



*Research article*

## **Modeling consumer home composting intentions for sustainable municipal organic waste management in Iran**

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**Abstract:** Home composting (HC) can be a cost-effective strategy for organic solid waste management. This option is also desirable since HC is increasingly automated, with HC machines composting faster than conventional composting in outdoor settings. Besides, HC may reduce organic solid waste management costs, especially for developing countries with scarcer resources. Taking Iran as a study case, the paper examines the influence of variables pertaining to the theory of planned behavior, the value-belief-norm framework, and the technology acceptance model. This study uses data collected from a territory-wide survey (n = 367) of Isfahan's residents to predict HC intentions. The results show that both attitude and subjective norms appear as the most impactful of all variables. These results further vary according to sex, with women being significantly more prone to HC than men. The findings may provide a reference to implement HC in Iran and other developing countries and possibly developed ones.

**Keywords:** home composting; organic solid waste; pro-environmental behavior; theory of planned behavior; value-belief-norm theory; technology acceptance model

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### **1. Introduction**

The unrelenting increase of organic solid waste is a common problem worldwide [1]. Modern lifestyles and population growth have inevitably increased organic solid waste (OSW) worldwide [2]. To deal with this issue, most developed and developing countries have adopted a hierarchical framework for waste management that involves a descending order of priority: prevention, minimization, reuse, recycling, and disposal [3]. These waste management programs attempt to change

consumers' household waste management behaviors to achieve a cleaner environment [4]. Both prevention and reduction strategies have been prioritized for waste management, and thus a significant proportion of studies have focused on these strategies [5–8]. Yet, although waste prevention, minimization, and reuse are the most desirable options in the hierarchy of waste management, their implementation sometimes requires substantial changes in consumers' lifestyles, making them often difficult to implement [9]. Instead, recycling has become one of the most popular waste management options worldwide [10–12]. Besides, recycling is also a critical dimension of socially responsible consumption behavior [13,14], meaning that recycling - more than any other waste management strategy - is crucial to evolve towards more sustainable consumption behavior.

In the literature on household recycling worldwide, most studies have focused on curbside recycling programs and municipal solid waste (MSW) recycling. This is understandable because, in developed countries such as the United States or Canada, for example, the composition by MSW is predominantly composed of non-organic waste such as paper (27%), yard trimmings (14%), plastics (13%), metals (9%), rubber/leather/textiles (9%), wood (6%), glass (4%) and other materials (3%). In comparison, only more than one-tenth (15%) is food (i.e., OSW) [2]. However, there are also some exceptions among developed countries. For example, waste in Spain is almost half (49%) organic, 21% paper, 12% plastic, 8% glass, 4% iron, and 7% other materials [15]. Therefore, the implementation of recycling programs for non-organic waste is of growing interest worldwide [16].

Also, for organic waste, home composting (HC) appeared as an environmental solution at the household level that can reduce waste and turn materials into valuable resources [17,18]. As a form of organic waste recycling activity, HC curbs biodegradable waste volume going into landfill sites such as food and yard waste [19].

In most countries, including the UK [20], Spain [21], Sweden [22], Denmark [23], Japan [24], and Germany [25], home composting is used as a waste management approach. Yet, in developing countries, including Iran, the organic waste volume is comparatively higher [19]. Meanwhile, HC is under-developed. For example, waste production per capita in Isfahan is 500 grams. Of the 1000 tons of daily residual in Isfahan, 650 tons of organic waste can be converted into standard compost fertilizer [26,27]. So, to promote home composting effectively, it is essential to recognize the determinants of HC. However, the existing literature on HC is limited in several aspects.

First, composting is investigated from a managerial standpoint [2]. Second, when taking the individual as the unit of analysis, the literature focuses on the demographic variables leading to HC without exploring the psychological process underlying the behavior [11,28,29]. Third, the exploration of HC from an individual vantage point lacks theoretical foundations for exploring specific intrapsychic variables [20]. Fourth, these studies pertain to HC in developed countries such as Hong Kong and the United Kingdom. At the same time, HC in the context of developing nations is less documented in research. Finally, automated home composting differs from traditional composting due to the need to adopt a new technology to perform HC. Since these kinds of equipment are becoming increasingly popular for HC purposes [30,31], traditional behavioral models may less well apply, and the literature is under-developed in this regard. Albeit not focusing solely on automatic HC, this research fills that void in the literature by modeling the factors that impact home composting. This study thus contributes to the emerging literature about automated composters as well [32].

