting the efficacy of social campaigns in promoting acceptance. Third, perceived behavioral control (PBC) stands out as a crucial determinant, indicating that enhancing individuals' sense of control and convenience regarding reusable bag use can significantly elevate adoption rates.

Specifically, this research suggests that individuals, who have a positive AT towards reusable bags, feel compelled by society to utilize them, and feel that they have control over their use are more likely to RBC. By adding further proof of the TPB model's suitability in predicting pro-environmental actions, this study broadens the scope of earlier investigations. Reusable bags are environmentally and economically beneficial only when used multiple times before discarding. Therefore, encouraging the repeated use of RB is a pivotal step in promoting sustainable consumption of reusable bags and mitigating environmental impact. To reinforce this principle, policymakers should consider implementing policies that not only promote the adoption of reusable bags but also emphasize their extended use. Public awareness campaigns should highlight the durability and longevity of reusable bags, emphasizing the environmental benefits derived from their repeated use. One effective strategy is to collaborate with retailers to offer incentives for customers who consistently reuse their bags, such as discounts or loyalty points. Additionally, implementing educational programs in schools and community centers can further instill the value of extended use among individuals, fostering a sense of responsibility towards sustainable consumption. Policymakers should also explore the possibility of introducing regulations that encourage manufacturers to produce durable and long-lasting reusable bags, contributing to the overall goal of reducing single-use plastic waste and promoting a culture of sustainability.

7. Limitation and future research

This study has three possible methodological constraints. First, the study's design was cross-sectional as sample data were only gathered once. The research was not able to thoroughly follow the variables that impact the usage of RB made of non-plastic over time. In order to overcome this limitation, future research may use a longitudinal time horizon to identify the variables that affect the long-term usage of reusable shopping bags. Second, self-reported data were used in research, and social desirability bias might have affected the results. It's possible that those who responded may exaggerate how often they used reusable bags. Future research may use techniques like field experiments or observations to obtain data, which lessen the chance of exaggerated replies. Third limitation relates to the geographic source of respondents, as our research was restricted to the province of Lahore, hence restricting

the applicability of the results. By taking into account other cities in Pakistan, future research may expand on the conclusions of this one.

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References

Ahmad, S., Zulkurnain, N., & Khairushalimi, F. (2016). Assessing the validity and reliability of a measurement model in Structural Equation Modeling (SEM). British Journal of Mathematics & Computer Science, 15(3), 1–8.

Ahmad, W., Kim, W. G., Anwer, Z., et al. (2020). Schwartz personal values, theory of planned behavior and environmental consciousness: How tourists' visiting intentions towards eco-friendly destinations are shaped? Journal of Business Research, 110, 228–236. https://doi.org/10.1016/j.jbusres.2020.01.040

Ajzen, I. (1985). From Intentions to Actions: A Theory of Planned Behavior. In: Kuhl, J., Beckmann, J. (editors). Action Control. Springer Berlin Heidelberg.

Ajzen, I. (1991). The theory of planned behavior. Organizational Behavior and Human Decision Processes, 50(2), 179–211. https://doi.org/10.1016/0749-5978(91)90020-T

Arias, C., & Trujillo, C. A. (2020). Perceived Consumer Effectiveness as A Trigger of Behavioral Spillover Effects: A path towards Recycling. Sustainability, 12(11), 4348. https://doi.org/10.3390/su12114348

Arifani, V. M., & Haryanto, H. (2018). Purchase intention: implementation theory of planned behavior (Study on reusable shopping bags in Solo City, Indonesia). IOP Conference Series: Earth and Environmental Science, 200, 012019. https://doi.org/10.1088/1755-1315/200/1/012019

Asih, D., Setini, M., Soelton, M., et al. (2020). Predicting green product consumption using theory of planned behavior and reasoned action. Management Science Letters, 3367–3374. https://doi.org/10.5267/j.msl.2020.5.042

Atkinson, J. W. (1964). An introduction to motivation. Van Nostrand. D. van Nostrand Co. Ltd.

