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Investigating Factors Affecting Successful Waste Recycling Management (Case Study: Shiraz's Municipality, Iran)

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Abstract

Using waste recycling management, various responsibilities can be categorized, and work efficiency can be greatly increased. This indicates that responsible people should take waste management functions at construction and demolition operation sites more seriously, actively engage in the development of marketing, and seek to promote development. The present study aimed to investigate factors that affect successful waste recycling management in Shiraz. This study was applied in terms of goal, and descriptive-correlative in terms of data gathering. The statistical population of this study consisted of experts and directors of Shiraz's Municipality. Sampling was performed via the non-probabilistic method of convenience type. For this, the number 270 people were selected as the sample volume. The main tool to gather data was a questionnaire. Data were analyzed by structural equation. Findings revealed that social values and norms had the highest effects on behavioral goals. The project's limitations had the highest effects on waste recycling success. Included in the project's limitation factors were recycling costs that had the highest effects on the success or failure of waste recycling. In addition to the project's limitations, economic satisfaction, government oversight, and technical factors had the highest effects on waste recycling success. Out of economic satisfaction factors, saving and optimal use of recycled materials had the highest effects on waste recycling success. Meanwhile, out of technical factors, required tools and machinery had the highest effects on waste recycling success.

Keywords: Recycling management, Shiraz's municipality, Waste

Introduction

The increasing growth of the urban population followed by increased human interventions in the environment, which have endangered it, make humans take measures to protect nature and to recycle waste. This issue has today attracted the attention of many urban experts and managers. Solid urban materials include all redundant/waste materials which result from activities carried out in the city. These materials have different physical and chemical diversity. Currently, complexities that exist in the urban community have made significant changes to the quantity and quality of waste, thereby causing crises with its location and dumping. Today, the disposal of solid waste in large cities has turned into a growing concern. In addition to higher costs of collection, transportation, and disposal of urban waste in the country, relevant environmental perils are so grave. Thus, all groups of society, especially municipality managers need to take measures to deal with these perils. In this regard, it is critical to use the experience of other countries and to apply successful

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models in different cities inside the country (Manouri & Mir Hosseini Seyed, 2017).

According to Waste Management Laws, urban managers should use ways to manage waste and prevent the unsystematic disposal of it, and return capital to the national economy; this will certainly help preserve the environment, society's economy, employment, citizens' participation, and private sector (Manouri & Mir Hosseini Seyed, 2017).

All issues related to garbage and waste can be investigated in the form of waste material management. Solid waste management can be defined as a planned inter-sectoral activity based on engineering and economic principles by its different departments, i.e., production, at-site storage, collection, transportation, processing and recycling, and finally disposal of solid waste materials. Waste segregation at source is performed as one of the most effective and economical processing ways in most countries in the world. Also, the systemic employment of these methods could, to some extent, reduce the burden of transportation costs. However, during the implementation of at-source waste segregation plans, costs incurred rise against benefits due to the lack of systematic planning and the absence of appropriate management measures, with the profit arising from segregation plans being so insignificant, and negative, in some cases (Chobanglos & Krit, 2009).

The establishment of a regular system for collecting and recycling waste is one of the primary needs of cities across developing countries. In each appropriate system, collection and disposal, the establishment of effective and constant communication between citizens, as well as administrative agents are regarded as secrets for success (Eid Niya, 2007).

Meanwhile, in all new waste collection systems, attempts are made to train citizens to reduce the volume of produced waste, which will thus reduce the volume of waste delivered to municipality officials and the costs of its collection and disposal. The reuse of waste and recycling is not a simple task, as it is required to establish scientific, technical, and cultural infrastructure, with the latter may be the most important in this regard (Abbas Ali et al., 2013).

Today, waste management is an inter-sectoral activity that is planned based on engineering principles. Also, this sector includes economic and urban issues, local planning, and social sciences, also (Jingkuang & Yousong, 2011). Considering the development of urbanity in the last century, waste management has become a complex and critical issue. Waste management is said to be an interdisciplinary body of knowledge whose success requires other disciplines. The number of sciences and specialized disciplines involved in waste management, including technical and engineering, management, financial disciplines, and public affairs have also added to these complexities.

Currently, there are various waste management methods in different countries. An investigation of successful experiences at the global scale can, together with the proper understanding of regional conditions, help improve and reform the waste management system. In recent decades, significant progress has been made in waste management. Because this issue is so critical, large-scale studies are warranted in this connection, as a variety of studies are being panned in this direction.

