Developing a questionnaire on strategies for increasing housewives' participation in source separation of municipal solid waste based on the theory of planned behavior

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Original Article

Abstract

Creating awareness and recognizing behavioral factors associated with recycling is essential for waste management. To identify factors influencing recycling behavior, a theory of planned behavior (TPB)-based questionnaire was designed. The aim of this study was to assess the validity and reliability of the questionnaire. This psychometric study was conducted through a multistage random sampling on 283 homemakers of Mahabad Town, Iran, in 2014. The method recommended by Ajzen and Francis was used for designing the questionnaire. Its validity was evaluated using quantitative and qualitative face validity, ration and content validity index, and qualitative judgment of an expert panel of 8 members and its structural validity using exploratory factor analysis. In addition, its reliability was assessed using internal consistency (Cronbach's alpha coefficient) and retest (intraclass correlation) methods. Of the 53 initial questions, after calculating the content validity ratio (CVR) with values higher than 0.80 and content validity index (CVI) with values higher than 0.79, we modified 3 questions and deleted 8 questions; therefore, 45 questions were approved. Using exploratory factor analysis with a varimax rotation, 9 factors with a value of higher than 1 were selected, which were able to predict 91.81% of the total variation. The reliability of the tool was confirmed through calculating Cronbach's alpha (0.87). Results of retest indicated the consistency of the questionnaire. This research found that the Persian version of the Theory of Planned Behavior Questionnaire (TPB questionnaire) has suitable validity and reliability and can be used in research and administrative activities on increasing the participation of homemakers in municipal solid waste source separation.

KEYWORDS: Factor Analysis, Questionnaire, Recycling, Waste Management

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Introduction

Technological development and rapid population growth have caused an increase in consumption and household waste production level. It, in turn, may lead to crises such as water and soil pollution, greenhouse gas emission, and negative impacts on the quality of human life.[1] These problems are more common and visible in developing countries, where garbage collection does not occur at all.[2] If one wants to reduce such pollution, it would be essential to apply waste management procedures along with economic and engineering principles to eliminate waste disposal.[3]

According to the Waste Management Act,

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enacted in 2004, urban authorities should apply procedures with the aim of achieving functional elements in waste management to prevent unsafe disposal of waste and to encourage private sector and citizen participation.[4] Cost-effective techniques for waste minimization include increasing awareness, providing educational packages for the public, and encouraging citizens to cooperate in the design of household waste recycling processes.[5] Recycling is a process whereby materials used previously are collected, processed, rebuilt, and reused. Recycling requires two methods of separation; separation of material from waste, and source separation.[6]

Material separation of waste has some consequences, but source separation is more efficient and cheaper compared with no action in this regard. Today, source separation recycling is performed as one of the most efficient and economical processing methods in most countries. This approach reduces the cost of transportation. If household waste separation and recycling management be performed correctly, a part of the national capital is returned.[7] Around 40,000 tons of solid waste is generated in Iran daily, only 10% of which is recycled and the remaining is buried using unsanitary methods, while more than half of this amount is recyclable.[8] In contrast, in developed countries, 80% of household waste is recycled and returned to the consumption cycle. In Australia and the UK, around 60% of household waste is recycled.[9]

Waste recycling and reusing is not an easy task and requires scientific, technical, and cultural infrastructures. Perhaps, the most important part of this task is the cultural factor.[10] Citizens must be educated to generate less waste, and categorize waste at their house in order to simplify the recycling programs.[11]

There is a need to test and conduct theory-based studies to understand the mechanisms responsible for recycling behaviors. Several behavior change theories have been applied to explain the factors influencing recycling behavior, including Schwartz's Norm Activation Model[12], the theory of reasoned action, and the theory of reasoned planned behavior.[13] The theory of planned behavior (TPB) provides a theoretical framework for the systematic examination of factors that affect behavioral change.[14] According to the TPB, a persons' behavior is based on his/her readiness to perform a given behavior (i.e. intention).[15] TPB considers intention as immediate antecedent of behavior, and intention is based on attitudes toward behavior, subjective norms, and perceived behavioral control.[16] Attitude toward a behavior is a persons' positive or negative evaluation of that behavior. It is assumed to have two components; behavioral belief, and evaluation of consequences of the behavior, which leads to acquisitive attitude toward behavior. Subjective norms are perceived social pressure to perform or not to perform the behavior in question. This perception or opinion has been labeled as the individual's normative belief, which is often multiplied by the motivation to comply with that norm. Perceived behavioral control is the extent to which one believes he/she can successfully enact a behavior (i.e., to what extent the performance of a behavior is under his/her control). Behavioral intention is indicative of the extent of intention and will of the individual to perform the target behavior. Behavior always proceeds behavioral intention and is attached to it.[17]