Badawi, A. N., Adelazim Ahmed, T. S., Alotaibi, E. K., et al. (2024). The Role of Awareness of Consequences in Predicting the Local Tourists' Plastic Waste Reduction Behavioral Intention: The Extension of Planned Behavior Theory. Sustainability, 16(1), 436. https://doi.org/10.3390/su16010436

Bamberg, S. (2003). How does environmental concern influence specific environmentally related behaviors? A new answer to an old question. Journal of Environmental Psychology, 23(1), 21–32. https://doi.org/10.1016/S0272-4944(02)00078-6

Bentler, P. M., & Bonett, D. G. (1980). Significance tests and goodness of fit in the analysis of covariance structures. Psychological Bulletin, 88(3), 588–606. https://doi.org/10.1037/0033-2909.88.3.588

Boyd, A. D., Jardine, C. G., & Driedger, S. M. (2009). Canadian Media Representations of Mad Cow Disease. Journal of Toxicology and Environmental Health, Part A, 72(17–18), 1096–1105. https://doi.org/10.1080/15287390903084629

Chang, S.-H., & Chou, C.-H. (2018). Consumer Intention toward Bringing Your Own Shopping Bags in Taiwan: An Application of Ethics Perspective and Theory of Planned Behavior. Sustainability, 10(6), 1815. https://doi.org/10.3390/su10061815

Chen, Y., Awasthi, A. K., Wei, F., et al. (2021). Single-use plastics: Production, usage, disposal, and adverse impacts. Science of The Total Environment, 752, 141772. https://doi.org/10.1016/j.scitotenv.2020.141772

Durak, S. G. (2016). Investigation and Evaluation of the Effect to Environmental Pollution of Plastic Shopping Bags. Turkish Journal of Scientific Reviews, 9(2), 20–24. https://dergipark.org.tr/tr/download/article-file/418008

Ekasari, A., Rahayu, F., & Diamanta, A. (2021). Understanding Attitude towards Reusable Bag: Its Antecedents and Consequences. International Journal of Science and Society, 3(3), 186–197. https://doi.org/10.54783/ijsoc.v3i3.364

Ekasari, A. (2020). Campaigning Reusable Bag: The Role of Retailers to Achieve Sustainable Consumption. Proceedings of the

International Conference on Management, Accounting, and Economy (ICMAE 2020). https://doi.org/10.2991/aebmr.k.200915.047

Ekasari, A., & Zaini, S. M. (2020). Moral Norm and Theory of Planned Behavior: The Intention to Use Eco-Friendly Reusable Bag. Indonesian Journal of Sustainability Accounting and Management, 4(1), 56. https://doi.org/10.28992/ijsam.v4i1.94

Eraslan Yalcin, M., & Kutlu, B. (2019). Examination of students' acceptance of and intention to use learning management systems using extended TAM. British Journal of Educational Technology, 50(5), 2414–2432. Portico. https://doi.org/10.1111/bjet.12798

Ertz, M., Huang, R., Jo, M.-S., et al. (2017). From single-use to multi-use: Study of consumers' behavior toward consumption of reusable containers. Journal of Environmental Management, 193, 334–344. https://doi.org/10.1016/j.jenvman.2017.01.060

Excell, C., Salcedo-La Viña, C., Worker, J., & Moses, E. (2018). Legal limits on single-use plastics and microplastics: A global review of national laws and regulations. United Nations Environment Programme (UNEP) in partnership with the World Resources Institute (WRI).

Feng, A. L., Wesely, N. C., Hoehle, L. P., et al. (2017). A validated model for the 22-item Sino-Nasal Outcome Test subdomain structure in chronic rhinosinusitis. International Forum of Allergy & Rhinology, 7(12), 1140–1148. Portico. https://doi.org/10.1002/alr.22025

Fishbein, M., & Ajzen, I. (1977). Belief, attitude, intention, and behavior: An introduction to theory and research. Addison-Wesley Publishing Company.

Gamerman, E. (2008). An Inconvenient Bag. The Wall Street Journal.

Hagger, M. S., & Hamilton, K. (2024). Longitudinal tests of the theory of planned behaviour: A meta-analysis. European Review of Social Psychology, 35(1), 198–254. https://doi.org/10.1080/10463283.2023.2225897

Hasan, S. N. M. S., Harun, R., & Hock, L. K. (2015). Application of Theory of Planned Behavior in Measuring the Behavior to Reduce Plastic Consumption Among Students at Universiti Putra Malaysia, Malaysia. Procedia Environmental Sciences, 30, 195–200. https://doi.org/10.1016/j.proenv.2015.10.035

Hu, L., & Bentler, P. M. (1999). Cutoff criteria for fit indexes in covariance structure analysis: Conventional criteria versus new alternatives. Structural Equation Modeling: A Multidisciplinary Journal, 6(1), 1–55. https://doi.org/10.1080/10705519909540118

Ishak, M. F., Mahbob, N. N., & Hasim, M. A. (2023). Determinants of Using Reusable Eco-Friendly Shopping Bags among Gen-Y. Information Management and Business Review, 15(3(I)), 115-123.

