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From Waste to Wealth: Assessing Awareness and Adoption of Organic Compost/Biofertilizer in the Context of Urban Horticulture and Food Safety in Karachi City

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ABSTRACT

This study investigates the determinants of intention to purchase organic compost in Karachi's urban horticulture sector. While previous research has largely emphasized organic food adoption, the adoption of compost and biofertilizers remains underexplored, despite their importance for waste management, soil fertility, and food safety. The purpose of this study is to extend the Theory of Planned Behavior (TPB) by incorporating awareness, environmental concern, and health consciousness into the model to better explain compost adoption. A quantitative, cross-sectional design was employed with data collected from 349 farmers and nursery owners in Gadap Town, Karachi. A structured questionnaire measured six independent variables: awareness, attitude, subjective norms, perceived behavioral control, environmental concern, and health consciousness against the dependent variable, intention to purchase compost. Data were analyzed using SPSS for descriptive and SmartPLS for structural equation modeling. The results reveal that awareness (β = 0.246), attitude (β = 0.143), perceived behavioral control (β = 0.135), environmental concern (β = 0.139), and health consciousness (β = 0.193) significantly influence purchase intention, while subjective norms (β = 0.055) show no significant effect. The model explains 61.4% (R^2 = 0.614) of the variance in intention. This study makes a novel contribution by focusing on compost adoption in developing urban contexts, extending TPB with ecological and health-related constructs. The findings provide both theoretical insights and practical guidance for policymakers and marketers aiming to promote sustainable waste-to-resource practices.

Introduction

Urban horticulture has become an essential approach to addressing the intertwined challenges of food security, waste management, and environmental sustainability in rapidly expanding cities. Among the sustainable practices supporting urban horticulture, the use of organic compost stands out for its multiple benefits. Compost enriches soil fertility, reduces dependency on chemical fertilizers, and improves crop productivity while simultaneously lowering the environmental risks posed by synthetic inputs (Kca et al., 2021; Shukla et al., 2022). At the same time, composting recycles organic matter and diverts waste from landfills, promoting resource efficiency and aligning with circular economy principles (Sharma et al., 2019). Thus, organic compost serves not only as an agricultural input but also as a waste management strategy that contributes to greener and more resilient cities.

The relevance of compost use is particularly critical in megacities such as Karachi, which faces significant urban and environmental pressures. A large proportion of municipal waste in Karachi is organic, yet ineffective disposal practices contribute to landfill overflow, pollution, and public health risks (Hasan, 2020). At the same time, conventional farming and gardening practices, heavily reliant on chemical fertilizers, threaten soil quality and long-term agricultural sustainability (Chausali & Saxena, 2021). Organic compost offers a sustainable alternative that can restore soil health, enhance water retention, and support safer food production, while also reducing the ecological footprint of agriculture (Chen et al., 2020). Its adoption in urban horticulture could therefore address both the city's waste crisis and its need for sustainable food systems (Rashid & Shahzad, 2021).

Beyond environmental and agricultural benefits, composting carries economic and social significance. The establishment of composting systems and markets can create livelihood opportunities for small-scale farmers, entrepreneurs, and community-led initiatives, fostering innovation and supporting the local green economy (Gamage et al., 2023). Globally, increasing consumer demand for sustainable and organic products further emphasizes the need to understand consumer intentions regarding compost use (Wojciechowska & Barska, 2021). Insights into these intentions are especially valuable in urban centers of developing countries, where waste generation and environmental pressures are most acute.

While previous studies have widely examined consumer behavior toward organic food, highlighting factors such as brand awareness, eco-conscious attitudes, and social media influence (Wang et al., 2019; Bhutto et al., 2023), limited research has focused on consumer willingness to adopt compost products. The Theory of Planned Behavior (TPB) has proven effective in predicting sustainable choices, demonstrating that attitudes, subjective norms, and perceived behavioral control significantly influence eco-conscious behaviors (Hameed et al., 2019). Similarly, adoption of organic farming practices has been shown to depend on household, psychosocial, and supportive factors (Sapbamrer & Thammachai, 2021). Yet little is known about how these dynamics translate into consumer intentions to purchase organic compost, particularly within urban horticultural contexts.

Research Gap

This gap is particularly relevant for Pakistan, where the pressures of urbanization demand sustainable strategies that link waste management, food production, and environmental health. By focusing on Karachi, this study seeks to investigate the factors that influence consumer intentions toward purchasing organic compost. Understanding these drivers—ranging from environmental

and health consciousness to behavioral and social determinants—will provide insights that can guide urban households, policymakers, and entrepreneurs in promoting compost adoption. Ultimately, the study contributes to building sustainable urban ecosystems by highlighting how composting can transform waste into a resource, strengthen urban horticulture, and foster eco-conscious consumer behavior.

Literature Review

The present study draws on the Theory of Planned Behavior (TPB), which provides a strong foundation for understanding and predicting human behavior. TPB posits that an individual's actions are shaped by three primary determinants: attitude toward the behavior, subjective norms, and perceived behavioral control (Ajzen, 1991). Together, these factors influence behavioral intentions, which in turn predict actual behavior. The model has been extensively applied in fields such as environmental psychology, marketing, and health studies, particularly in contexts where individual decision-making is linked to sustainability and pro-environmental behavior. In the domain of urban horticulture and sustainable consumption, TPB offers a useful lens to examine how consumers form intentions to adopt practices such as the purchase and use of organic compost.

A wide body of empirical research has explored the role of TPB and related behavioral frameworks in explaining organic food consumption. For instance, Bhutto et al. (2023) examined Generation Z in Pakistan, finding that social media influence and brand awareness significantly shape satisfaction and repurchase intentions of organic food. Similarly, Hameed et al. (2019) applied TPB to eco-conscious consumer behavior in Karachi, revealing that environmental concerns, trust, and intrinsic religious orientation strengthened pro-environmental actions, though attitudes toward green products showed weaker predictive power. These studies highlight how consumer behavior toward organic products is shaped by both internal attitudes and external social influences.

