UNDERSTANDING PRO-ENVIRONMENTAL BEHAVIOR OF WOMEN SHOPPERS IN NORTHERN MINDANAO, PHILIPPINES: AN EXPANDED TPB-NAM FRAMEWORK USING MIXED METHODS

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ABSTRACT

The irreversible consequences of plastic pollution to health and the environment opened a wide array of research. Expanding on the Theory of Planned Behavior (TPB) and Norm Activation Model (NAM), this paper identified the predictors of intention to use (IU) eco-friendly shopping bags. KII and FGDs were conducted with women shoppers in Iligan City, Philippines. Results from the PLS-SEM modeling showed that product image, policy support, and education level have direct and positive effects on the intention to use. Socio-economic variables such as marital status, household size, and income have significant moderating effects, while education level has a significant mediating effect. Subsequently, thematic analysis revealed that shoppers prioritized durability, aesthetics, affordability, perceived pro-environmental policies as effective, and affirmed targeted campaigns to foster sustainable shopping practices. Hence, collective efforts between government and private entities may explore implementation of incentive schemes (i.e., discounts and rewards) and regular city-wide "green days" for "bringing-selling-using" of eco-friendly shopping bags as these can increase awareness and continuous adoption of sustainable practices, eventually shaping pro-environmental behavior across age, gender, and income groups over time.

Key words: sustainable consumption, SmartPLS, theory of planned behavior, norm activation model, intention to use

INTRODUCTION

In the 21st century, plastic pollution has become one of the pressing environmental challenges with widespread ecological, economic, and public health implications. The accumulation of plastic waste in oceans, inland waters, and even in remote ecosystems is documented (Essel et al. 2015; Farvazova 2020), resulting in biodiversity loss, disruptions of food systems, and risks to human health (Naeem et al. 2016). The global reliance on single-use plastic bags amplifies these challenges, with an estimated 500 million plastic bags used annually (Spokas 2008). The improper disposal and persistence of plastic materials in the environment have resulted in the formation of microplastics – small plastic fragments from the breakdown of larger items, e.g. plastic food packaging, have been found in soil, marine organisms, and human food chains (Seltenrich 2015; Yuan et al. 2002).

The escalating environmental concern has catalyzed a global shift toward sustainable consumption practices and the development of alternative materials. Eco-friendly shopping bags are reusable, biodegradable, or made from recycled materials, and emerged as a substitute for single-use plastic bags. The promotion of eco-friendly shopping bags by businesses demonstrates responsible environmental practices while meeting the growing consumer expectation for products that are pro-environment, that benefit both the environment and future generations (Karalar and Kiraci 2011; Steg et al. 2009). These bags not only lessen single-use plastics but also reflect a growing consumer awareness and demand for environmentally responsible products (Ekasari and Zaini 2020; UNCTAD 2023). Yet, the adoption of such sustainable practices remains minimal across populations with significant variation in behavioral responses to environmental campaigns and product innovations (Osarodion et al. 2023).

Recent studies provide insights into these consumer behaviors, such as Cam et al. (2025) who suggest that product attributes, environmental concern, and supply-side factors directly influence eco-bag use in Vietnam although product features were observed to have indirect effects on consumer behavior. Ethical self-identity and attitudes are important in predicting intention to use biodegradable bags, moderated by religiosity (Zaman et al. 2023). In Indonesia, authority endorsement and institutional signals increase in shop owner's willingness to distribute reusable bags (Spranz et al. 2018). Ekasari and Zaini (2020) identified that environmental knowledge, and perceived behavioral control predict the use of eco-bags, but this study did not account for demographic characteristics as moderators. More recently, perceived price and green product features influence green buying behavior while perceived responsibility is weak, suggesting that external cues outweigh intrinsic norms under certain circumstances (Nugraha and Soelasih 2023). The studies emphasize the complex interplay of psychological constructs, product-related factors, and institutional support in shaping pro-environmental behavior.

In trying to understand sustainable shopping practices, particularly identifying drivers of this pro-environmental behavior within a specific local policy context, an expanded Theory of Planned Behavior (TPB) and Norm Activation model (NAM) were adopted, with environmental awareness (EA), support for policy (SFP), willingness to pay (WTP), and product image (PI) included in the framework as additional constructs to account for institutional and consumer-market factors relevant to the research locale. This study is enthused by previous studies adopting NAM (De Groot et al. 2009; Schwartz 1977; Setiawan et al. 2021; Yang et al. 2018) and TPB (Ajzen 1991).

The construct adopted from NAM is personal norm (PN) while attitude (ATT), subjective norm (SN), and perceived behavioral control (PBC) were adopted from TPB. PN refers to a person's subjective feeling of obligation to act in a pro-environmental way. It is activated when individuals become aware of the consequences of their actions and feel a sense of responsibility to address those impacts. Complementary to NAM, TPB is a robust framework that predicts pro-environmental consumer behavior with three core determinants influencing behavioral intention, namely, ATT which refers to the individual's perceptions of the desirability or undesirability of using eco-friendly reusable bags (Hale 2003), SN which is the person's perceptions of the influencers (e.g., family, peer, or society) who would think that individuals should or should not act (Ajzen 1991), and PBC which refers to the belief in one's ability to easily access and utilize eco-friendly shopping bags, reflects consumers' judgment of how easy it is to perform certain behavior and their ability to control (Ye 2022). As this study integrates constructs from NAM and TPB, variables such as EA, SFP, WTP, and PI are also added in the model to account for institutions, particularly depicting the locale's context. EA refers to people's perceptions of environmental issues, including aggregate aspects of environmental knowledge. It is an important aspect in preparing individuals to find solutions to environmental issues and is seen as a key factor that affects people's consumption behavior (Fu et al. 2020). SFP refers to people's positive support for government regulations on environmental safeguards. Positive support is essential in the transition from non-environmental to sustainability-driven consumption practices. EA and SFP are essential factors to fostering personal responsibility, aligned with NAM's emphasis on

how knowledge of environmental impacts and endorsement of policy initiatives can activate norms and influence pro-environment actions. WTP describes the grocery shoppers' level of acceptability and its relationship to the additional cost of eco-friendly shopping bags. PI is also added to TPB to describe consumers' preferences in terms of durability, convenience, design, function and purpose that influences intention to use. These constructs have been widely used to assess consumer-level environmental decision-making, such as the adoption of sustainable products like eco-friendly reusable shopping bags.