In developing countries, waste accounts for a large part of urban garbage, which not only incurs disposal costs but also leaves undesirable impacts on the environment. Waste volume is so large that it has become a social and environmental problem in Iran and the world. Waste recycling, in this direction,

not only helps protect the environment but also involves scientific methods that are economically justified. On the other hand, excessive use of natural resources for constructing roads, and producing concrete, bricks, and other waste has resulted in a lack of natural resources.

Considering the large volume of urban waste production, and the growing need for stone materials, the use of natural resources, mostly lying on river paths, could cause dangerous floods. Also, the disposal of urban waste along or into riverbeds changes rivers' natural system, and the presence of harmful agents in the waste enters underground waters (Farhang, 2020).

Large quantities of urban waste and unsystematic disposal of which cause many problems for cities; the most important of them are as follows (Weisheng & Webster, 2017):

- Environmental problems
- Need for a place to dump waste
- Creation of an undesirable scenery

Waste recycling can reduce the need for energy, and natural resources, and the extraction of materials and land required for hygienic and safe dumping. The experiences of other countries such as the United States, Germany, Taiwan, and Britain indicate that destruction management can be used to substantially reduce produced waste, while waste reuse can protect the environment (Haghparast & Dashtgerd, 2015).

As regards factors affecting optimal waste management, previous studies cited the following:

1) Contractor's representative's commitment to the site
2) Gathering of packed materials and contact with the supplier
3) Minimization of waste in construction
4) Design and implementation of construction with standard materials
5) Employment of workers only to dispose of waste

Using waste recycling management, various responsibilities can be categorized, and work efficiency can be greatly increased. This indicates that responsible people should take waste management functions at construction and demolition operation sites more seriously, actively engage in the development of the marketing market, and seek to promote development (Jingkuang & Yousong, 2011). The waste recycling process can largely protect the existing resources that are sometimes unrecyclable. For this, it is imperative to prevent this large volume of waste into the environment. As explained above, the goal of the present study was to investigate the factors affecting the success of waste recycling management in the city of Shiraz's municipality, Iran.

Research Methodology

Gaining knowledge through relevant research methods is called science. The difference between a scientific theory and other methods of gaining knowledge is that the former uses scientific methods to gain knowledge. This study was applied in terms of goal, and descriptive-correlative in terms of data gathering. The statistical population of this study consisted of experts and directors of Shiraz's Municipality. Sampling was performed via the non-probabilistic method of convenience type. For this, the number 270 people were selected as the sample volume. The main tool to gather data was a questionnaire. To gather data, a five-point Likert[2] scale of 1) completely disagree, 2)

[2] Likert scale is a psychometric scale, which is frequently used in research questionnaires. Using this scale in research surveys is so common that the terms Likert scales and Score scales are alternatively used, with the former being a subset of the latter. This scale was named after its inventor. Likert distinguished between the scales itself and the way its scores were responded. From technical point, the Likert scale only

disagree, 3) neither agree nor disagree 4) agree, and 5) completely agree was used. Having been gathered, data were analyzed by SPSS (descriptive analysis) and AMOS (inferential analysis) software using structural equations.

Research variables

The studies variables of the questionnaire are:

1. *Behavioral goal:* Behavior or conduct which, if done by a learner, is expected to be observed and measured; behavioral goals refer to goals that determine the type of behaviors and abilities we expect the individual to achieve after special learning.
2. *Waste recycling success:* It refers to all materials from humans or animals' daily activities, which are naturally in solid forms. This waste is disposed of because it is no longer used, or is not wanted. Waste management also refers to the management of processes resulting from destruction and construction (Haghparast & Dashtgerd, 2015). Here, recycling refers to the process of using materials consumed for the production and construction of the same good or other goods used.

Independent variables:

1. *Behavior attitude:* It refers to a wide spectrum of behaviors not explicitly stated in the job description, though it affects organizational life. Item 1 of the questionnaire relates to this variable (Fu, 2014).
2. *Social norm:* Social norms refer to certain behaviors common in a group or society; these are the norms the individual learns and uses during their lives, and expects others to also do it. Thus, social norms are certain behaviors that are based on social values. Social values gradually turn into social norms, which, if observed, will regulate society. Items 2, 3, and 4 of the questionnaire about this variable.
3. *Perceived behavior control:* It refers to the individual's perception of control over behavior, which reflects the facilitators and barriers of the previous behavior. An individual's behavior is determined by their behavioral intention; in other words, behavioral intention predicts behavior (Raoa et al., 2006). Item 5 of the questionnaire pertains to this variable.
4. *Behavioral goal:* Item 6 of the questionnaire pertains to this variable.
5. *Technical factors:* Items 7, 8, and 9 of the questionnaire about this variable.
6. *Government oversight:* Items 10 and 11 pertain to this variable.
7. *Economic satisfaction:* It denotes the consumer's satisfaction with goods and services. Items 12, 13, and 14 pertain to this variable.
8. *Project's limitations:* Items 15, 16, 17, and 18 pertain to this variable.