Other perspectives have also been employed to expand understanding of organic consumption. Khan et al. (2023) used goal-framing theory to show that hedonic motivations and normative triggers positively influence purchase intentions toward organic food. Chekima et al. (2017) further highlighted the attitude-behavior gap, emphasizing that while consumers often express positive intentions toward organic products, actual consumption depends on factors such as sensory appeal, product-specific attitudes, and health orientation, moderated by future orientation. These findings suggest that bridging the gap between intention and behavior requires attention to both psychological motivations and contextual barriers.

Trust, perceived value, and environmental knowledge also play a central role in shaping consumer preferences. Lazaroiu et al. (2019) demonstrated that consumer trust and perceptions of ecological benefits significantly influence adoption of organic products, while Khan (2016) highlighted challenges in Pakistan's organic market related to pricing, availability, and perceptions that organic food is a luxury product. Addressing these market barriers through effective marketing and education is therefore critical to fostering greater adoption of organic products.

Parallel research has focused on the adoption of organic farming practices by producers. Sapbamrer and Thammachai (2021) identified a range of drivers including household demographics, attitudes, moral obligations, costs of production, and institutional support, emphasizing the importance of extension services and training. Similarly, Liu et al. (2018) and Dessart et al. (2019) reviewed behavioral and socio-economic determinants of sustainable farming

practices, showing that dispositional, social, and cognitive factors strongly influence adoption decisions. Nguyen et al. (2021a), using an integrated TPB and Norm Activation Model (NAM), found that attitudes, subjective norms, and personal standards were key predictors of Vietnamese farmers' intentions to engage in organic agriculture. These studies underscore the significance of behavioral and contextual factors in shaping sustainable agricultural practices, which in turn influence consumer access to organic products.

More specifically to composting, studies have begun to explore consumer and farmer acceptance of organic compost derived from municipal solid waste. Vigoroso et al. (2021) found that in Italy, both professional and recreational users valued compost for improving soil quality and reducing environmental impact, with social influence and peer recommendations being more effective than financial incentives in encouraging adoption. Similarly, Yazdanpanah et al. (2022), applying the Health Belief Model in Iran, showed that perceived benefits, barriers, and cues to action significantly influenced farmers' willingness to adopt organic farming, reinforcing the importance of awareness and extension services in shaping sustainable practices.

Together, this body of literature suggests that both consumer behavior and farmer adoption are influenced by a complex interplay of psychological factors (attitudes, motivations, values), social dynamics (norms, peer influence, trust), and contextual conditions (market access, costs, institutional support). While extensive work has been done on organic food consumption, fewer studies have specifically addressed consumer intentions toward organic compost, particularly in urban settings of developing countries. Given the environmental and agricultural challenges in cities like Karachi, examining these factors is critical to understanding how compost can be positioned as a sustainable solution that links waste management, urban horticulture, and consumer behavior.

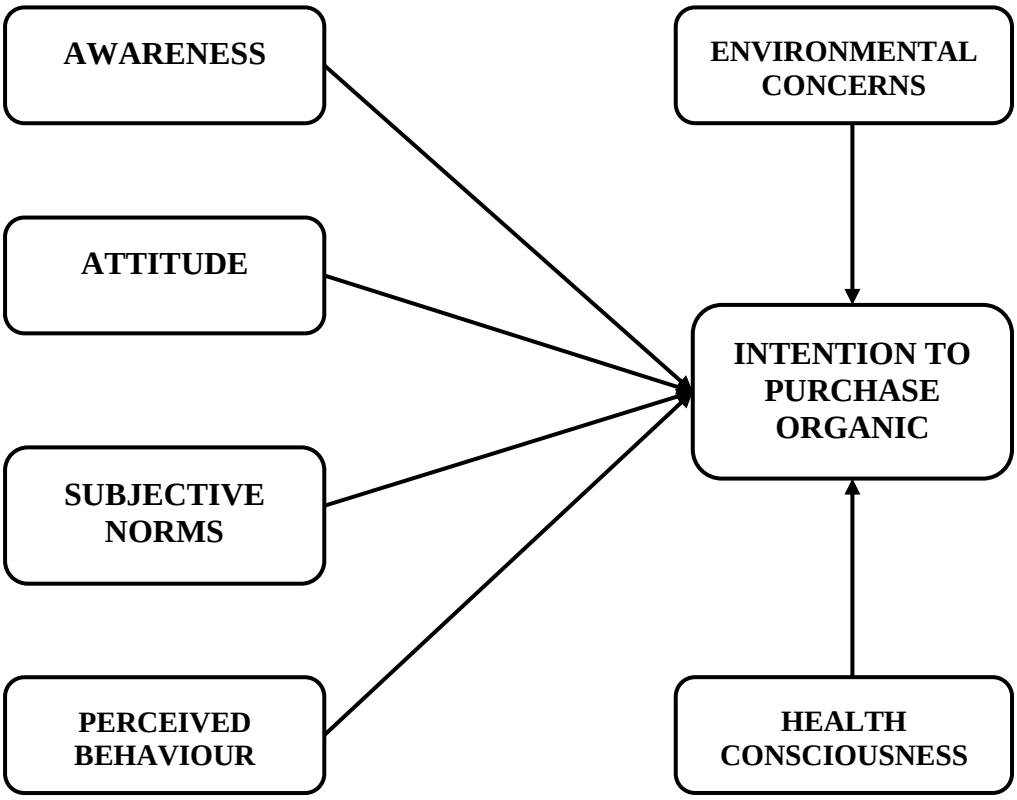


Figure 1 Conceptual Framework

Hypothesis Development

Awareness and Intention to Purchase Organic Compost

Awareness is a foundational factor in driving adoption of organic compost since it reduces information asymmetry and enables consumers to evaluate compost as a viable substitute for chemical fertilizers. Recent studies emphasize that greater awareness leads to favorable decisions in sustainable consumption. Bhutto et al. (2023) found that social media-driven awareness significantly shapes repurchase intentions toward organic food among Generation Z. Similarly, Khan et al. (2023) highlighted that awareness combined with normative triggers enhances consumers' purchase intentions of organic products. Hameed et al. (2019) also noted that awareness and eco-conscious behavior strongly predict sustainable consumption patterns in Pakistan. Earlier, Demirtas (2018) confirmed that awareness of organic food benefits significantly affects consumption behavior, supporting the positive role of knowledge in adoption.