However, consumer choices are not in isolation. The role of institutional support and policy interventions is recognized in shaping sustainable practices among consumers. Local ordinances that restrict plastic bag use, promote eco-bag alternatives, or incentivize sustainable behavior can strengthen consumers' motivation and create a more enabling environment for behavior change (Karalar and Kiraci 2011). Similarly, perceived product image (i.e., quality, functionality, design) influences consumer preference and adoption, and recent evidence from emerging markets shows that institutional support and market-related signals are significant, with external factors outweighing internal psychological constructs (Chatrakamollathas and Nuengchamnong 2024). Thus, the interplay of psychological, social, and structural factors warrants further empirical investigation.

Demographic characteristics such as marital status, household size, income, and education are also included in the expanded framework as studies have shown that consumer heterogeneity influences pro-environmental behavior, an aspect that remains understudied in literature (Ekasari and Zaini 2020; Nugraha and Soelashi 2023). This study surveyed women because of their main role as decision makers in household budgeting and practices (i.e., grocery shopping, recycling) (Fry et al. 2023; Guiot et al. 2019), and their stronger engagement in sustainable lifestyles compared to men (Sahin et al. 2012). The expanded TPB and NAM frameworks cover both rational decision-making and moral responsibility of consumers. In particular, the constructs EA, WTP, SFP, and PI, capture psychological, marketing, socio-economic, and institutional aspects of consumer behavior. Socio-demographic moderators like civil status, education level, income, and household size provide different paradigms on sustainable shopping practices.

In the Philippines, plastic pollution has remained a long-standing challenge despite national and local-level policy efforts, such as the implementation of the Ecological Solid Waste Management Act of 2000. In the case of Iligan City, the chosen locale of this study, its local government unit (LGU) enacted a local ordinance, through an executive order, for a single-use plastic ban. In response, business establishments provide a range of eco-friendly shopping bag alternatives such as brown paper bags, carton boxes for free or reusable bags for sale. While these alternatives are available and accessible, the actual adoption and support for the local ordinance are not consistent and significant. For this reason, it is imperative to understand the constructs that shape consumers' pro-environmental behavior as inputs for evidence-based policy impact evaluation to redesign initiatives and programs depending on time relevance and policy goals.

MATERIALS AND METHODS

Research locale. Iligan City was deemed a suitable research locale for this study because of the present implementation of single-use plastic ban and promotion of eco-friendly reusable bags in shopping markets. Figure 1 shows the commonly available eco-friendly reusable bags substitute to single-plastic shopping bags in Iligan City. As of 2019, approximately 30% of all LGUs in the Philippines had enacted some form of plastic regulation, predominantly total bans of plastic bags. The widespread adoption is often influenced by national mandates, such as RA 9003 or the Ecological Solid Waste Management Act of 2000, and the pressing need to mitigate flooding exacerbated by clogged drainage systems. While Iligan City shares these common policy initiatives with other regions, Iligan City's approach stems from its specific historical, industrial, and environmental context, which has necessitated an

evolving policy framework. The city's proactive approach in adopting diverse management technologies is a compelling case to study. The present policy and changes in business operations that promote eco-friendly shopping bags should be sustained, especially for a booming area aspiring to become a smart city by 2030. In Iligan, there are existing institutions, private firms (i.e., Republic Cement Inc.), and facilities (i.e., material recovery processing and landfill) installed and operational to support the local resolution promoting sustainable consumption, and yet the increasing amount of waste generated and disposed at the landfills is becoming a pressing dilemma for Iligan City officials and residents alike. Local waste generation outpaces recovery efforts, resulting in the City Materials Recovery and Composting Facility (CMRCF) exceeding its full capacity (Dela Cerna, 2019).

Figure 1. Commonly available "eco-friendly reusable shopping bags" in Iligan City, Northern Mindanao, Philippines

Research participants. Studies by Sanchez et al. (2016); Kennedy et al. (2015); Vicente-Molina et al. (2013) showed that women were observed to exhibit stronger pro-environmental values, particularly in the study of Tien and Huang (2023) where 1,839 women adults showing higher environmental values than men. In most households, women stereotypically manage household budgeting and grocery shopping more frequently than men (Pewresearch.org 2019), and as such they are a significant representation of the consumers' demographic in understanding sustainable shopping practices. This study focuses on women shoppers to strengthen the findings that isolate and analyze the constructs influencing intention to use within a highly relevant and influential demographic group. This allows for a deeper and focused assessment rather than generalization of findings that obscure important demographic-related shopping preferences and behavior. The study's focus on women provides in-depth insights into a key consumer group but its findings may have limited generalizability to other genders and populations.

A total of 257 women grocery shoppers in Iligan City, Philippines were surveyed for this study. This sample size of 240 was determined using the minimum required number of participants for adequate statistical power from G*Power software. To ensure robustness and account for potential incomplete questionnaires or unfinished interviews due to unforeseen and uncontrolled circumstances (i.e., weather, health-related issues), or other data contaminations and qualifications, an additional 36 respondents or 15% of the sample size was added. The total number of questionnaires that were subject to analysis was 257. Convenience sampling was used by inviting 257 women grocery shoppers pre-selected shopping areas and establishments where eco-friendly reusable bags were accessible to participate in the survey. The convenience sampling method ensured completion of the study within the budget and time availability. These 257 women grocery shoppers surveyed in Iligan City, Philippines, were pre-qualified based on select demographic characteristics such as currently working, adult or above 18 years old, and a resident of Iligan City before the enactment of Executive Order. A series of KII and FGDs was then conducted in wet markets, shopping areas, and commercial centers around Poblacion, Iligan City, from June to August 2024.