Jager, W. (2000). Modelling consumer behaviour. University Library Groningen.

Karmarkar, U. R., & Bollinger, B. (2015). BYOB: How Bringing Your Own Shopping Bags Leads to Treating Yourself and the Environment. Journal of Marketing, 79(4), 1–15. https://doi.org/10.1509/jm.13.0228

Kline, R. B. (2011). Convergence of Structural Equation Modeling and Multilevel Modeling. In: The SAGE Handbook of Innovation in Social Research Methods. SAGE Publications Ltd.

Lebreton, L., & Andrady, A. (2019). Future scenarios of global plastic waste generation and disposal. Palgrave Communications, 5(1). https://doi.org/10.1057/s41599-018-0212-7

Lehmann, S. (2011). Optimizing Urban Material Flows and Waste Streams in Urban Development through Principles of Zero Waste and Sustainable Consumption. Sustainability, 3(1), 155–183. https://doi.org/10.3390/su3010155

Lohmöller, J.-B. (1989). Latent Variable Path Modeling with Partial Least Squares. Physica-Verlag HD. https://doi.org/10.1007/978-3-642-52512-4

Muposhi, A., Mpinganjira, M., & Wait, M. (2021). Factors influencing the use of non-plastic reusable shopping bags: A cognitive-normative-habitual approach. Australian Journal of Environmental Education, 37(3), 306–325. https://doi.org/10.1017/aee.2021.9

Muralidharan, S., & Sheehan, K. (2016). "Tax" and "Fee" Message Frames as Inhibitors of Plastic Bag Usage Among Shoppers. Social Marketing Quarterly, 22(3), 200–217. https://doi.org/10.1177/1524500416631522

Nasution, M. I., Fahmi, M., Jufrizen, Muslih, & Prayogi, M. A. (2020). The Quality of Small and Medium Enterprises Performance Using the Structural Equation Model-Part Least Square (SEM-PLS). Journal of Physics: Conference Series, 1477(5), 052052. https://doi.org/10.1088/1742-6596/1477/5/052052

Patel, K. R. (2023). Harmonizing sustainability, functionality, and cost: Navigating responsible packaging innovations in modern supply chains. American Journal of Economic and Management Business (AJEMB), 2(8), 287–300.

Sengupta, S. (2023). Sustainable products from natural fibers/biomass as a substitute for single-use plastics: Indian context. In:

Novel sustainable raw material alternatives for the textiles and fashion industry. Springer.

Staff, E. (2022). Fact Sheet: Single Use Plastics. EARTHDAY.ORG.

Stafford, W., Russo, V., & Nahman, A. (2022). A comparative cradle-to-grave life cycle assessment of single-use plastic shopping bags and various alternatives available in South Africa. The International Journal of Life Cycle Assessment, 27(9–11), 1213–1227. https://doi.org/10.1007/s11367-022-02085-2

Suleman, R., Amjad, A., Ismail, A., et al. (2022). Impact of plastic bags usage in food commodities: an irreversible loss to environment. Environmental Science and Pollution Research, 29(33), 49483–49489. https://doi.org/10.1007/s11356-022-21091-3

Taber, K. S. (2018). The Use of Cronbach's Alpha When Developing and Reporting Research Instruments in Science Education. Research in Science Education, 48(6), 1273–1296. https://doi.org/10.1007/s11165-016-9602-2

Teo, T. (2008). Pre-service teachers' attitudes towards computer use: A Singapore survey. Australasian Journal of Educational Technology, 24(4). https://doi.org/10.14742/ajet.1201

Timyan, A., & Sadachar, A. (2020). Reusable shopping bags: insights on psychological factors leading to consumers' (sustainable) practices. International Journal of Fashion Design, Technology and Education, 13(2), 190–203. https://doi.org/10.1080/17543266.2020.1762248

Ujeh, K. C. (2021). The negative environmental effects of plastic shopping bags. Available online: https://www.ibanet.org/article/76F8D2A9-1A1D-4A2F-8A6F-0A70149FD4D5 (accessed on 2 January 2024).