H1: Awareness of organic compost has a significant positive effect on the intention to purchase organic compost.

Attitude and Intention to Purchase Organic Compost

Attitude, which reflects an individual's evaluation of compost as beneficial, has been consistently identified as a strong predictor of intention. Bhutto et al. (2023) showed that favorable consumer attitudes toward organic products positively influenced repurchase intentions among younger generations in Pakistan. Hameed et al. (2019) also revealed that eco-conscious attitudes significantly shaped sustainable behaviors, suggesting that positive evaluations toward green products enhance adoption. Similarly, Khan et al. (2023) found that normative and motivational triggers shaped attitudes that reinforced purchase intentions of organic food. Earlier work by Chekima et al. (2017) highlighted that attitudes narrow the gap between intention and actual behavior, underlining their importance in driving organic product adoption.

H2: Attitude toward organic compost has a significant positive effect on the intention to purchase organic compost.

Subjective Norms and Intention to Purchase Organic Compost

Subjective norms capture the influence of social expectations and peer pressure on individual decision-making, and are widely studied in the Theory of Planned Behavior. Castillo et al. (2021) demonstrated that subjective norms significantly impacted farmers' adoption of pressurized irrigation systems, highlighting the role of peer and community influence. Cakirli Akyüz and Theuvsen (2020) also found subjective norms to be critical in motivating farmers toward adopting sustainable organic practices in Turkey. Similarly, Khan et al. (2023) confirmed that normative triggers strongly shape purchase intentions of organic food in Pakistan, showing the influence of community and societal approval. Earlier, Al-Swidi et al. (2014) established that subjective norms are a key determinant of organic food consumption, reinforcing the assumption that social acceptance fosters adoption.

H3: Subjective norms have a significant positive effect on the intention to purchase organic compost.

Perceived Behavioral Control and Intention to Purchase Organic Compost

Perceived behavioral control (PBC) reflects an individual's belief in their ability and resources to perform a behavior, and it has been consistently shown to predict pro-environmental intentions. Nguyen et al. (2021a) reported that PBC significantly influenced Vietnamese farmers' intention to adopt organic agriculture, indicating that perceived ease and ability enhance sustainable choices. Gwara et al. (2022) similarly found that farmers' perceptions of control shaped their willingness to adopt waste-based fertilizers, with stronger PBC associated with higher adoption likelihood. Daxini et al. (2019) emphasized that farmers' intentions to follow nutrient management plans were largely determined by their perceived behavioral control. Earlier, Ajzen (2002) identified PBC as a central construct of the Theory of Planned Behavior, highlighting its enduring importance across behavioral studies.

H4: Perceived behavioral control has a significant positive effect on the intention to purchase organic compost.

Environmental Concern and Intention to Purchase Organic Compost

Environmental concern reflects an individual's awareness and worry about ecological degradation, and it strongly predicts pro-environmental intentions. Bhujel and Joshi (2023) emphasized that higher levels of environmental consciousness significantly influenced farmers' sustainable agricultural practices in India, showing that concern for the environment translates into positive behavioral outcomes. Sadiq et al. (2023) also highlighted that environmental concern motivates consumers in emerging economies to adopt organic food despite contextual limitations, underscoring its influence on green purchase intentions. Yazdanpanah et al. (2022) demonstrated that perceived environmental benefits and reduced risks strongly motivated Iranian farmers to adopt organic practices. Earlier, Fransson and Gärling (1999) established environmental concern as a core determinant of eco-friendly behavior, which continues to serve as a theoretical foundation in sustainability research.

H5: Environmental concern has a significant positive effect on the intention to purchase organic compost.

Health Consciousness and Intention to Purchase Organic Compost

Health consciousness plays a pivotal role in motivating consumers toward organic products, as it directly relates to minimizing chemical exposure and promoting safer food. Bhutto et al. (2023) showed that health concerns were a key driver of organic food repurchase intentions, especially among younger consumers. Trivedi and Soni (2020) also identified health consciousness as a major determinant of both farmers' and consumers' intentions to adopt organic products, linking personal well-being with sustainable practices. Michaelidou and Hassan (2008) further confirmed that health consciousness, alongside food safety concerns, strongly influenced consumer attitudes and purchase intentions toward organic food. Earlier, Salleh et al. (2010) found that health concerns were a primary reason for consumers' preference for organic products, reinforcing its enduring importance.

H6: Health consciousness has a significant positive effect on the intention to purchase organic compost.