To fill these knowledge gaps, this paper analyzes first-hand data from a territory-wide sampling survey conducted in 2019. The survey used the stratified random sampling method to sample 367 residents of Isfahan to better understand the determinants of HC intentions in developing countries.

More specifically, this paper used the variables about three seminal theoretical frameworks in consumer choice modeling – the theory of planned behavior, the value-belief-norm theory, and the technology acceptance model – on HC intentions in the context of a developing nation. This study may reference future HC studies and the improved implementation of HC programs in developing and possibly developed countries alike.

## **2. Theoretical framework and hypotheses development**

### *2.1. The theory of planned behavior (TPB)*

The theory of planned behavior (TPB) provides a framework for predicting behavior while considering the individual as the unit of analysis. A previous version of that theory known as the theory of reasoned action (TRA) examined the impact of behavioral beliefs and evaluation of behavioral outcomes on attitudes, as well as normative beliefs and motivation to comply with subjective norms, with both attitudes and subjective norms being posited as antecedents to intentions [33]. An attitude is a psychological emotion and indicates a person's negative and positive evaluation of a particular behavior [34]. Subjective norms are the social pressure perceived by the individual to perform the behavior [33]. The first assumption of the TRA is that behavioral intentions lead to behavior, while a series of other factors influence behavior indirectly through intentions [35]. The second assumption of this theory is that behavior is volitional, i.e., voluntarily controlled. Behavior is controlled by a person who behaves differently out of personal choice and not based on external principles or accidents. Hence, this theory performs well in predicting behaviors done by conscious choice but predicts less well behaviors that are not entirely volitional [36]. Accordingly, Ajzen added the construct of perceived behavioral control to the theory of reasoned action (TRA) and devised TPB [37]. The TPB suggests that behavioral intentions are determined by perceived behavioral control [34]. Perceived behavioral control indicates the extent to which one's behavior is under voluntary control, and perceived behavioral control is defined as one's beliefs about how easy or difficult it is to perform a given behavior [37]. The central argument in TPB is that each behavior is triggered by an intention and the perceived behavioral control. Attitudes and subjective norms are supposed to affect behavioral intentions alone. In sum, attitudes toward behavior, beliefs about the external viewpoints of reference persons, and beliefs about the ability to participate in particular behaviors influence a person's intention to engage in that specific behavior [38]. However, previous studies on recycling have shown that the three main factors of TPB cannot predict behavior well [19,39]. Given HC's nomological proximity with recycling in that composting is the “recycling of compostable waste” [40], it follows that this theory needs to be complemented with other variables or theories.

According to Fishbein and Ajzen [34], attitude has a positive impact on intentional behavior. Also, Mosler et al. [4] indicate a high correlation between attitude and composting intentions. Most studies suggest that attitude has a significant and positive impact on environmental intentions [4,19,20,39,41–43]. Some studies showed that subjective norms positively correlate with a person's composting/recycling intention [41,44,45]. Meng et al. [44] indicated a significant positive relationship between social norms and recycling intentions. Besides, Knussen et al. [46] employed the TPB model as a research framework to study recycling behavioral intentions. Their research showed that perceived behavioral control has a significant impact on recycling intention. While supported in the context of recycling, especially in developed countries, we posit investigating those relationships

about the TPB in the framework of HC in a developing country. Consequently, we derive the following hypotheses:

H1: Attitude is positively related to home composting intentions.

H2: Subjective norms positively influence home composting intentions.

H3: Perceived behavioral control has a positive effect on home composting intentions.