Construct identification and modeling. The first part of the research instrument is composed of 33 indicators for nine constructs, describing the respondent's intention to use, degree of awareness, and stance on eco-friendly reusable shopping bags with corresponding Likert scale (i.e., very low awareness to very high awareness, strongly disagree to strongly agree). The constructs and indicators were adopted from the literature and tested to ensure relevance and appropriateness to meet the objective of the study. Each construct from NAM and TPB is hypothetically influencing consumers' IU eco-friendly shopping bags. While Educ level, Marital status, HH size, and Income were included in the model as moderating variables. Moderating variables do not directly influence IU but will shape the constructs' effect on IU. The model and the insights are intended to provide evidence-based inputs for need-based action strategies in promoting sustainable shopping practices. The model is expected to identify the drivers that translate consumers' preferences into consistent choice and action to support local resolutions and eco-friendly shopping bag features that aim to reduce waste and harm the environment.

Construct analysis. Responses from both KII and FGD were tabulated and sorted in Microsoft Excel. Using Stata, the values for Cronbach's Alpha and average variance extracted (AVE) were obtained for the reliability and validity of constructs. The results were further analyzed through partial least squares - structural equation modeling using the SmartPLS software to establish the complex interrelationships of several constructs, with a small sample size and non-normally distributed data (Hair et al. 2011). The model was subject to correlation analysis and internal discriminant validity using the Fornell-Larcker criterion and Heterotrait-Monotrait (HTMT) Ratio (Hair et al. 2024). The outer and inner variance inflation factor (VIF) values were also derived from the collinearity diagnostics. VIF values are critical in assessing the presence of multicollinearity between predictor variables, which can distort the reliability of regression coefficients of the study.

The goodness-of-fit of the model was assessed using the Standardized Root Mean Square Residual (SRMR) and the Normal Fit Index (NFI). The SRMR is an absolute measure of model fit by representing the square root average squared discrepancy between the observed and model-implied correlation matrices. The threshold value is 0.08. Lower SRMR (< 0.08) indicates a better fit and is considered acceptable for PLS path models (Hu and Bentler 1999; Henseler et al. 2015). The NFI is a relative measurement that compares the fit of the proposed model to a null model, with values ranging from 0 to 1. The threshold value is 0.90. Higher NFI (>0.90) indicates a good model fit (Bentler and Bonett 1980; Hair et al. 2017).

Selected socioeconomic variables were also obtained to provide context for interpreting subsequent findings and ensure a better perspective in understanding diverse backgrounds that shape respondents' pro-environmental behavior (Nowell et al. 2017). The qualitative data obtained from the two focus group discussions (FGD) were subject to thematic analysis (Braun and Clarke, 2006) to identify recurring patterns related to the factors of intention to use reusable bags. The FGD was conducted after the completion of data collection and the initial quantitative phase. The questions in the FGD were formulated based on the initial results from the KII, specifically on the constructs that were significantly driving intention to use. The whole duration of the discussion was recorded in a secure device as agreed and with consent from the participants. The recording was then transcribed and analyzed.

RESULTS AND DISCUSSIONS

Intention to use constructs and the model. Table 1 presents the summary of values of Cronbach's Alpha that range between 0.711 to 0.903 and are above the acceptable threshold of 0.70. This indicates the strong reliability of each item to measure intention to use. All the AVE values are above 0.50 and range between 0.691 to 0.908, indicating convergent validity and verifying that the items within each construct effectively represent the integration of NAM and TPB in the study. The model achieved a good fit with all constructs, demonstrating high factor loading and satisfactory reliability and validity

metrics, thus supporting the proposed framework and its application in understanding the interplay of each construct that drives the intention to use eco-friendly reusable bags.

Table 1. Values for Cronbach's Alpha (α) and average variance extracted per construct.

Construct	Indicator	α	Ave
NAM			
EA	EA1. To what extent are you aware that plastic bags negatively affect human health?	0.844	0.691
	EA2. To what extent are you aware that plastic bags negatively affect animal health?		
	EA3. How aware are you that plastic bags pose a threat not only to marine life but also to agricultural land?		
	EA4. How aware are you of the City's ban on single-use plastics and the encouragement to use eco-friendly reusable bags?		
PN	PN1. I believe that using eco-friendly reusable bags protects the environment for future generations.	0.899	0.908
	PN2. I believe that if I use eco-friendly reusable bags, I can be a good example of an environmentally concerned citizen.		
SFP	SFP1. I will support coding days by using and buying eco-friendly shopping bags.	0.893	0.701
	SFP2. I will support imposing fines and penalties on coding days.		
	SFP3. I will support increasing fines and strict penalties for using plastic bags to shift shoppers toward using eco-friendly reusable bags.		
	SFP4. I support bringing eco-friendly reusable bags to dry sections of the public market to minimize the use of single-use plastic.		
	SFP5. I support that collaboration among businesses, governments, and communities is necessary for a sustainable future.		
TPB			
ATT	ATT1. Bringing eco-friendly reusable bags is meaningful.	0.903	0.774
	ATT2. Bringing eco-friendly reusable bags for grocery shopping is necessary.		
	ATT3. I prefer to use eco-friendly reusable bags over other kinds of eco-friendly shopping bags displayed at the counter.		
	ATT4. I use eco-friendly reusable bags to comply with the local mandate.		
SN	SN1. I am influenced by my family to use eco-friendly reusable bags.	0.837	0.754