Conceptualization

The Theory of Planned Behavior (TPB) provides a robust framework to explain individual decision-making in sustainable contexts, linking attitudes, subjective norms, and perceived behavioral control with behavioral intention (Ajzen, 1991; Ajzen, 2002). Recent studies have applied TPB and related frameworks to understand eco-conscious behaviors, showing its relevance in organic consumption and sustainable agriculture. For instance, Bhutto et al. (2023) identified the role of social media influence and brand awareness in shaping organic food repurchase intentions, while Khan et al. (2023) emphasized that normative triggers and motivational drivers significantly affect purchase decisions. Bhujel and Joshi (2023) also confirmed that environmental consciousness and knowledge predict farmers' sustainable practices, reinforcing the need to integrate environmental variables with behavioral models. Earlier, Chekima et al. (2017) stressed the attitude–behavior gap in organic food adoption, while Hameed et al. (2019) highlighted eco-conscious consumer behavior in Pakistan, linking environmental concern and trust with green consumption. While much has been done on organic food adoption, limited research has extended TPB to compost and biofertilizer use in urban horticulture, creating a gap for models that integrate awareness, health consciousness, and environmental concern in developing country contexts.

Methodology

Research Design

Research on sustainable agriculture and consumer behavior increasingly employs quantitative approaches to capture complex relationships among psychological, social, and environmental factors. Recent studies have demonstrated the usefulness of survey-based quantitative methods and structural equation modeling (SEM) in examining consumer adoption of sustainable practices. For example, Bhutto et al. (2023) applied SEM to analyze repurchase intentions of organic food among Generation Z, while Khan et al. (2023) used goal-framing theory with quantitative testing to explain purchase intentions toward organic food. Bhujel and Joshi (2023) also employed quantitative models to assess how environmental concern drives adoption of sustainable agricultural practices. Earlier, Hair et al. (2019) recommended SEM as a robust tool for validating reflective constructs and testing complex causal paths in behavioral research, while Bentler and Chou (1987) highlighted sample-size estimation methods critical for reliable SEM analysis. Therefore, adopting a cross-sectional quantitative design with PLS-SEM offers methodological rigor, allowing this study to validate the conceptual model and test the hypothesized relationships on compost adoption in Karachi's urban horticulture sector.

Sampling

The study employed a purposive random sampling technique to ensure the inclusion of individuals directly associated with agricultural practices and the purchase of agricultural inputs. The target population comprised farmers engaged in crop cultivation, nursery managers, and individuals actively involved in agricultural production in Gadap Town, Karachi. This region was selected due to its significance in horticultural activities and the growing interest in sustainable soil management practices. Respondents were specifically chosen from among those who had prior experience with the use of organic compost, as their familiarity with the product would allow for more informed responses regarding purchase intentions. Since the exact population size was unknown, the sample size determination followed the multiplication method outlined by Bentler and Chou (1987), Hair et al. (2010), and Schumacker et al. (2004). According to this approach, the number of indicators in the research model is multiplied by ten to estimate the minimum required

sample. With 35 indicators included, the target sample size was calculated as 350 respondents, which was deemed sufficient to provide statistical reliability and generalizability.

Data Collection and Instrument

Data were collected through a structured, self-administered questionnaire designed to capture both demographic details and behavioral constructs related to the intention to purchase organic compost. The survey was distributed to the selected respondents in the target area, with a particular focus on individuals actively engaged in agricultural production and horticulture. Prior to data collection, clear communication was established with participants to ensure voluntary participation and understanding of the study's objectives. The research instrument consisted of a five-point Likert scale, ranging from 1 (strongly disagree) to 5 (strongly agree). The questionnaire was adapted from validated scales used in prior studies, ensuring both relevance and rigor. A pilot study was conducted to test the instrument's clarity, reliability, and validity, following which minor modifications were made to enhance comprehensibility. The constructs measured in the study included awareness (5 indicators), attitude (5 indicators), subjective norms (5 indicators), perceived behavioral control (5 indicators), environmental concern (5 indicators), health consciousness (5 indicators), and purchase intention (5 indicators). Table 1 presents the sources from which these constructs were adapted.

Data Analysis

The data collected were analyzed using the Statistical Package for Social Sciences (SPSS) Version 29.0 for descriptive and preliminary statistical analysis, and Smart PLS Version 4.0 for Partial Least Squares Structural Equation Modelling (PLS-SEM). The analysis process began with data screening to identify and address potential missing values and outliers. Descriptive statistics were used to summarize demographic characteristics, while reliability and validity tests were performed to confirm the robustness of the constructs. Structural equation modelling was employed to test the hypotheses and evaluate the relationships between independent and dependent variables. The regression analysis within the SEM framework allowed for the identification of direct and indirect effects, thereby confirming the proposed conceptual framework.

Results and Discussion

The results of this study confirm that awareness, attitude, perceived behavioral control, environmental concern, and health consciousness significantly influence the intention to purchase organic compost, while subjective norms remain insignificant. These findings align with recent literature on sustainable consumption. For instance, Bhutto et al. (2023) highlighted that awareness and eco-conscious attitudes strongly predict repurchase intentions of organic food, while Khan et al. (2023) demonstrated that normative triggers and motivations enhance purchase behavior in emerging markets. Similarly, Bhujel and Joshi (2023) showed that environmental concern and knowledge play a decisive role in sustainable agricultural adoption. Earlier, Hameed et al. (2019) emphasized that eco-conscious consumer behavior in Pakistan is driven by environmental concern and trust, while Chekima et al. (2017) identified the gap between positive attitudes and actual organic purchase, reinforcing the need to address contextual barriers. Together, these insights validate the study's results and highlight how extended TPB variables explain compost adoption in Karachi's urban horticulture context.