In TPB, the most important determinant factor of an individual's behavior is his behavioral intention.[18] Therefore, in order to increase the prediction of source separation behavior, it was attempted to add other factors that can contribute along with subscales of this theory[17,18]. No standard questionnaire based on Ajzen's theory existed to conduct a TPB-based study. Hence, it is essential to conduct a study in order to design a new questionnaire suited to the characteristics of the target population, and a trial to ensure the psychometric properties of the

TPB scale.[13,19]

Despite numerous TPB questionnaires in English, no study has yet been conducted to validate the questionnaires for citizens' participation in the source separation of solid waste in Iran. Hence, this study was aimed at developing and evaluating the psychometric properties of the TPB-based questionnaire in relation to public participation in source separation of household solid wastes in Mahabad Town, Iran.

Materials and Methods

This was a psychometric study performed in 2014. The target population comprised of homemakers in Mahabad, Iran. As family planners, homemakers have to be aware of environmental problems and ways to deal with them. They can play a crucial role in changing consumption patterns and reducing pollution. After consideration of literature review and the recommendations of experts, the recommended procedures of Aijen[13] and Francis[12] were used for primary designing of the questionnaire. Therefore, in the first stage, 8 questions related to factors effective on participating in source separation were distributed among 30 housewives who referred to 8 health centers in different parts of the town. This stage was performed in order to identify salient beliefs, benefits, factors, perceived barriers, and effective reference groups in participation. In the next stage, the answers to each question were classified according to different concepts (attitude, subjective norm, perceived behavioral control, and self-identity, action planning, perceived barriers, perceived benefits, facilitating factors, and behavioral intention). The most indicated responses to each question were selected. Then, the questionnaire was designed through holding several meetings with an expert panel and obtaining their views regarding the relevance of expressions in terms of clarity (use of simple and understandable words) and use of common language (avoiding the use of technical words). The questionnaire

was based on a 5-point Likert scale. The pilot questionnaire was prepared to determine its reliability and validity. The qualitative and quantitative methods were used to determine the validity of the questionnaire.

In the qualitative method, the pilot questionnaire was distributed among 8 panel members via e-mail, which is approximately 2 times more than the minimum number proposed by Lawsche.[20] They were asked to review and provide feedback on the questionnaire based on the application of appropriate simple words, observations, writing, grammar, and the placement of items in the right place. In the qualitative approach, in order to ensure that the most important and most accurate content (essential items) are selected, content validity ratio (CVR) was used. CVR values of higher than 0.75, in accordance with Lawsche's Table, were accepted in the present study. Moreover, in order to ensure that tool items are designed to measure the content, the content validity index (CVI) was used. Therefore, the panel members were asked to express their ideas on each item in terms of simplicity, clarity, and relevance through four-episode range for each item, and finally, those items with a CVI of higher than 0.79 were accepted.

In the third stage, in order to determine the validity of the tool, both qualitative and quantitative methods were used. İn the qualitative method, an interview was carried out with 10 housewives in order to obtain feedback on difficulty in understanding the phrases and words, the possibility of ambiguity, and incomplete interpretations of the meanings of words. Then, to specify the quantitative validity, the impact of each item was used. To do this, the questionnaire was given to 10 housewives. After completion of the questionnaire, using the impact of items formula (score = frequency × importance), the impact of each item was calculated and the impact scores of higher than 1.5 were accepted.