Construct	Indicator	α	Ave
	SN2. The family members in our household wish me to use eco-friendly reusable bags for grocery shopping.		
	SN3. Social expectations encourage me to use eco-friendly reusable bags.		
PBC	PBC1. It is easy for me to use eco-friendly reusable bags.	0.711	0.638
	PBC2. I can easily remember and prepare to use eco-friendly reusable bags before going to the grocery supermarket.		
	PBC3. It is up to me whether to use eco-friendly reusable bags.		
WTP	WTP1. I am willing to buy the eco-friendly shopping bags displayed at grocery supermarkets rather than using my eco-friendly reusable bags.	0.868	0.787
	WTP2. I am willing and prefer buying the eco-friendly shopping bags displayed at the supermarket instead of using eco-friendly reusable bags to avoid the hassle when I go grocery shopping.		
	WTP3. I am willing to pay for eco-friendly shopping bags even if it is costly.		
PI	PI1. I intend to use eco-friendly reusable bags because they are still durable.	0.872	0.663
	PI2. I intend to use eco-friendly reusable bags because they are more convenient than paper bags and carton boxes displayed at the counter.		
	PI3. I intend to use eco-friendly reusable bags because of their design that promotes environmental sustainability.		
	PI4. I am satisfied with the purpose and function of eco-friendly reusable bags.		
	PI5. I am satisfied with the eco-friendly reusable bags because of their color.		
IU	IU1. I intend to use eco-friendly reusable bags to reduce environmental impact.	0.872	0.663
	IU2. I intend to use eco-friendly reusable bags to decrease waste in the landfills of the city.		
	IU3. I intend to support the policy on using eco-friendly reusable bags.		
	IU4. I intend to use eco-friendly reusable bags for sustainable consumption.		

Figure 2 presents the algorithm model. The model drew several relationships among the constructs. The arrows in the model are the pathways and standardized path coefficients, indicating the strength and direction of the relationships between constructs from the two theories of the study.

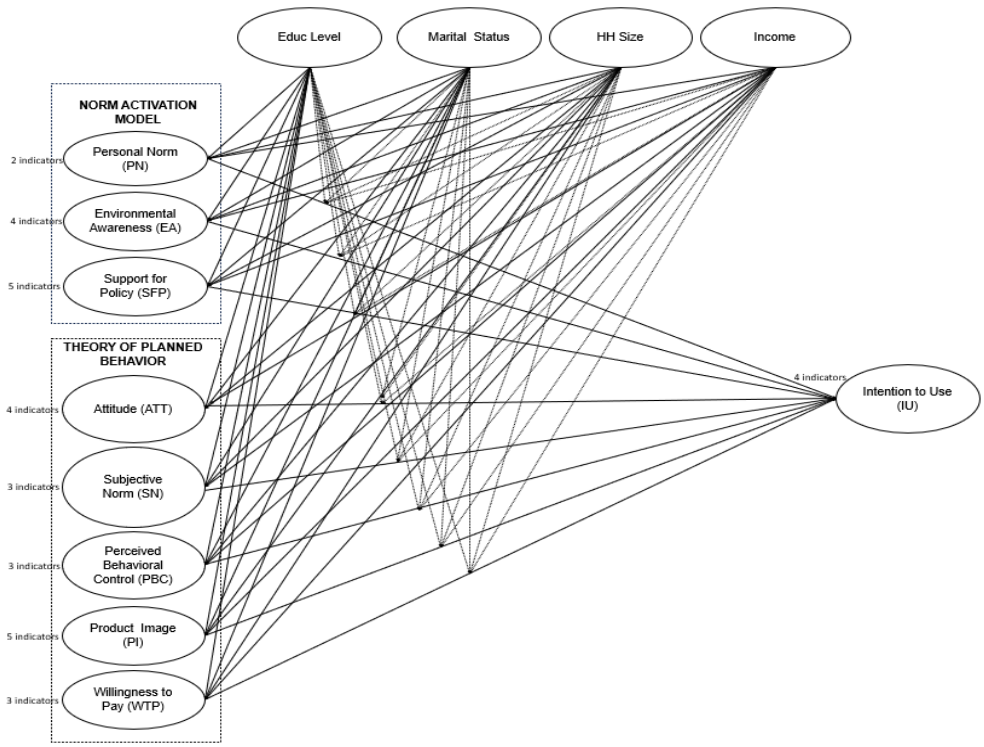

Figure 2. The algorithm of the expanded TPB and NAM as adopted in the study.

A cross-loadings analysis showed a correlation between indicators and multiple constructs. The indicators IU1 to IU4, PBC1 to PBC2, PI1 to PI4, PN1 to PN2, SFP1 to SFP5, SN1 to SN3, and WTP1 to WTP3, along with education level, household size, income group, and marital status, demonstrated strong loadings with a value above 0.70.

Table 2 presents the measurement of discriminant validity using the Fornell-Larcker criterion. Attitude (ATT), household size (HH), income, and marital status have perfect discriminant validity, with a threshold value of 1.00. For other constructs, values range between 0.799 to 0.953, showing an acceptable discriminant validity. Overall, all values are beyond the threshold of 0.70, implying a significant path in the model (Hair et al. 2024). Thus, each construct is distinct and exhibits stronger internal correlations, reinforcing construct differentiation and theoretical consistency. On the other hand, Table 4 presents another measurement of discriminant validity using the HTMT ratio. The recommended value of the HTMT ratio is equal to or below 0.90 (Henseler et al. 2015). Ratios range from 0.017 to 0.729, which are all less than 0.9, thus implying that the two constructs, e.g., Educ Level and ATT, are distinct and that discriminant validity has been achieved.