Demographic Descriptive Analysis

Table 1: Demographic Profile

Sample Characteristics	N	%
Gender		
Male	347	99.4
Female	2	0.6
Age		
18-30	49	14.0
31-45	78	22.3
45-60	149	42.7
60 and above	73	20.9
Marital Status		
Married	266	76.2
Single	83	23.8
Education		
Primary	95	27.2
Matric	116	33.2
Intermediate	104	29.8
Graduation (14 Year Education)	25	7.2
Masters (16 Year Education)	9	2.6
Enterprise Type		
Private/Partnership	211	60.5
Sole/Self Employed	114	32.7
Government/Public Sector	24	6.9
Income (in PKR)		
50,000 or less	136	39.0
51,000 to 100,000	81	23.2
101,000 to 150,000	67	19.2
151,000 to 200,000	35	10.0
201,000 and above	30	8.6

In total, 349 valid responses from farmers were received. The study investigates the demographic, along with socioeconomic characteristics of farmers from the city of Karachi. The descriptive analysis resulted an interesting pattern among the respondents. With regards to gender, the majority farmers were male (99.4%) while a smaller proportion were female (0.6%). Age-wise, majority respondents fall between 46 and 60 years old (42.7%), followed by reasonable number of respondents in the age bracket of 31-45 and those age above 60 with percentage of (22.3%) and (20.9%) respectively, and smaller percentages in the 18–30 age range (14.0%). Majority of respondents were married (76.2%), while (23.8%) of the respondents were single.

In terms of socioeconomic factors, the educational literacy of farmers varied considerably. A notable proportion were illiterate considering those have studied till Primary standard (27.2%), while respondents who have completed their matriculation had the highest share (33.2%) followed respondent with intermediate education (29.8%). Graduates (14 years of Education) and respondents who have completed their Masters (16 years of Education) were (7.2%) and (2.6%) respectively. With respect to type of farm/nursery ownership, the study exhibits that the majority

of the respondent run their business under Private or Partnership with (60.5%), followed by sole proprietorship or self-employed farmers with (32.7%) while the public or government owned nurseries shares the lowest proportion of (6.9%). With respects to farmers monthly income, the proportion showed diverse ranges. A small percentage had a monthly income higher than PKR 200,000 (8.60%), while larger proportions of respondent earns less than PKR 50,000 (39.0%), followed by earning range of PKR 51,000 to 100,000 (23.2%), 101,000 to 150,000 (19.2%), and 151,000 to 200,000 (10.00%).

Common Method Biases

Table 2: Common Method Biases Analysis

Construct	VIF
Attitude	3.943
Awareness	4.075
Environmental Concern	2.060
Health Concern	2.469
Perceived Behavior Control	2.931
Subjective Norms	2.346

Note: The above table checks for the common method biases. VIF < 3.3

The use of a full collinearity diagnostic test to determine whether common method bias is present or absent means that our findings are a function of the measurement techniques rather than the effect we are examining (Jordan & Troth, 2020). According to Table 4, the research we conducted is not affected by common method bias, as indicated by full collinearity diagnostic results that are lower than the recommended (VIF< 3.3) (Hair et al., 2019).

Outer Loading

Table 3: Outer Loadings, Composite Reliability, and Average Variance Extracted

Construct	Item code	Outer Loadings	Composite Reliability	Ave. Variance Extracted
AOC	AOC1	0.740	0.906	0.657
	AOC2	0.744		
	AOC3	0.806		
	AOC4	0.805		
	AOC5	0.734		
ATT	ATT1	0.764	0.894	0.624
	ATT 2	0.758		
	ATT 3	0.716		
	ATT 4	0.747		
	ATT 5	0.718		
SubN	SubN1	0.690	0.844	0.570
	SubN 2	0.685		
	SubN 3	0.724		
	SubN 4	0.661		
Pbc	Pbc1	0.677	0.864	0.557
	Pbc 2	0.653		
	Pbc 3	0.688		

	Pbc 4	0.692		
	Pbc	0.712		
EVC	Evc1	0.738	0.852	0.524
	Evc 2	0.550		
	Evc 3	0.638		
	Evc4	0.698		
	Evc5	0.645		
HC	HC2	0.823	0.846	0.677
	HC4	0.788		
	HC5	0.755		
Itop	Itop1	0.675	0.846	0.584
	Itop 2	0.705		
	Itop 3	0.717		
	Itop5	0.707		

Note: The above table checks the reliability and convergent validity of reflective constructs.

To evaluate the indicator's dependability, the first outer loadings have been examined. In Wong's opinion, the outer loading needs to be higher than 0.708. (2013). According to the results, one item about subjective norms, one item about intention to buy, and two items about health concerns were eliminated because their outer loading was less than 0.5 (Hair et al., 2019). This item doesn't correspond to the construct, as evidenced by the deleted elements. The remaining reported items that had outer loadings greater than the cutoff of 0.708 were kept in the analysis, meaning that the respective construct accounts for over 50% of the indicator's explained variation. The composite reliability criterion is >0.70, and it is used to evaluate internal consistency (Hair et al., 2019). With reliability values above 0.70, all the constructs are considered highly reliable. An item's association with other items belonging to the same construct is demonstrated by convergent validity (Bagozzi & Yi, 1988). Convergent validity is checked in the underlying study using AVE statistical values, which ought to be more than 0.50 (Hair et al., 2019). The results demonstrate that convergent validity has been demonstrated, with an AVE value >0.50 for every construct. Table 4 displays the output for the outer loading, CR, and AVE.

Heterotrait-Monotrait Ratio (HTMT Ratio)

Table 4: Heterotrait-Monotrait Ratio Validity

Construct	AOC	ATT	SubN	Pbc	Evc	HC	Itop
AOC							
ATT	0.949						
SubN	0.805	0.838					
Pbc	0.860*	0.843	0.784				
Evc	0.669	0.638	0.682	0.756			
HC	0.801	0.812	0.805	0.818	0.757		
Itop	0.842	0.822	0.745	0.821	0.712	0.817	

Note: The above table exhibits the discriminant validity of the studied constructs.

The distinctions between the investigated variables are referred to as discriminant validity. The discriminant validity is established using HTMT ratios. A value of <0.85 was proposed by (Hair et al., 2019). Except for one construct that relates knowledge and perceived behavioral control, all of the study's constructs had discriminant validity less below the 0.85 threshold, as shown by Table 5s HTMT ratio output.