## 2.2. *Technology acceptance model (TAM)*

One of the most popular and broadly used theories for predicting technology adoption by individuals is the technology of the acceptance model (TAM) [47]. Davis developed this theory in 1989, adapted from the theory of reasoned action [47]. The TAM framework is used to predict the factors affecting adopting new technologies [48]. According to this theory, the adoption of technology is directly related to behavioral intentions. In this theory, perceived ease of use and perceived usefulness affect attitudes, which, in turn, affects behavioral intention [49]. This theory adds a critical perspective to investigating pro-environmental behavior, namely the ease of performing a given behavior and its perceived usefulness. None of the previous theories integrates these crucial variables that are core determinants of behavior. For these reasons, the TAM theory has already been used to predict responsible technology acceptance, such as smart grid technology acceptance [50]. The application of TAM to HC might seem unsettling at this point. However, it should be stressed that HC practices have gradually changed and are increasingly becoming automated. HC systems have progressively moved from being outdoors and manual to indoors and automated with automatic HC units that provide an easier way to get involved with the composting process and maintain it over the long run [30,31]. To control for that technological component, we added the TAM variables.

Therefore, Davies et al.'s [51] technology acceptance model (TAM) involving perceived usefulness and perceived ease of use, as crucial variables of acceptance of technically- or technologically-related practices, seems particularly relevant. It means that individuals first evaluate the cost and benefits of behavior before engaging in it. According to TAM, perceived easiness impacts perceived usefulness, and attitude is influenced by perceived usefulness and perceived easiness. This division of attitude is based on evidence from previous studies that have shown that attitude is not unidimensional [42,51–53] showed that perceived usefulness is positively related to recycling intention. According to extant research, the main research hypotheses about the TAM are as follows:

H4: Perceived ease of use has a positive and significant impact on perceived usefulness.

H5: Perceived usefulness has a positive and significant impact on attitudes towards home composting.

H6: Perceived ease of use has a positive and significant impact on attitudes towards home composting.

## 2.3. *Personal norms*

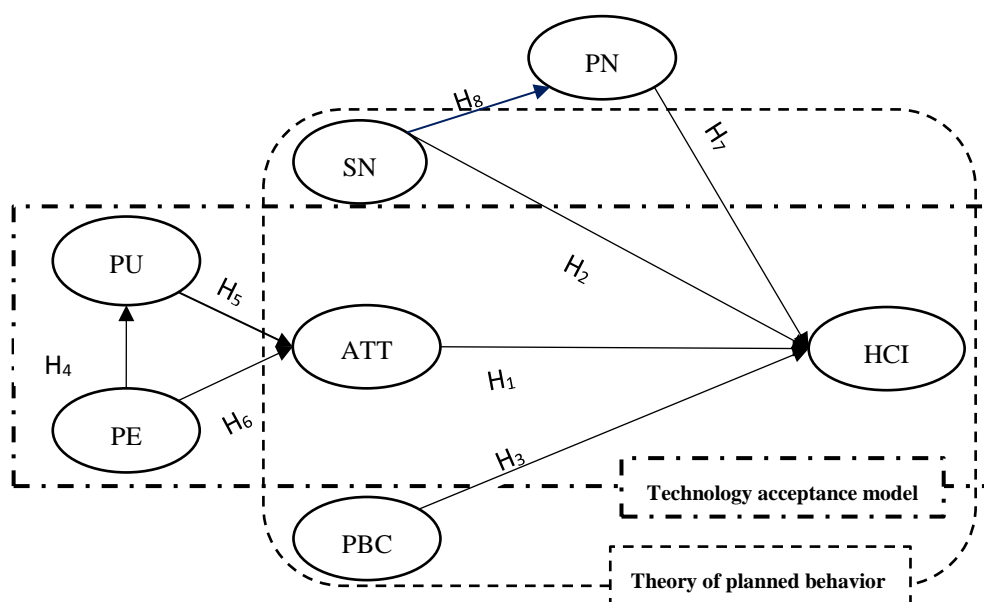
Several studies have examined the relationship between PN and behavioral intention (BI) in pro-environmental and prosocial behaviors. For example, Yuan et al. [54] showed that personal norm has a positive and significant effect on citizens' behavior towards kitchen waste recycling. An empirical study in Taiwan indicated that personal norms have a positive impact on recycling intention. According to Tonglet et al. [1], moral norms and recycling consequences are also important determinants of households' recycling intentions. Accordingly, we posit the following relationships:

H7: Personal norm has a positive and significant effect on home composting intentions.