Socio-economic constructs like household size, income group, marital status, and education level also showed consistent positive loadings to ATT, PN, PBC, SFP, and PI. These cross-loading results indicate strong contributions of each indicator to its respective construct, affirming the constructs' distinctiveness within the model.

Table 2. Measurement of discriminant validity using the Fornell-Larcker Criteria.

	ATT	Educ Level	EA	HH size	Income	IU	Marital Status	PBC	PN	PI	SN	SFP	WTP
ATT	0.880												
Educ Level	0.173	**1.000**											
EA	0.385	0.080	0.831										
HH size	0.052	-0.141	0.028	**1.000**									
Income	0.106	0.254	0.048	0.022	**1.000**								
IU	0.616	0.132	0.341	0.006	0.059	0.908							
Marital Status	0.034	-0.013	0.034	0.079	-0.019	0.027	**1.000**						
PBC	0.604	0.126	0.224	0.008	0.158	0.466	-0.025	0.799					
PN	0.595	0.151	0.402	0.075	0.123	0.600	-0.047	0.428	0.953				
PI	0.624	0.074	0.359	0.016	0.089	0.661	0.063	0.565	0.529	0.815			
SN	0.601	0.082	0.177	0.035	0.183	0.452	0.043	0.660	0.372	0.591	0.868		
SFP	0.659	0.168	0.384	0.035	0.042	0.665	0.063	0.400	0.710	0.617	0.435	0.837	
WTP	0.224	0.027	0.090	0.002	0.038	0.270	0.027	0.323	0.136	0.442	0.338	0.360	0.887

Table 3. Measurement of discriminant validity using the Heterotrait-monotrait (HTMT) Ratio per construct.

	ATT	Educ Level	EA	HH size	Income	IU	Marital Status	PBC	PN	PI	SN	SFP	WTP
ATT													
Educ Level	**0.184**												
EA	0.443	**0.087**											
HH size	0.059	0.141	**0.029**										
Income	0.113	0.254	0.057	**0.022**									
IU	0.667	0.137	0.383	0.017	**0.061**								
Marital Status	0.034	0.013	0.038	0.079	0.019	**0.050**							
PBC	0.729	0.142	0.312	0.016	0.177	0.555	**0.079**						
PN	0.655	0.159	0.463	0.079	0.130	0.656	0.050	**0.519**					
PI	0.692	0.079	0.431	0.028	0.092	0.715	0.069	0.713	**0.576**				
SN	0.696	0.089	0.229	0.046	0.201	0.512	0.049	0.842	0.428	**0.692**			
SFP	0.729	0.177	0.452	0.047	0.054	0.725	0.067	0.500	0.790	0.685	**0.505**		
WTP	0.240	0.060	0.125	0.075	0.039	0.285	0.035	0.452	0.133	0.521	0.383	**0.399**	

Table 4 presents the PLS-SEM algorithm and bootstrapping report showing the direct and indirect effects of each construct on IU and the p-values. PI and SFP show a direct and significant effect on intention to use, with p-values of 0.000 and 0.009, respectively, indicating that product-related and institutional factors are reliable predictors of IU. While the moderating effect for marital status x WTP, household size x ATT, and income x SN indicates that socio-economic variables moderate the relationships. Lastly, educational level shows a significant indirect effect on IU with a p-value of 0.036, suggesting a limited effect on IU.

Table 4. PLS-SEM algorithm model and bootstrapping report.

Relationship	X	$\bar{x}$	STDEV	Path Coefficients	T statistics	P values
Direct effects						
PI → IU	0.269	0.262	0.073	0.260	3.664	0.000
SFP → IU	0.313	0.336	0.119	0.359	2.624	0.009
Educ Level → SFP	0.179	0.180	0.061	0.179	2.927	0.003
Marital Status x WTP → IU	-0.229	-0.206	0.104	0.248	2.210	0.027
HH size x ATT → IU	0.273	0.228	0.105	0.261	2.613	0.009
Income x SN → IU	0.196	0.207	0.072	0.193	2.704	0.007
Indirect effects						
Educ Level → IU	0.114	0.119	0.054	-0.007	2.100	0.036

X = observation

$\bar{x}$ = sample mean

Figure 3 presents the graphical presentation of the algorithm from Table 2, which shows the interaction between constructs from the expanded TPB and NAM on IU. Both SFP from NAM and PI from TPB are in orange markings, showing the direct effect on IU. While ATT, SN, and WTP from TPB are in green markings have significant moderating effects on IU through WTP, ATT, and SN constructs. Interestingly, education level has a direct effect on both SFP and IU. Education provides consumers with information on the consequences of plastic pollution, which may shape the consumer's preferences and behavior, suggesting the inevitable role of education as a catalyst for change. For this study, this means that well-informed consumers can lead to active participation in adherence to new policy and the adoption of sustainable shopping practices over time.