Indicator Collinearity & Significance of outer weight

Table 5: Collinearity (VIF) & Statistical significance of weights

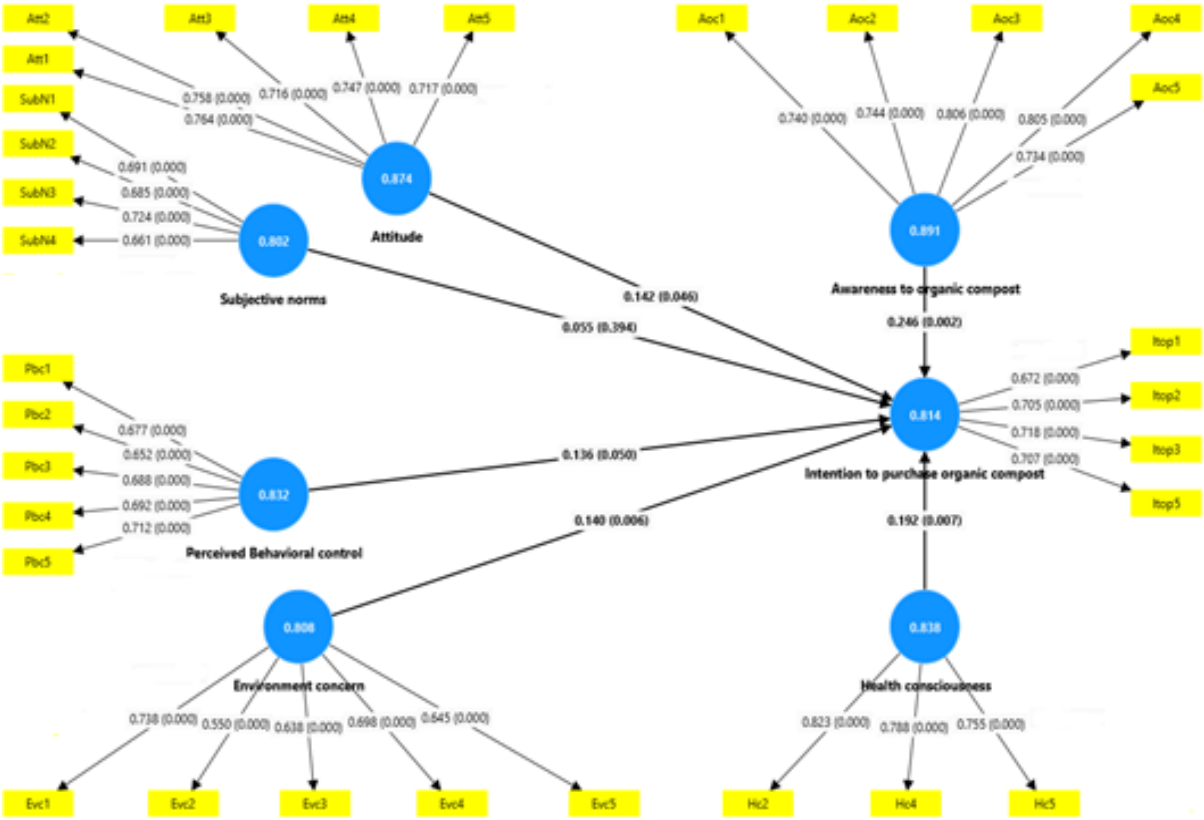
Construct	VIF	P Values
AOC -> ITOP	4.032	0.000
ATT -> ITOP	4.097	0.000
SUBN -> ITOP	2.347	0.000
PBC -> ITOP	2.908	0.000
EVC -> ITOP	1.997	0.024
HC -> ITOP	2.347	0.000

Note: VIF=Variance inflation factor is conducted to identify collinearity of formative construct at p-value < 0.05 indicating the significance of outer weights.

According to Hair et al., (2019) values of variance inflation factor (VIF) should be lower than 3.3 as it estimates indicator collinearity. VIF values of all constructs in the formative model as presented in Table 6 are < 3.3, representing that the current study didn't found collinearity amongst the constructs. Contribution of an item to its related variable is represented as Outer weight. The outer weight threshold is p-value < 0.05 as suggested by Hair et al., (2019). The output in table 6 exhibited that the weights of all variables are significantly lower than the suggested value of <0.05.

PLS SEM

Figure 2: PLS SEM Results



This PLS-SEM path model illustrates the relationships among the independent variables and the intention to purchase organic compost. The results indicate that awareness (β = 0.246, p < 0.01),

attitude ($\beta = 0.143$, $p < 0.05$), perceived behavioral control ($\beta = 0.135$, $p < 0.05$), environmental concern ($\beta = 0.139$, $p < 0.01$), and health consciousness ($\beta = 0.193$, $p < 0.01$) all have a significant positive effect on purchase intention. In contrast, subjective norms ($\beta = 0.055$, $p > 0.05$) show no significant influence. The model explains 61.4% of the variance ($R^2 = 0.614$) in purchase intention, which reflects a moderately strong predictive power. Overall, the findings suggest that personal awareness, attitudes, and eco-health concerns are stronger drivers of compost adoption than social pressure.