Thus, the conceptual model of the research is as follows (Figure 1):

refers to the former. In Likert-based questionnaire, respondents express their agreement and disagreement on a symmetrcial agree/disagree spectrum.

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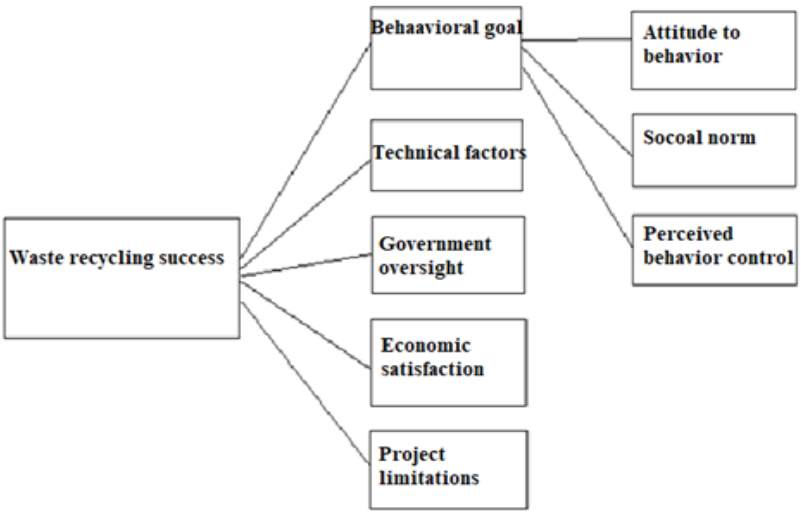

Figure 1. Conceptual model of the research

Thus, given the conceptual model, the following research hypotheses are stated:

1. Attitude to behavior has a positive effect on behavioral goal
2. Social norm has a positive effect on behavioral goal
3. Perceived behavior control has a positive effect on behavioral goal
4. Behavioral goal has a positive effect on waste recycling success
5. Technical factors have a positive effect on waste recycling success
6. Government oversight has a positive effect on waste recycling success
7. Economic satisfaction has a positive effect on waste recycling success
8. Project's limitations have a negative effect on waste recycling success

Findings

Descriptive findings

Descriptive findings include the frequency percentage of demographic characteristics of the statistical sample (Table 1). As noted, the highest frequency percentage pertains to the male gender, B.A. education, and work history of 11-15 years.

Table 1. Descriptive statistics of respondents to the questionnaire

Gender	Male	74.55%
	Woman	25.44%
Education	B.A.	60.61%
	M.A.	27.97%
	PhD	11.39%
Work history	1-5 years	11.39%
	6-10 years	22.78%
	11-15 years	37.97%
	Over 16 years	27.84%

Source: Study Findings

Inferential findings

To investigate the questionnaire's validity, the CVR index was used which was reported to be 0.76, being acceptable. On the other hand, one of the ways to calculate reliability is to use Cronbach's alpha, which is used to calculate the internal consistency of the measurement tool that is questionnaires. Cronbach's alpha was reported to be 0.76 indicating acceptable reliability. Also, the Kolmogorov-Smirnov test was used to examine the data normality (Table 2). According to the results, the probability level in all items was over 5%; thus, the null hypothesis stating the normality of the data is accepted.

Table 2. Kolmogorov-Smirnov results

Item No.	Kolmogorov-Smirnov test statistic	Sig.
1	0.18	0.34
2	0.17	0.34
3	0.19	0.34
4	0.17	0.34
5	0.26	0.34
6	0.21	0.34
7	0.29	0.34
8	0.33	0.34
9	0.28	0.34
10	0.33	0.34
11	0.22	0.34
12	0.31	0.34
13	0.38	0.34
14	0.33	0.34
15	0.37	0.34
16	0.23	0.34
17	0.35	0.34
18	0.38	0.34

Source: Study findings

Investigating research hypotheses
First, second, and third hypotheses

As noted, item 1 pertained to the first hypothesis, items 2, 3, and 4 pertained to the second hypothesis, and item 5 pertained to the third hypothesis. In this section, the first three hypotheses were evaluated. The goodness of fit indices that were investigated in this study is GFI, AGFI, RMSEA, Chi-square, NFI, and CFI. The values of these indices are given in (Table 3).