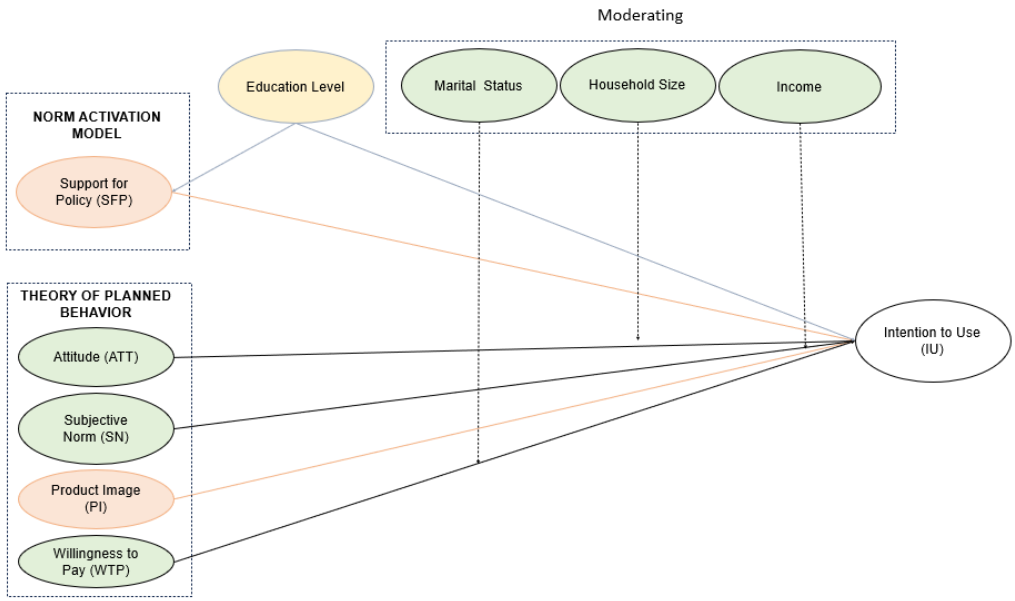

Figure 3. The algorithm of constructs from the expanded TPB and NAM affecting IU.

Table 5 presents the variance inflation factor (VIF) obtained from the collinearity diagnostics. VIF in the study ranges between 1.154 to 4.718, and within the threshold, indicating no significant collinearity issues. However, EA3, SFP2, SFP3, ATT2, ATT3, WTP2, IU2, IU3, and IU4 exhibit moderate multicollinearity but within the acceptable range. The indicators from each construct are sufficiently independent of each other, dependable, and do not redundantly measure the same underlying dimension of the theoretical underpinnings of NAM and TPB.

Table 5. Outer and Inner VIF values from the collinearity diagnostics.

Theory	Construct	Indicator	VIF	
NAM	EA	EA1	2.675	No serious multicollinearity
		EA2	2.692	No serious multicollinearity
		EA3	**3.010**	**Moderate multicollinearity**
		EA4	1.265	No serious multicollinearity
	PN	PN1	2.996	No serious multicollinearity
		PN2	2.996	No serious multicollinearity
	SFP	SFP1	2.069	No serious multicollinearity
		SFP2	**4.062**	**Moderate multicollinearity**
		SFP3	**3.032**	**Moderate multicollinearity**

Theory	Construct	Indicator	VIF	
		SFP4	2.039	No serious multicollinearity
TPB	ATT	ATT1	2.755	No serious multicollinearity
		ATT2	**3.268**	**Moderate multicollinearity**
		ATT3	**3.137**	**Moderate multicollinearity**
		ATT4	2.421	No serious multicollinearity
	SN	SN1	2.120	No serious multicollinearity
		SN2	2.241	No serious multicollinearity
		SN3	1.720	No serious multicollinearity
	PBC	PBC1	1.907	No serious multicollinearity
		PBC2	1.921	No serious multicollinearity
		PBC3	1.154	No serious multicollinearity
	WTP	WTP1	2.247	No serious multicollinearity
		WTP2	**3.149**	**Moderate multicollinearity**
		WTP3	2.163	No serious multicollinearity
	PI	PI1	2.355	No serious multicollinearity
		PI2	2.301	No serious multicollinearity
		PI3	2.339	No serious multicollinearity
		PI4	2.239	No serious multicollinearity
		PI5	1.498	No serious multicollinearity
	IU	IU1	2.792	No serious multicollinearity
		IU2	**4.039**	**Moderate multicollinearity**
		IU3	**4.718**	**Moderate multicollinearity**
		IU4	**3.796**	**Moderate multicollinearity**

The model fit from the PLS SEM was assessed using the two indices, SRMR and NFI. The model yielded an SRMR value of 0.274 (Table 6), which is above the threshold of 0.08 (Hu and Bentler 1999),

and an NFI value of 0.611, below the accepted benchmark (Bentler and Bonnet 1980). These values suggest that the model could be further improved and that the proposed expanded framework may not adequately capture the underlying relationships. The model fit indicates some divergence between the proposed expanded framework and the observed data. Specifically, the high SRMR and low NFI values suggest that while the framework incorporates theoretically grounded constructs, the relationship hypothesized may not fully capture the complexity of intention to use eco-friendly reusable shopping bags in the Iligan context. However, this does not undermine the relevance of constructs such as PN, ATT, SN, PBC, EA, SFP, WTP, and PI, instead highlights that their unique interactions may be context dependent. Thus, the findings deem for refining causal pathways and exploring additional contextual variables that may influence behavioral intention, particularly regarding the heterogeneity of consumer groups.

Several factors may help explain the weaker performance of the expanded TPB-NAM model, suggesting that its predictive capacity is partly structured by contextual misalignment. While studies of Yang et al. (2018) and Setiawan et al. (2021) may have applied NAM and TPB to predict pro-environmental behavior in other Asian regions, Iligan City represents a different landscape where strong policy interventions and readily available shopping bag alternatives is contributory. In this study, the role of institutional authority and regulatory signals direct individual attitudes and norms, consistent with Sprantz et al. (2018) who highlights the decisive role of policy and shaping pro-environmental behavior. The extent and selection of constructs included in the model may also have contributed to its mixed performance of the expanded model. With nine constructs and multiple hypothesized paths, the potential for overlapping effects or weak causal linkages is high (Nugraha and Soelasih 2023; Zaman et al. 2023). This suggests that some theoretically sound constructs have limited predictive power across contexts. Moreover, focusing exclusively on women may have caused sample specificity. While evidence suggests that women are more likely to engage in sustainable consumption lifestyles (Sahin et al. 2012), their adoption of eco-friendly bags may depend on product attributes and market conditions, which aligns with Nguyen et al. (2022) showing that product attributes and accessibility prevail over psychological factors. Thus, these findings suggest that while TPB and NAM remain strong theoretical foundations, their explanatory power can vary across context. It is then deemed to integrate institutional, demographic, and market-level subtleties into future model refinements.