Volva, L., & Djamaludin, M. D. (2018). Shopping Bag Usage Behavior of Non-working Housewives in the Perspective of Theory of Planned Behavior (Indonesian). Jurnal Ilmu Keluarga Dan Konsumen, 11(1), 49–59. https://doi.org/10.24156/jikk.2018.11.49

Wang, B., & Li, Y. (2022). Consumers' Intention to Bring a Reusable Bag for Shopping in China: Extending the Theory of Planned Behavior. International Journal of Environmental Research and Public Health, 19(6), 3638. https://doi.org/10.3390/ijerph19063638

Wang, B., Liu, B., & Li, Y. (2023). A dark side of trust: examining the influence of environmental risk perception on citizens' plastic-avoiding behavior. IEEE Transactions on Computational Social Systems.

Warner, B. M. (2009). Sacking the culture of convenience: Regulating plastic shopping bags to prevent further environmental harm. University of Memphis Law Review, 40, 645.

Westgate, P. M. (2016). Intra-cluster correlation selection for cluster randomized trials. Statistics in Medicine, 35(19), 3272–3284. Portico. https://doi.org/10.1002/sim.6922

Wikipedia. (2023). List of towns in Lahore. Available online: https://en.wikipedia.org/wiki/List-of-towns-in-Lahore (accessed on 2 January 2024).

Yadav, R., & Pathak, G. S. (2016). Young consumers' intention towards buying green products in a developing nation: Extending the theory of planned behavior. Journal of Cleaner Production, 135, 732–739. https://doi.org/10.1016/j.jclepro.2016.06.120

Yan, D., Cai, X., Xie, M., et al. (2022). Why is reusable bag consumption easier to say than do? Frontiers in Psychology, 13. https://doi.org/10.3389/fpsyg.2022.956998

Zainudin, N., Qi, W. Y., Lau, J. L., et al. (2021). Determinants of Using Alternative to Single-Use Plastic Bags. International Journal of Academic Research in Business and Social Sciences, 11(11). https://doi.org/10.6007/ijarbss/v11-i11/11659

Zaman, K., Iftikhar, U., Rehmani, M., et al. (2023). Embracing biodegradable bags: effects of ethical self-identity on consumer buying behavior. Social Responsibility Journal, 19(3), 474–485. https://doi.org/10.1108/srj-03-2021-0099

Appendix

Analyzing the consumer behavior of reusable bag: An application from the theory of planned behavior

Purpose of the questionnaire

The purpose of the questionnaire is to gather valuable data regarding individual's attitude, beliefs and more importantly their consumption behaviors related to using reusable bags while shopping in the supermarkets in Lahore.

Respondents' data

Name		Age	
Gender	Male	**Occupation**	
	Female		
Area		**Education level**	

Part 1: Attitudes towards reusable bags

1. How important is it for you to use reusable bags instead of single-use plastic bags?

    Very Unimportant   Unimportant   Neutral   Important   Very Important
2. To what extent do you believe using reusable bags is good for the environment?

    Not at all   Slightly   Moderately   Quite a lot   A lot
3. Do you believe using reusable bags makes a positive statement about your personal values?

    Not at all   Slightly   Moderately   Quite a lot   A lot

Part 2: Subjective norms

1. How important is it for you to follow the opinions of your friends and family regarding the use of reusable bags?

    Very Unimportant   Unimportant   Neutral   Important   Very Important
2. To what extent do you believe your friends and family think you should use reusable bags?

    Not at all   Slightly   Moderately   Quite a lot   A lot
3. Do you feel pressure from your friends and family to use reusable bags?

    Not at all   Slightly   Moderately   Quite a lot   A lot

Part 3: Perceived behavioral control

1. How often do you have access to reusable bags when you go shopping?

    Never   Rarely   Occasionally   Frequently   Always
2. How easy do you think it is to remember to bring reusable bags when shopping?

    Very Difficult   Difficult   Moderately Difficult   Easy   Very Easy
3. To what extent do you believe you have control over whether or not you use reusable bags?

    Not at all   Slightly   Moderately   Quite a lot   A lot

Part 4: Reusable bag consumption

1. How often do you use reusable bags when shopping?

    Never   Rarely   Occasionally   Frequently   Always
2. How many reusable bags do you own?

    1   2   3   4   5 or More

3.   What type of reusable bags do you use?

Cloth Bags   Paper Bags   Reusable Plastic (Polypropylene)   Other_____   Cloth Bags

4.   How many times do you use one reusable bag?

1 time   2 times   3 times   4 times   5 or More than 5 times