Many researchers have approved the causal relationship between SN and PN. SN precedes PN because SN reflects the social pressure on a person that guides him/her to decide whether or not a behavior is correct [55–57]. Park and Ha [58] showed that a person's perception of recycling is socially acceptable and will guide his/her decision to feel obliged to recycle. Also, Han et al. [59] identified the prominent role of SN and confirmed the positive causal relationship between SN and PN. Based on these theoretical and empirical works, perceived social pressure on eco-friendly behavior, primarily home composting, would influence a person's moral duty to act pro-environmentally. Therefore, the following hypothesis is presented:

H8: Subjective norms about composting positively affect personal norms related to composting.

It should be mentioned that the TPB is capable of integrating new variables. Therefore, this theory can be developed using new variables. Thus, the TPB is central to the research framework, and TAM and personal norms are used to broaden this framework. The integrated research framework is shown in Figure 1.



**Figure 1.** The integrated research framework.

*Note:* Home composting intentions (HCI); Personal norms (PN), Subjective norms (SN), Perceived behavioral control (PBC), Perceived easiness (PE), Perceived usefulness (PU), and Attitude (ATT).

### 3. Research method

#### 3.1. Study area

Isfahan is one of Iran's largest cities, with a population of approximately 2 million people. By population, Isfahan is Iran's third-largest city, and it is also an important city as it is located at the intersection of the north-south and east-west routes that traverse Iran. It has a dry continental climate with four distinct seasons. Isfahan urban waste production per capita is about 500 grams/ per day. In Isfahan, 1,000 tons of daily solid waste is produced by residents, which includes 650 tons of compostable organic waste [26,27].

### 3.2. Research instrument

The research instrument consists of a questionnaire structured according to the components of the conceptual framework. The five items of PU were adapted from Chen and Tung [42]. Besides, PE was measured by an ad hoc scale of four items developed by the researchers. Also, five PN items were drawn from Tonglet et al. [1] and Liao et al. [60]. The five ATT items were adapted from Liao et al. [60] and Zeweld et al. [53]. SN was measured using three items by Oztekin et al. [61]. Four items of PBC were adapted from Liao et al. [60]. Finally, eight items of BI were adapted from Taylor and Todd [39]. Also, composting knowledge was measured with a binary question (low or high) adapted from Zhou et al. [62].

The 5-point Likert Scale (strongly disagree = 1 and strongly agree = 5) was used to measure all constructs, except behavioral intention. A five-point Likert scale measured the behavioral intention (from 0 “not at all” to 2 “very high”). Since the questionnaire items were taken from the English research, they were appropriately translated into Persian and then back to English to ensure translation accuracy. A panel of experts confirmed the validity of the questionnaire. A pilot study was conducted to assess the reliability of the questionnaire. The pilot study was conducted in Khomeini Shahr, one of the counties of the Isfahan province. The head of the household was selected to answer the questionnaire. A total of 30 household heads were, therefore, randomly selected to complete the questionnaire. The results showed that Cronbach’s alpha was higher than 0.6. Thus, the reliability of the questionnaire was confirmed [63].

### 3.3. Participants

The total number of participants in this study amounted to 367 respondents. As shown in Table 1, about 36% of the sample consisted of males, and 64% of the sample consisted of females. This indicated that females show a higher propensity for waste management than men do. This initial finding is in line with previous studies [4,64]. The average age of participants was 45 years old (SD = 7.76).

Means, standard deviations, and correlation coefficients of all variables are presented in Table 2. As can be seen, the correlations were high, especially with HC intentions. Yet, since the correlation coefficients of variables were lower than 0.8, there was no collinearity between the predictor variables [65]. Also, tolerance (TOL) and the variance inflation factor (VIF) were used to detect multicollinearity (see Table 2). The TOL values and VIF values of less than ten and even less than 5, for all variables, indicate no co-linearity between the predictor variables.