Table 6. Summary of indices for model fit.

	Saturated model	**Estimated model**	
SRMR	0.062	0.274	Does not meet threshold (Above threshold)
NFI	0.761	0.611	Does not meet threshold (Below threshold)

Accepted threshold for SRMR < 0.08-0.10
Accepted benchmark for NFI > 0.90

Model and construct analysis. Table 7 presents the path coefficients from the bootstrapping report with remarks on direct and indirect effects of constructs on consumers' IU. The hypotheses presented in the table demonstrate statistically significant paths at 5% level. PI has a strong and positive influence on IU with a path coefficient of 0.260, indicating that consumers are more likely to use eco-friendly reusable shopping bags when these are perceived as stylish and durable, aligning with Chuang and Ma (2001), but contradicting Yeow et al. (2014), who suggest that inconvenience shapes consumer behavior. SFP is the strongest predictor of IU with a path coefficient of 0.359, indicating that the enforcement of a single-use plastic ban reinforces consumer preference for reusable bags, aligning with Patterson et al. (2017). Education level's direct effect on IU is weakly negative (path coefficient = 0.007). suggesting that while education promotes awareness, it does not necessarily result in behavioral

shifts, which other factors like lifestyle and social status may influence (Afroz et al.2009). The analysis also found significant moderating effects of marital status on WTP, and household size on ATT indicate IU of eco-friendly shopping bags, aligning with (Roberts 1996; Barr et al., 2011).

Path coefficients and IU model fit. The path coefficients highlight several key constructs, with SFP (path coefficient = 0.359) and PI (path coefficient = 0.260) having the strongest direct effects on IU. This suggests that external factors like institutions and perceived quality have a stronger influence than internal psychological factors. Chatrakamollathas and Nuengchamnong (2024) similarly found that institutional support and product attributes are significant determinants of the adoption of eco-friendly bags in emerging markets. However, with the expanded framework adopted in this study, the findings showed that external drivers interact with socio-demographic moderators such as household size, marital status, and income, highlighting the need for context-specific intervention. The significant negative path from education level to IU (path coefficient = 0.179) is particularly revealing. It challenges the linear assumption of TPB where knowledge is a direct precursor to intention. The significant moderating effects provide deeper insights into the complex expanded TPB-NAM framework. The interaction of marital status and WTP (path coefficient = 0.248) supports the TPB's emphasis on perceived behavioral control, showing that married individuals with limited household budgets are motivated by the long-term cost-saving aspect of reusable bags, aligning with other studies on household consumption patterns. Similarly, significant interactions between HH size and ATT (path coefficient = 0.261) indicate that larger households, driven by a higher volume of waste, led to a stronger positive attitude towards reusable bags. This aligns with NAM's underpinning that sense of personal obligation is activated by awareness of consequences, which is particularly relevant in Iligan's plastic waste problem. The moderating effects were significant reinforces the direct paths in the model were likely oversimplified. The poor model fit does not negate the construct's relevance but indicates that the relationships are not universal and have limited generalizability. Rather, they are highly dependent on socio-economic contexts, which are consistent with existing local statistical reports and studies.

Table 7. Bootstrapping report with remarks.

Relationship	Path Coefficients	T statistics	P values	Remarks
Direct Effects				
PI → IU	0.260	3.664	0.000	Significant
SFP → IU	0.359	2.624	0.009	
Educ Level → SFP	0.179	2.927	0.003	
Marital Status x WTP → IU	0.248	2.210	0.027	
HH size x Att → IU	0.261	2.613	0.009	
Income x Sub Nor → IU	0.193	2.704	0.007	
Indirect Effects				
Educ Level → IU	-0.007	2.100	0.036	Significant

Socio-economic profile of the respondents. Table 8 presents the counts and percentage of respondents in terms of education level, marital status, income group, and household size. The profile of respondents shows a group of shoppers predominantly composed of well-educated single women from low-middle income households with 3 to 5 members, which may provide an insight to the poor model fit. The high education level suggests a baseline of environmental awareness, which may not be the primary driver of behavior as the model hypothesizes. Similarly, the significant portion of single women and those with low-middle income may have different motivations and constraints (i.e., financial capability) of which the constructs from the expanded NAM and TPB may inadequately capture. Also, the findings that most respondents have 3 to 5 members in their households may suggest minimal influence on shopping practices and directly undermine the potential for larger households to be a significant motivator of a sustainable shopping lifestyle. For the socio-economic profile, the model's poor model fit may be due to its inability to attribute for the specific, and possibly conflicting, motivation and constraints unique among women shoppers.

Table 8. Socio-economic profile of the study participants.

	Category	Count	
Education Level	No schooling completed	2	1%
	Some grade school completed	14	5%
	Some high school, no diploma	36	14%
	High school graduate, diploma or the equivalent	45	18%
	Some college credit, no degree	50	19%
	Bachelor's degree	74	29%
	Master's degree	33	13%
	Doctorate Degree	3	1%
			100%
Marital Status	Single	146	57%
	Married	111	43%
			100%
Income Group	High income	5	2%
	Upper-middle income	68	26%
	Low-middle income	136	53%

	Category	Count	
	Low income	48	19%
			100%
Household Size	2 members	21	8%
	3 to 5 members	148	58%
	6 more members	88	34%
			100%
Age	15 to 20 years old	47	18%
	21 to 30 years old	75	29%
	31 to 40 years old	46	18%
	41 to 50 years old	41	16%
	51 to 60 years old	45	18%
	61 years old and above	3	1%
			100%
Employment Status	Employed	124	48%
	Unemployed	31	12%
	Student	70	27%
	Self-employed	32	12%
			100%