Since the research tool was designed for the

first time, in order to identify patterns of correlations between the items in each domain, exploratory factor analysis was used.[21] In this analysis, the ratio of variables to subjects should be at least equivalent to 1 to 5. Therefore, with respect to the number of items, the minimum sample required for this study was estimated to be 265 subjects. In order to increase the accuracy, 300 subjects were enrolled in the study. However, 17 questionnaires were eliminated due to incompleteness, and exploratory factor analysis was conducted using the data of 283 questionnaires. To determine the reliability of the instrument, with an emphasis on internal consistency, Cronbach's alpha was used. The reliability coefficient ranges from 0 to +1. Therefore, the revised questionnaire was distributed among 30 women referred to the 8 urban health centers. By collecting the data, Cronbach's alpha value was calculated, and values greater than 0.7 were accepted. In order to check the repeatability of the questionnaire, intraclass correlation coefficient (ICC) was used. For this purpose, the modified questionnaire was distributed in two steps at a time interval of 14 days for each of the 30 women referred to those health centers. Each homemaker answered the questionnaires anonymously and indicated their awareness on the study purposes by signed a consent letter. The data was collected and analyzed using SPSS software (version 16, SPSS Inc., Chicago, IL, USA).

Results and Discussion

The mean ± standard deviation of age of homemakers who participated in this study was 37.94 ± 10.52. In addition, 53.03% of subjects had a diploma, and 48.4% of them had incomes in the range of 1-1.5 million Tomans (Table 1). In qualitative evaluation of content validity, cases, such as using simple and appropriate words, following writing rules, and aligning the items in the right place, were considered. As a result, several items of the tool were considered for revision and necessary changes. To obtain CVR,

based on the number of experts according to Lawsche's Table[20], estimating numerical mean of the judgments of panel members was estimated., Questions with a CVR of higher than 0.75 and mean value higher than 1.5 were accepted. Ultimately, based on these results, 5 questions were eliminated.

For CVI, those items with a CVI of higher than 0.79 were accepted; hence, 3 questions were eliminated. Therefore, 45 out of 53 questions, which had suitable content validity, were entered into the next stages of validity.

Table 1. Demographic characteristic variables of the study participants

Variable	Frequency (%)
Age (year)	
20–29	69 (24.38)
30-39	123 (43.46)
40–49	50 (17.66)
> 50	41 (14.50)
Qualification	
Secondary school	48 (16.97)
Diploma/certificate	150 (53.03)
University degree	85 (30.00)
Income (million Rials)	
5-10	87 (30.75)
10.1-15	137 (48.40)
> 15	59 (20.85)
Having the knowledge to separate household waste at home	
Yes	170 (60.00)
No	113 (40.00)
Having the space to separate household waste at home	
Yes	27 (80.00)
No	56 (20.00)
Having the time to separate household waste at home	
Yes	225 (90.00)
No	28 (10.00)

In the qualitative evaluation of face validity, 4 items needed to be corrected based on comments received from participants. The necessary changes were carried out for clarification. In the quantitative evaluation stage, as the efficiency level of all the items was above

1.5, all items were identified to be appropriate. In exploratory factor analysis, the value of Kaiser-Meyer-Olkin (KMO) Measure of Sampling Adequacy index was determined to be 0.875, which is much higher than 0.6. This is indicative of sufficient sampling for factor analysis. Bartlett's test of sphericity was significant (as the degree was 0 and $P < 0.005$). This indicated that the data were suitable for factor interactions. The calculated share extractive values for all items were shown to be between 0.748 and 0.923, indicating suitability of all items. The analysis of exploratory factor with a varimax rotation indicated 9 valuable factors greater than 1, which provided evidences of the multidimensionality of the questionnaire. According to the content of the questions, these 9 factors were namely attitude (5 questions), subjective norm (3 questions), perceived behavioral control (4 questions), self-identity (6 questions), action planning (4 questions), facilitating factors (5 questions), perceived benefits (5 questions), perceived barriers (9 questions), and behavioral intention (4 questions) (Table 2). These factors accounted for 91.81% of the total variance (Table 3).