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Table 3. Goodness of fit indices

Index	Value	Result
GFI	0.96	Confirmed
AGFI	0.90	Confirmed
RMSEA	0.06	Confirmed
Chi-square	28.171	Confirmed
NFI	0.94	Confirmed
CFI	0.9	Confirmed

Source: Study Finings

As stated, values of GHI, AGFI, NFI, and CFI were higher than 0.9. Therefore, these indices indicated an acceptable fit. RMSE values were also at 0.06, suggesting an acceptable fit. The Chi-square value was also 28.171, being significant at p<0.1. This statistic indicated that the observed and calculated matrix of variance-covariance was different. This statistic was affected by the sample volume, as the direct interpretation of which was mostly prevented. The ratio of this statistic to the degree of freedom was smaller than 3, which suggested a good fit. In sum, all six indices confirmed the model's proportionality. Thus, the study's structural model was proportional in terms of fit indices, and also factors can be used in the structural model.

(Figure 2) illustrates factor loadings and explained variances of the items.

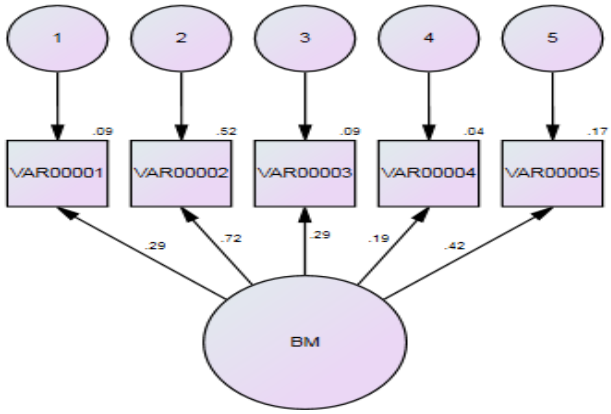

Figure 2. Calculating structural equations in the first, second, and third hypotheses

As noted, item 2 has the highest factor loading of 0.72 on its construct. (Table 4) gives factor loading significance and fit indices

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Table 4. Factor loadings of items 1 to 5

Item	Factor loading (PC)	Sig.	T statistic
1	0.29	0.00	1.73
2	0.72	0.000	10.3
3	0.29	0.005	2.82
4	0.19	0.00	10.3
5	0.42	0.00	8.82

Source: Study findings

Therefore, all factor loadings were significant at 99%, and their t statistic was also significant. Thus, attitude to behavior, social norm, and behavioral control had a positive and significant effect on behavioral goals. Out of these factors, social norms (social values) had the highest effects on behavioral goals. Since other factor loadings were not many, the mentioned effects were concluded to be moderate. Therefore, the first, second, and third hypotheses were supported.

Fourth, fifth sixth, seventh and eighth hypotheses

As noted, item 6 pertained to the fourth hypothesis, items 7, 8, and 9 pertained to the fifth hypothesis, items 10 and 11 about the sixth hypothesis, items 12, 13, and 14 pertained to the seventh hypothesis, and items 15, 16, 17 and 18 pertained to the eighth hypothesis. In this section, the remaining five hypotheses were evaluated. The goodness of fit indices that were examined here is GFI, AGFI, RMSEA, Chi-square, NFI, and CFI, with their values given in (Table 5).

Table 5. Goodness of fit indices

Index	Value	Result
GFI	0.95	Confirmed
AGFI	0.92	Confirmed
RMSEA	0.06	Confirmed
Chi-square	95.25	Confirmed
NFI	0.94	Confirmed
CFI	0.9	Confirmed

Source: Study findings

As noted, values of AGFI, GFI, NFI, and CFI are higher than 0.9. Therefore, they enjoyed an acceptable fit. RMSE values were also 0.06 which suggested an acceptable fit. The chi-square value was 95.25 which is significant at $p<0.1$. The ratio of this statistic to the degree of freedom is less than 3, indicating a good fit. In sum, all six indices confirmed the model's proportionality. Thus, the study's structural model was proportional in terms of fit indices, and also factors can be used in the structural model.

(Figure 3) illustrates factor loadings and explained variances of the items.