Hypothesis testing using PLS SEM

Table 6: Hypothesis testing using PLS SEM

Hypotheses	Paths	Coefficients	St. D.	P-Value
H1=Awareness effects Intent to buy compost	AOC->ITOP	0. 246	0.071	0.002*
H2=Attitude effects Intent to buy compost	ATT->ITOP	0.143	0.079	0.046*
H3=Subject norm effect compost buying intent	SUBN->ITOP	0.054	0.064	0.394
H4=Perceived behavioral control effect compost buying intent	PBC->ITOP	0.135	0.069	0.050*
H5=Environmental concern effects Intent to purchase compost	EVC->ITOP	0.139	0.051	0.006*
H6=Health concern effects intent to purchase compost	HC->ITOP	0.193	0.070	0.007*

Note: * represents accepted hypotheses at p-value <0.05

As studied by Hair et al., (2019) values of T-statistics should be higher than 1.96 while p values equal or less than 0.05 to assess the Direct effects. T-statistics was employed using IBM SPSS linear regression as mentioned in Table 8 and p values estimated using PLS SEM using Smart PLS are mentioned in Table 8. H1 evaluates whether awareness of organic compost has a positive effect on farmers' intention to purchase organic compost. Results revealed that AOC does affect ITOP (t=2.77, p=0.002). Hence H1 is supported. H2 evaluates the effect of attitude towards organic compost in relation to farmer's intention to purchase organic compost. The output supports the hypothesis amongst ATT and ITOP (t=3.567, p=0.046). Hence, H2 is supported. H3 is Subjective norms indicating the effectual relationship with ITOP. The result revealed that the Subjective norm does not have an effectual relationship with farmers' intention to purchase organic compost. (t=-1.070, p= 0.285). Hence, H3 is not supported. H4 indicates that Perceived Behavioral Control can affect farmers' intention to purchase organic compost. Results indicate that Perceived Behavioral Control does have an effectual relationship with farmers' intention to purchase organic compost. (t=-3.394, p= 0.05). Hence, H4 is supported. H5 indicates that Environmental Concern can affect farmers' intention to purchase organic compost. Results indicate that environmental concern does have an effectual relationship with farmers' intention to purchase organic compost. (t=-3.804, p= 0.006). Hence, H5 is supported. H6 indicates that Health consciousness/concern can affect farmers' intention to purchase organic compost. Results indicate that Health consciousness/concern does have an effectual relationship with farmers' intention to purchase organic compost. (t=-3.078, p= 0.007). Hence, H6 is supported.

Effect Sizes (f^2 Analysis)

Table 7: Effect Sizes (f^2 Analysis)

Paths	f^2	Effect Size
Awareness of organic compost -> Intention to purchase organic compost	0.038	Large
Attitude -> Intention to purchase organic compost	0.013	Medium
Subjective norms -> Intention to purchase organic compost	0.003	Small
Perceived Behavioral control -> Intention to purchase organic compost	0.017	Medium
Environment concern -> Intention to purchase organic compost	0.025	Medium
Health consciousness -> Intention to purchase organic compost	0.037	Large

The f^2 values highlight the relative contribution of each predictor variable to the intention to purchase organic compost. Awareness (f^2 = 0.038) and health consciousness (f^2 = 0.037) demonstrate a large effect, indicating that these two constructs are the strongest drivers of compost adoption. Environmental concern (f^2 = 0.025), perceived behavioral control (f^2 = 0.017), and attitude (f^2 = 0.013) show medium effects, suggesting that while they positively influence intention, their contribution is comparatively less powerful than awareness and health concerns. In contrast, subjective norms (f^2 = 0.003) have only a small effect, confirming their minimal role in shaping purchase decisions. Overall, these findings suggest that consumers' decisions are more strongly shaped by personal knowledge, environmental and health motivations, rather than social influence or pressure.

The results of this study show that awareness, attitude, perceived behavioral control, environmental concern, and health consciousness significantly affect the intention to purchase organic compost, while subjective norms remain insignificant. These findings are consistent with Bhutto et al. (2023), who demonstrated that awareness and eco-conscious attitudes strongly predict organic food repurchase intentions. Similarly, Bhujel and Joshi (2023) confirmed that environmental consciousness plays a vital role in sustainable agricultural adoption, reinforcing the importance of ecological motivation. In addition, Nguyen et al. (2021a) found that perceived behavioral control significantly influenced farmers' intentions to adopt organic agriculture, supporting our results. However, our insignificant finding for subjective norms contrasts with Khan et al. (2023), who reported that normative triggers and social influence positively shaped organic food purchase intentions. Earlier, Hameed et al. (2019) also emphasized that eco-conscious behavior in Pakistan was strongly influenced by environmental concern and trust, supporting the significance of these constructs in our model.

Discussion

The findings of this study contribute significantly to understanding consumer adoption of organic compost in the context of urban horticulture in Karachi. The results reveal that awareness, attitude, perceived behavioral control, environmental concern, and health consciousness positively influence the intention to purchase compost, while subjective norms remain insignificant. Theoretically, this extends the Theory of Planned Behavior (TPB) by integrating ecological and health-related variables with conventional predictors, thus enhancing its explanatory power (Ajzen, 1991; Ajzen, 2002). Similar to Bhutto et al. (2023), awareness and positive attitudes are confirmed as strong determinants of sustainable behavior, while Bhujel and Joshi (2023) demonstrated that environmental concern and knowledge directly drive sustainable practices, supporting our

findings. Moreover, Nguyen et al. (2021a) showed that perceived behavioral control is central in adoption decisions, which aligns with our results. However, unlike Khan et al. (2023), who found normative triggers to be significant in predicting organic food intentions, our findings suggest that in Karachi's urban horticulture context, individual knowledge and eco-health motivations outweigh social pressures. Earlier work by Chekima et al. (2017) and Hameed et al. (2019) also stressed the gap between positive attitudes and actual adoption, suggesting that contextual extensions like awareness and health are essential to better explain consumer intentions. Thus, our results support TPB's robustness while highlighting the need to contextualize it with sustainability-oriented constructs.