**Table 1.** Demographic characteristics of the sample (n = 367).

Variable	n	Percentage
Gender		
Male	133	36.2
Female	234	63.8
Education level		
Under high school	65	17.7
High school	209	56.9
Technician or Associate	59	16.1
Bachelor & higher	34	9.3
Employment status		
Employed	98	26.7
Housekeeper and/or retiree	269	73.3
Age (average)	(45 years old)	
20–30	11	2.9
31–40	67	18.2
41–50	168	45.7
51<	121	32.9
No. of household members (average)	3.7	

**Table 2.** Means, standard deviations and correlations.

	M	SD	TOL	VIF	1	2	3	4	5	6	7
1. ATT †	3.34	0.84	0.48	2.08	<b>0.842</b>						
2. HCI ††	3.11	0.98			0.775**	<b>0.839</b>					
3. PBC ††	3.67	0.74	0.54	1.84	0.604**	0.661**	<b>0.768</b>				
4. PE ††	3.15	0.73	0.54	1.86	0.502**	0.671**	0.508**	<b>0.790</b>			
5. PN ††	3.17	0.95	0.49	2.03	0.595**	0.693**	0.488**	0.596**	<b>0.889</b>		
6. PU ††	3.46	0.55	0.63	1.58	0.582**	0.632**	0.524**	0.444**	0.477**	<b>0.717</b>	
7. SN ††	3.04	0.86	0.68	1.47	0.311**	0.451**	0.432**	0.515**	0.430**	0.207*	<b>0.814</b>

Note: The diagonal values show the square root of the average variance extracted (AVE). Off-diagonal values represent the unchanged values of the inter-factor correlations. \* $P < 0.05$ , \*\* $P < 0.01$ ; † 1 (none) to 5 (high); †† 1 (strongly disagree) to 5 (strongly disagree).

### 3.4. Measurement model

Testing the appropriateness of the model was done in two steps. A confirmatory factor analysis (CFA) using SmartPLS was done to assess overall and local fit and evaluate both reliability and validity. At this stage, four indicators were deleted from the model. The model showed a good local fit. Table S1 shows the local fit with the factor loadings and the results of testing for reliability and validity. As shown in Table S1, the reliability of the scales in the measurement model was confirmed

with an alpha coefficient higher than the recommended level of 0.6 [63]. According to Hair et al. [66], the factor loadings of all indicators should be higher than 0.7. Indicators with factor loadings between 0.4–0.7 will be eliminated when they increase the composite reliability and convergent validity. If the composite reliability and validity are higher than their minimum value, indicators between 0.4–0.7 are not omitted [66]. As shown in Table S1, all average variance extracted estimates were over 0.50 [66], indicating convergent validity [67]. Discriminant validity was tested following Fornell and Larcker's criteria [67]. The square root of the average variance extracted for a given construct was compared with the correlations between that construct and all the other variables in the model. As shown in Table 2, the square roots of the AVE of each construct are consistently higher than the corresponding inter-correlations involving those constructs.

### 3.5. Structural model

After confirming the suitability of the research measurement model, we assessed the structural model. The model showed good overall and local fit indices. The overall fit of the research model was evaluated with the goodness of fit (GoF) index [68]. According to Table S2, the amount of GoF index was 0.468. Therefore, the overall fit of the model was at a suitable level and can be used to test the research hypotheses. Data analysis was performed using SPSS and SmartPLS 2.0 M3 software. Besides, the predictive relevance of the model is also tested using blindfolding, as shown in Table S2. HCI, attitudes, PN, and PU were used as target constructs. Q-square values greater than 0 indicate the predictive validity of the model construct. The Q-square value for HCI was 0.713, which shows the predictive relevance for HCI. The same applies to attitudes (0.406), PU (0.250), and personal norms (0.788). We also estimated the R-square values to identify further the effect of hidden exogenous variables on the endogenous variables and represented the predictive power of the model. As shown in Table S2, HCI displayed the highest R-square (0.727), followed by personal norms (0.185), PU (0.198), and attitudes (0.413), thus indicating that the model explains from one third to two-thirds of these variables. Overall, this is a good result in the social sciences context, where these values are typically low. The amount of R-square, F-square, and Q-square indicate model quality.

## 4. Result

The results are presented in two stages. First, descriptive and inferential statistical analyses were used to examine if any significant difference exists among home composting intentions and other integrated model variables concerning gender. Second, research hypotheses were tested based on the integrated model.

### 4.1. Results of descriptive and inferential statistics' analysis

A series of independent t-tests were used to detect any difference in the mean of variables. Based on Table 3, it appears that females score significantly higher than men on every dimension, especially on HC intentions. These results support extant studies that emphasize that women are more prone to pro-environmental behavior and reflected in latent psychological constructs [4,64].