The reliability of the questionnaire was tested through internal consistency and stability. To assess internal consistency, Cronbach's alpha was used, and the value of Cronbach's alpha for the scale was equal to 0.87 for each subscale (Table 4). The alpha values calculated for each subscale and domain of this study were greater than 0.7. Hence, the reliability of the instrument was well assessed and approved. To estimate the stability of repeatability, test-retest method and ICC were used, and the test-retest for the entire questionnaire was 0.89 (Table 4). In order to prepare a household waste recycling behavior questionnaire, several studies have been conducted based on TBP.[22,23] In our study, there were insignificant differences among some indices compared with previous studies, which might be due to the cultural differences and participants. Cronbach's alpha for the total scale was 0.87 and for subscales it ranged from 0.74 to 0.95. These results were very close to the results obtained in a study by Karim Ghani et al. in Malaysia.[17] The review by Davis and Morgan in 2008 indicated that Cronbach's alpha for TPB-based study ranged from 0.56 to 0.87.[22] In a study conducted in the United States, the internal consistency of the instrument equaled 0.82.[23]

Table 2. Weight of factor extracted from the exploratory factor analysis with varimax rotation

Perceived barriers	Self-identity	Attitude	Perceived benefits	Facilitating factors	Intention	Perceived behavior control	Action planning	Subjective norms
0.63	0.58	0.83	0.78	0.64	0.66	0.64	0.66	0.55
0.71	0.63	0.75	0.44	0.52	0.47	0.43	0.41	0.56
0.53	0.43	0.63	0.52	0.41	0.56	0.58	0.52	0.67
0.66	0.54	0.47	0.58	0.74	0.74	0.71	0.69	
0.71	0.63	0.68	0.64	0.58				
0.64	0.68							
0.64	0.68							
0.74								
0.77								

Table 3. Total variance of exploratory factor analysis

Attitude	Self-identity	Perceived barriers	Perceived benefits	Facilitating factors	Intention	Perceived behavioral control	Action planning	Subjective norms
17.46	15.7	13.54	12.64	11.4	9.29	6.25	3.13	2.40

Table 4. The reliability results of the questionnaire subscales in theory of planned behavior (TPB) based study

Questionnaire dimensions	Number of Questions	Cronbach's alpha	Stability
Attitude	5	0.74	0.78
Subjective norm	3	0.88	0.85
Perceived behavioral control	4	0.79	0.84
Self-identity	6	0.87	0.91
Action planning	4	0.92	0.89
Facilitating factors	5	0.91	0.92
Perceived benefits	5	0.95	0.93
Perceived barriers	9	0.92	0.94
Intention	4	0.85	0.92

Test-retest results revealed that the prepared questionnaire has remarkable and full stability and this indicates that the questionnaire can provide reliable results in various circumstances of time and place. In addition, to determine the correlation pattern among the items in each domain, the exploratory factor analysis was used. However, it was not used in similar studies.[17,22,23] The results of exploratory factor analysis shows a nine-factor structure. In General, these factors show a 91.8% variance, indicating that most variables stated are related to the attitude factor. This is consistent with the study by Pakpour et al.[18] Structures of this study showed a 88.2% variance, among them attitude had the highest variance.

In the present study, the average score of the subscales for this instrument was 18.45, which was higher than the average scores (13.45 and 12.45) reported in literature.[22] This might be due to the differences in the study populations. In this study, the mean attitude subscale score was 20.52, which was higher than the average score (16.48) reported by Davis and Morgan.[22] The mean facilitator subscale score in this study was 15.85, which was similar to the score (15.45) reported by Karim Ghani et al.[17] This indicates that the presence of incentives and situational factors have a similar effective role in the source separation of wastes.

Finally, this study proved that the designed questionnaire has acceptable reliability and validity and is a useful instrument for researches and similar activities. One of the limitations of this study was that only 1 group of homemakers was investigated. Therefore, it is recommended that similar studies be conducted in the future in other parts of the country with different customs.

Conclusion

In most studies, designing and measuring the validity and reliability of the tool and data collection are time consuming and costly. Access to a reliable and valid tool, the psychometric properties of which have been approved, will increase the process speed and reduce the costs. In this study, the questionnaire had acceptable level of reliability and validity and contributed greatly to the identification of factors influencing recycling behavior.

Conflict of Interests

Authors have no conflict of interests.

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