From a literature and practical perspective, this research broadens the scope of sustainable consumption studies by shifting focus from organic food to organic compost/biofertilizer, an area less explored in developing countries. In line with Bhutto et al. (2023) and Hameed et al. (2019), the significance of awareness and environmental concern highlights that trust, ecological value, and consumer education remain vital for adoption. Similarly, Bhujel and Joshi (2023) emphasized that environmental knowledge enables favorable adoption behaviors, consistent with our results that environmental concern strongly predicts compost usage. Practical contributions emerge by showing that policymakers and stakeholders should prioritize awareness campaigns, health-focused marketing, and ecological messaging to promote compost adoption. At the same time, barriers identified in earlier research, such as the attitude–behavior gap (Chekima et al., 2017) and structural challenges like affordability and accessibility (Nguyen et al., 2021a), suggest that adoption cannot rely solely on motivation but requires institutional and policy support. The insignificance of subjective norms further implies that community pressure is less effective than personal health and environmental priorities in driving behavior in Karachi. Overall, the results provide new insights by confirming that individual-centered motivations are stronger than social influences, making this study a novel addition to both theory and practice in sustainable consumption and urban waste-to-resource strategies.

Conclusion

The findings of this study advance the understanding of compost adoption in urban horticulture by confirming that awareness, attitude, perceived behavioral control, environmental concern, and health consciousness are significant predictors of purchase intention, while subjective norms are not influential. These results extend the Theory of Planned Behavior (Ajzen, 1991; Ajzen, 2002) by incorporating ecological and health dimensions, thereby enhancing its predictive capacity in sustainability contexts. Similar to Bhutto et al. (2023), awareness and positive attitudes were found to be crucial in shaping adoption behaviors, while Bhujel and Joshi (2023) emphasized the importance of environmental consciousness, consistent with our findings. Likewise, Nguyen et al. (2021a) identified perceived behavioral control as a key determinant in organic farming adoption, mirroring our result that compost purchase intention depends on perceived ability and resources. However, the insignificance of subjective norms contrasts with Khan et al. (2023), who demonstrated that normative triggers strongly influenced organic food purchase intentions, suggesting that compost adoption is more individually motivated in Karachi's horticulture context. Earlier, Chekima et al. (2017) highlighted the gap between attitude and behavior in organic food, a concern addressed here by showing that awareness and health concerns reinforce intentions beyond mere positive attitudes. Thus, theoretically, this study confirms TPB's robustness while contextualizing it with sustainability-driven constructs relevant to developing urban settings.

From a broader contribution perspective, this research enriches the literature on sustainable consumption by shifting focus from organic food adoption toward the less-explored domain of

organic compost/biofertilizers, thereby bridging gaps in urban waste-to-resource practices. In line with Hameed et al. (2019), our results confirm that environmental concern is a strong motivator of eco-conscious behavior in Pakistan, while Bhutto et al. (2023) and Bhujel and Joshi (2023) reinforced that awareness and ecological knowledge are central to shaping adoption decisions. Practical contributions emerge by identifying that consumer decisions are influenced more by personal awareness, ecological concern, and health motivations than by social pressure, implying that policy interventions should focus on awareness campaigns, eco-health marketing, and product accessibility. Chekima et al. (2017) also emphasized the structural barriers in translating intention into action, suggesting that affordability and institutional support remain critical for adoption. The findings therefore offer actionable strategies for policymakers, entrepreneurs, and environmental planners to strengthen compost adoption in Karachi's urban horticulture, contributing both to sustainable food systems and effective waste management. Overall, the study provides theoretical, literature-based, and practical contributions by extending TPB, advancing sustainability research, and offering insights for practice, confirming that compost adoption is best driven by individual-centered eco-health motivations rather than external normative influence.

Future Research Directions

Although this study makes important contributions by extending the Theory of Planned Behavior (TPB) with awareness, environmental concern, and health consciousness, certain limitations provide opportunities for future research. First, the study is cross-sectional and restricted to Karachi's Gadap Town, which limits generalizability. Similar to the observations of Hameed et al. (2019), who emphasized that eco-conscious consumer behavior in Pakistan varies across contexts, future research should replicate this model in diverse geographical regions to improve external validity. Methodologically, while SmartPLS SEM enabled robust testing of reflective constructs, Hair et al. (2019) emphasized that longitudinal designs and larger sample frames would strengthen causal inference. Theoretically, Ajzen (1991, 2002) positioned TPB as a flexible model, yet our results particularly the insignificance of subjective norms suggest the need to integrate additional theories such as Value-Belief-Norm (VBN) or Goal-Framing Theory. Khan et al. (2023) found normative triggers to be significant in organic food adoption, contrasting with our findings; this indicates that future studies should test moderating variables like culture, gender, or income. Additionally, Chekima et al. (2017) stressed the persistent attitude–behavior gap in organic consumption, reinforcing the need for future research to address structural barriers such as affordability and availability in compost adoption.

From a managerial and policy perspective, the findings demonstrate that consumer adoption of compost is strongly shaped by awareness, environmental concern, and health consciousness rather than by subjective norms. Bhutto et al. (2023) confirmed that awareness and eco-conscious attitudes strongly predict repurchase intentions in organic food markets, suggesting that awareness campaigns and consumer education are vital for compost promotion. Bhujel and Joshi (2023) also highlighted the importance of ecological concern in sustainable adoption, implying that marketing should emphasize compost's environmental benefits. Policymakers should design targeted interventions such as subsidies or certification programs to improve affordability and trust, as earlier studies (Chekima et al., 2017; Hameed et al., 2019) indicated that consumer intentions often fail to translate into behavior due to cost and trust issues. Nguyen et al. (2021a) stressed the role of perceived behavioral control, which suggests that ensuring product availability and accessibility will further enhance adoption. Moreover, the insignificance of subjective norms implies that strategies relying solely on peer pressure or community influence may be ineffective in Karachi's horticulture; instead, campaigns should highlight personal health and ecological safety. By

addressing these managerial and policy priorities, compost adoption can be positioned as a sustainable solution to urban waste management and food safety challenges in Pakistan.

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