**Table 3.** Independent *t*-tests.

Variable	Gender	M	SD	<i>t</i> -value
HCI	Male	2.605	0.824	8.080***
	Female	3.402	0.952	
ATT	Male	3.068	0.861	4.754***
	Female	3.500	0.794	
PN	Male	2.833	0.948	5.297***
	Female	3.368	0.894	
PBC	Male	3.400	0.737	5.362***
	Female	3.821	0.694	
PE	Male	2.882	0.696	5.590***
	Female	3.308	0.712	
PU	Male	3.336	0.598	3.383***
	Female	3.534	0.502	
SN	Male	2.764	0.904	4.751***
	Female	3.193	0.788	

\*\*\*Sig. < 0.001

The results also showed that an independent yard in the house indicates higher intentions of home composting ( $t = 10.64$ , Sig. = 0.001). A household without a separate yard could not recognize the composting benefits. This is confirmed by Loan et al. [19] and Oztekin et al. [61].

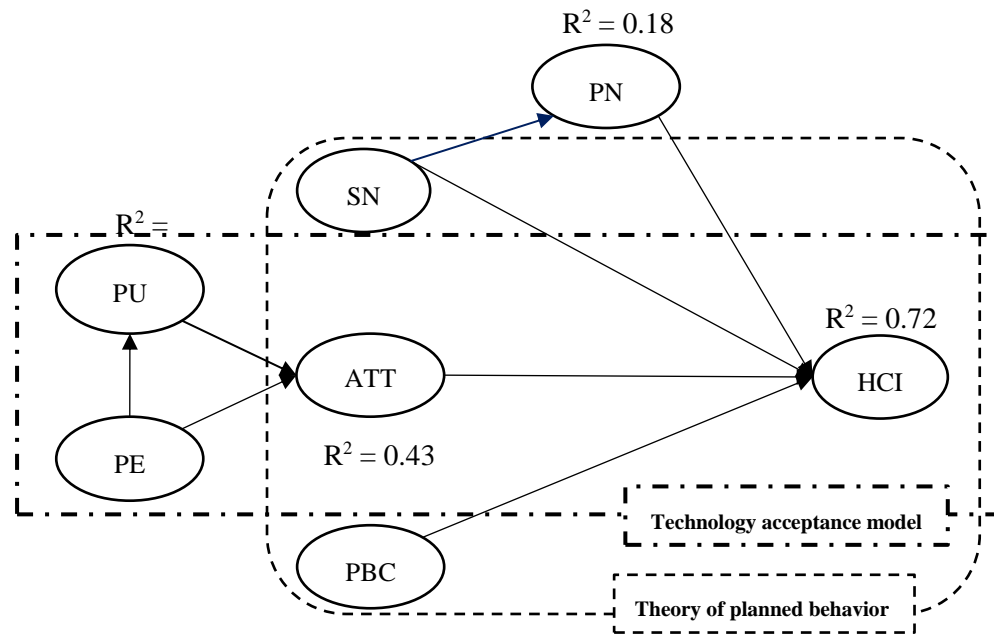
#### 4.2. Hypotheses testing

Table 4 presents the results of the structural model testing. The results indicate that attitudes significantly impact HCI ( $\beta = 0.451$ , Sig. < 0.001). Subjective norms have a considerable effect on HCI ( $\beta = 0.220$ , Sig. < 0.001). PBC has a significant relationship with HCI ( $\beta = 0.209$ , Sig. < 0.001). Personal norms are positively related to HCI ( $\beta = 0.278$ , Sig. < 0.001). Also, perceived usefulness has a significant impact on attitude ( $\beta = 0.447$ , Sig. < 0.001). Further, subjective norms positively relate to personal norms ( $\beta = 0.430$ , Sig. < 0.001). Finally, perceived easiness has a significant influence on both perceived usefulness ( $\beta = 0.444$ , Sig. < 0.001) and attitudes ( $\beta = 0.502$ , Sig. < 0.001). Collectively, the results provide evidence of support for H1-8. Table 4 provides the beta coefficients and p-values for each hypothesis. Figure 2 illustrates the R-square values and beta coefficients for the model.