Table 9 presents a summary of themes from the qualitative analysis showing interrelated dimensions of sustainable shopping practices particularly on the intention to use eco-friendly shopping bags. This provides crucial insights regarding the model obtained from SEM by highlighting the key terms associated with the constructs from each theory that were enriched by the participant's actual experiences. The participants consistently emphasized their preference for "recyclable bags" due to durability, aesthetics, and affordability, suggesting that PI is not just functional utility but also social value and long-term effectiveness. This supports the model that highlights the direct effect of PI on IU as shoppers perceived eco-friendly bags as practical and socially desirable alternatives than single-use

plastic bag. Also, participants highlighted the role of SFP, particularly local ordinances and firm-level initiatives were effective in shaping pro-environmental behavior. Participants affirmed the importance of targeted awareness campaigns and education to enhance environmental knowledge resulting to increase acceptance of sustainable practices. Notably, there were also significant behavioral barriers like "forgetfulness" and "impromptu shopping" that were not represented in the constructs of the expanded TPB and NAM but are common challenges.

Table 9. List of themes from the qualitative analysis mapped within the expanded framework.

List of Themes and Number of Codes	Framework	Interpretation from Participant's Narratives
Preference and Perception (3), Practicality and Usability (1), Cost Sensitivity (1), Economic Considerations (1), Social Influence and Pressure (2), Practicality and Convenience (2), Financial Influence (2), Marital Status and Family Influence (2), Income-Driven Behavior (2)	TPB (16)	ATT: Codes from "Preference and Perception" and "Economic Considerations" suggest shoppers prefer eco-friendly bags not only for durability and aesthetics but also for long-term value. This supports the SEM finding that PI has significant direct effect to IU. SN: Codes from "Social Influence and Pressure" and "Marital Status and Family Influence" highlights the role of family members, peers, and household members in shaping pro-environmental behavior. This supports the moderating effects of marital status and household size in the model, and where social context alters the strength of predictors. PBC: Codes from "Practicality and Usability", "Practicality and Convenience", "Financial Influence", and "Income-driven Behavior" suggest the practical and financial constraints that influence or affect IU eco-friendly shopping bags. This reinforces the model that income moderates IU, while suggesting that affordability and convenience influence perceived control.
Environmental Policy Support (2), Behavioral and Policy Change (3), Policy Influence (16), Educational Influence (17)	NAM (38)	PN: Codes from "Behavioral and Policy Change" indicates that shoppers develop this sense of obligation to develop pro-environmental behavior when institutional policies are in place, suggesting that external cues reinforce moral responsibility.

List of Themes and Number of Codes	Framework	Interpretation from Participant's Narratives
		EA: The strong representation of "Education and Influence" indicates that awareness of environmental issues is influence by formal education and campaigns. This supports the pathway where education level predicted SFP, highlighting awareness as a precursor to norm activation and policy adherence. SFP: Codes from "Environmental Policy Support" and "Policy Influence" indicates that participants strongly perceived ordinances and enforcement as effective approach for influencing behavior. This supports the model that SFP has significant direct effect in IU, confirming that institutional support is the strongest driver of pro-environmental behavior in this context.

While the model showed limitations in overall fit, the notable and compelling findings from this mixed method provides valuable insights into the complexity of pro-environmental behavior. Zaman et al. (2023) and Cam et al. (2025) emphasized the consumer-level determinants such as attitudes, norms, or ethical identity, but this study identified that institutional factors (i.e., support to policy), product attributes (i.e., image, durability, prestige), and demographic characteristics (i.e., income, marital status, household size) interact in ways that conventional models tend to oversimplify. The quantitative-qualitative approach strengthens the findings by contextualizing the model with the narratives that highlight the importance of habitual behavior (Muposhi et al. 2021), policy enforcement and institutional trust (Spranz et al. 2018; Wang et al. 2023), and market accessibility (Nguyen at al. 2022). The expanded TPB-NAM framework contributes to the science-based evidence that the intention-behavior gap in pro-environmental behavior is understood through a multi-level lens to account for psychological, structural, and socio-economic factors that should be simultaneously analyzed. Future research direction may include the refinement of the models that incorporate habits, enforcement mechanisms, and social group interactions using longitudinal or system-based approaches to account for the interaction between consumers' motivation, institutions, and market dynamics.

CONCLUSION

The intention to use eco-friendly reusable bags is shaped by a complex interaction of psychological, social, and economic factors drawn from the expanded TPB and NAM frameworks. The model provides two important insights: 1) the path coefficients showing SFP from NAM and PI from TPB have direct effects on IU, suggesting that external factors, e.g., institutional and perceived quality, significantly affect more than internal psychological factors; and 2) the moderating effects of marital status and household size suggest deeper insights into the complex expanded TPB-NAM framework. The qualitative findings and socio-economic characteristics provide a critical context with how PI, SFP, and education level have a significant direct effect on IU, while income, household size, and marital status have significant moderating effects. With this, one-size-fits-all approach is ineffective for

shaping pro-environmental behavior among consumers in Iligan setting. An innovative and future-thinking approach is required to translate these findings into effective policy action, such as tiered incentive schemes and "green days". However, such policy should be continuously refined based on income groups along with targeted campaigns in various media platforms to address the persisten gaps in environmental awareness highlighted by Ogiemwonyi (2024) and Sánchez et al. (2016). Lastly, future research opportunities should include and aim to strengthen the theoretical foundation with appropriate constructs and measurements. Multidisciplinary frameworks, e.g., system analysis, theory of change, should be adopted and continuously explored to understand and appreciate the interplay of psychological and social aspects without neglecting rigor and external validity. Consequently, this will develop a robust and replicable model that can estimate, predict, and understand consumer behavior patterns. This study is partly relevant, but with other complementing transdisciplinary approaches, the findings may contribute to the existing evidence of policy gaps and innovatively address the plastic waste problem before reaching the tipping point of irreversible ecological consequences.

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