**Table 4.** Hypotheses testing.

No.	Hypothesis	$\beta$	s.e.	<i>t</i>	Sig.
H1	ATT → HCI	0.4515	0.0774	5.8323	< 0.001
H2	SN → HCI	0.2209	0.0402	5.4881	< 0.001
H3	PBC → HCI	0.2091	0.0641	3.2629	< 0.001
H4	PE → PU	0.4449	0.0449	9.9163	< 0.001
H5	PU → ATT	0.4479	0.0571	7.8493	< 0.001
H6	PE → ATT	0.5027	0.0511	9.8299	< 0.001
H7	PN → HCI	0.2785	0.0569	4.8987	< 0.001
H8	SN → PN	0.4307	0.0499	8.6284	< 0.001

Note:  $\beta$  = beta coefficient; s.e. = standard error; *t* = t-value; Sig. = level of significance.



**Figure 2.** The conceptual model with the estimated results.

## 5. Discussion of the results

H1, suggesting that attitude has a positive and significant effect on behavioral intentions, was confirmed. So, people with a positive attitude toward home composting are more likely to engage in that behavior. This was consistent with the results of Chen and Tung [42], Edgerton et al. [20], Loan et al. [19] as well as Taylor and Todd [39]. More specifically, individuals who consider home composting as a good, hygienic, and rewarding practice were more prone to engage in HC.

Also, based on the findings, subjective norms are positively and significantly related to behavioral intentions. This was not consistent with Taylor and Todd [39] but was consistent with more recent findings such as those of Chen and Tung [42], Oztekin et al. [61], and Liao et al. [60]. Increasing public interest in environmental issues and positive sentiment in this regard in public opinion worldwide might account for the more recent level of significance of subjective norms on behavioral intentions [69].

The third hypothesis was about the positive impact of perceived behavioral control on behavioral intention. This hypothesis was confirmed by the findings, consistent with past research [1,39,60,61]. This result indicates that having the ability to perform HC in terms of sufficient skills, space, and time can positively affect behavioral intention.

The seventh hypothesis related to the positive influence of personal norms on behavioral intentions. The results confirmed this hypothesis and were consistent with Chen and Tung [42] and Tonglet et al. [1]. According to research findings, a person who adheres to specific environmental protection principles has higher intentions to perform HC.

One of the reasons that can lead to individuals' indifference about the environment in general, and HC, in particular, is the ignorance of the consequences related to the performing of a specific behavior [70]. Awareness of the positive consequences or perceived usefulness of HC makes one think about this behavior and potentially develop a positive idea [51]. The results demonstrated support for the hypothesis that awareness of the beneficial consequences of compost is positively related to

attitudes towards HC. The link between awareness of consequences and attitudes is in line with Bamberg and Möser [52], Chen and Tung [42], as well as Zeweld et al. [53].

Finally, if HC is perceived as being easier to perform, this will positively impact attitudes the most and, to a lesser extent, awareness of the consequences. This result matches Taylor and Todd's [39] and Zeweld et al.'s [53]. It can be argued that people who think HC is not complicated and challenging will, first of all, develop a more positive attitude about that practice, and secondly, be more aware of their responsibility to engage in HC. It is also interesting to observe that perceived easiness impacts attitudes much more strongly than awareness of consequences.

## 6. Conclusion and implications

### 6.1. Theoretical implications

This research aims to develop and estimate a model that examines the impact of various cognitive factors on household composting intentions in a developing nation. An integrated model combining the theoretical foundations of the theory of planned behavior and the technology acceptance model was used to determine the factors affecting home composting in the context of a developing country, namely Iran. This is the first study to combine these theories in an original integrated framework to improve the level of predictability of HC intentions. Consequently, no less than two-thirds (72.7%) of the overall variance in HC intentions was explained by the model, a remarkable performance for a study in the context of the social sciences. Besides, the study offers several interesting theoretical contributions to research.

First, most of the past research focused on recycling and in the context of developed and sometimes developing nations [10–12]. However, this study shows that several hypothesized relationships overlap significantly with those investigated in the extant literature about recycling or other pro-environmental behaviors [1,52,59,60]. Although these results will need to be replicated in other developing countries using home composting intentions or even behavior as the focal point, they are encouraging. In fact, in line with the spillover theory positing inter-resemblances between pro-environmental behaviors [40], this would mean that results about recycling or PEB in other contexts might potentially apply to HC and in developing contexts as well.

Second, and more specifically, the primary assumption in this study was the centrality of behavioral intentions. There is no behavior unless there is a behavioral intention [34,37]. According to the integrated model study results, HC intentions were directly influenced by the following cognitive factors: personal norms, subjective norms, perceived behavioral control, and attitudes. Besides, the integrated model results showed that perceived usefulness and perceived easiness indirectly lead to home composting intentions.

Thus, the results suggest that holding strong personal principles constitutes one of the most critical determinants of HC intentions in a developing country context. In line with the VBN theory [70], these personal norms are formed by social norms (i.e., subjective norm), which increase the holding of these norms.

According to the integrated model, behavioral intentions were influenced by subjective norms. Yet, since we did not differ between injunctive and descriptive norms [71], we do not know which type of norm has the most substantial effect. Findings further showed that perceived behavioral control had a positive and significant effect on behavioral intention. These results are in line with the traditional TPB. Finally, attitudes exerted the least strong impact on intentions. These results are not

surprising since past findings showed that attitudes have the lowest predictive capability consistently in pro-environmental intentions [71,72].

Finally, in line with the TAM model, perceived easiness constitutes a very important contributor to positive attitudes toward HC composting. This finding underscores the appropriateness of investigating HC with a technology-oriented model given the sharp increase in indoor and automated HC systems [30,31].

## 6.2. Managerial implications

The results of the present study have important implications for managers and policymakers. First, based on the results, females tend to be more willing to perform home composting than males. This is not surprising since women are more often involved in composting initiatives in developing countries, whether through economic empowerment or community programs involving composting or through their higher commitment to household management [73–75]. Therefore, home composting programs and training should prioritize females.

According to the results, men scored significantly lower than women on every dimension under study, including the primary independent variable of social norms and the dependent variable of HC intentions. Yet, this result is not specific to a developing country such as Iran. A large body of research has shown evidence of a small but consistent “gender gap” in environmental views and opinions. Females are more concerned about the environment than males and have stronger pro-environmental opinions and beliefs [76]. Altogether, these results suggest that fact-based public education initiatives about the environment and HC should be targeted towards males. However, past research suggests that females will be more open to such initiatives [77], and thus, the impact might be higher among females. We recommend involving males too or using another fact-based approach towards males to increase the overall level of awareness.

Since HC is a new sustainable strategy in developing countries, enhancing the attitude, personal norm, subjective norm, and perceived ease can increase the number of individuals that are eager to home compost.

Accordingly, it can be concluded that policy-makers and business developer should focus their efforts on three aspects: 1) improving communication about environmental issues related to untreated organic waste; 2) raising people's awareness and familiarizing them with the positive consequences of composting and the stages of compost production, and 3) instilling a sense of responsibility for HC to reach the positive benefits related to HC. Altogether, these measures should contribute to enhancing the positioning of HC as an important personal norm.

After personal norms, subjective norms were identified as the second most impactful variable on HC intentions. Accordingly, it can be concluded that it is essential to use pyramidal networks of influence. This means identifying key influencers in the community to forward the message about the importance of HC via word-of-mouth to their followers.

The findings demonstrated that perceived behavioral control had a positive and significant effect on behavioral intention. Therefore, it is suggested to strengthen individuals' perceptions of the ability to perform HC through educational and promotional brochures at the city level. Practical indications about the amount of time or resources needed to perform HC are highly recommendable in this regard.

It should be noted that the attitude toward compost was the most crucial direct predictor of behavioral intention. Therefore, local media can encourage a positive attitude among citizens by

increasing awareness of this sustainable strategy through advertising, entertainment, or informational programs.

## 7. Limitations and directions for future research

We developed an integrated model for predicting HC intentions in developing countries. Although the results were very conclusive since all the hypotheses were supported, we did not compare to what extent this process might differ between a developed context and a developing one. Future research might consider using multi-group structural equation modeling to assess potential differences. Besides, we did not distinguish between injunctive and descriptive norms despite the recent call to do so [71]. Consequently, future research might consider distinguishing between these two constructs.

## Conflict of interest

The authors unanimously declare that this paper is free from any conflict of interest.

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