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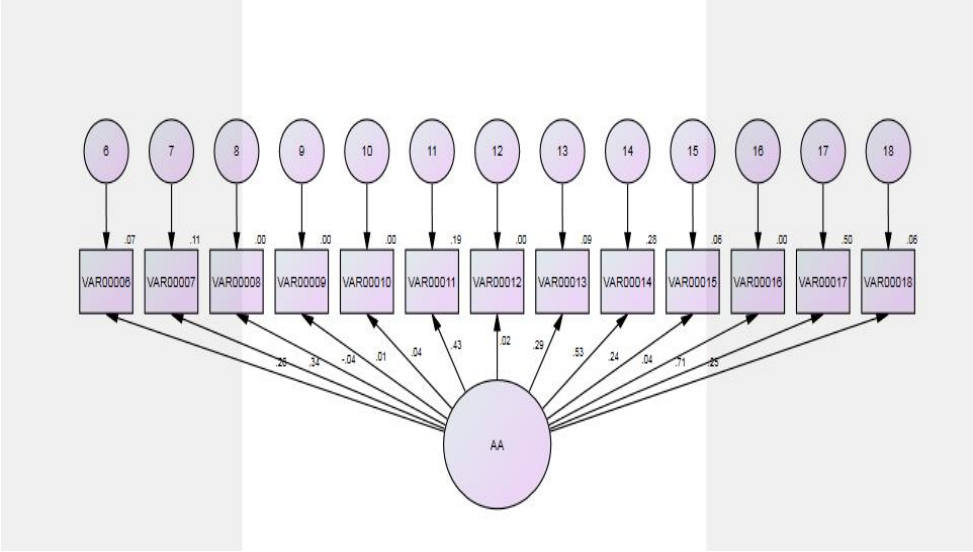

Figure 3. Calculation of structural equations in the fifth, sixth, seventh, and eighth hypotheses

As noted, in the fourth hypothesis, item 6 had a factor loading of 0.26; in the fifth hypothesis, item 7 had the highest factor loading of 0.34; in the sixth hypothesis, item 11 had the highest factor loading of 0.43; in the seventh hypothesis, item 14 had the highest factor loading of 0.53, and in the eighth hypothesis, item 17 had the highest factor loading of 0.71.

(Table 6) gives factor loading significance and goodness of fit indices.

Table 6. Factor loadings of items 6 to 18

Item	Factor loading	Sig.	T statistic
6	0.26	0.09	1.69
7	0.34	0.00	10.76
8	-0.04	0.00	10.45
9	0.01	0.00	11.15
10	0.04	0.00	11.15
11	0.43	0.00	9.84
12	0.02	0.00	11.15
13	0.29	0.00	10.64
14	0.53	0.00	8.76
15	0.24	0.00	10.83
16	0.04	0.00	11.15
17	0.71	0.00	5.47
18	0.25	0.00	10.8

Source: Study findings

In sum, all factor loadings were significant at 90 and 99%, and their t statistic was also significant.

Thus, technical factors, government oversight, economic satisfaction, and project's limitations were found to have a positive effect on waste recycling. Project's limitations, economic satisfaction, and government oversight had the highest effects on waste recycling management. Meanwhile,

sub factors of rising recycling costs, saving, and optimal use of recycled materials from among the criteria of project's limitations and economic satisfaction, respectively, held the highest effects on successful waste recycling. Thus, the fourth to eighth hypotheses were supported.

Hypothesis evaluation

Hypothesis evaluation results are given in (Table 7). As noted, all study hypotheses are supported.

Table 7. Hypothesis evaluation

Hypotheses	Hypothesis description	Result
First	Attitude to behavior has a positive effect on behavioral goal	Supported
Second	Social norm has a positive effect on behavioral goal	Supported
Third	Perceived behavior control has a positive effect on behavioral goal	Supported
Fourth	Behavioral goal has a positive effect on waste recycling success	Supported
Fifth	Technical factors have a positive effect on waste recycling success	Supported
Sixth	Government oversight has a positive effect on waste recycling success	Supported
Seventh	Economic satisfaction has a positive effect on waste recycling success	Supported
Eighth	Project's limitations have a negative effect on waste recycling success	Supported

Source: Study findings

Discussion and conclusion

Using waste recycling management, various responsibilities can be categorized, and work efficiency can be greatly increased. This indicates that responsible people should take waste management functions at construction and demolition operation sites more seriously, actively engage in the development of the marketing market, and seek to promote development. The present study aimed to investigate factors that affect successful waste recycling management in Shiraz. The most important results of this study are as follow:

1. Social values and norms had the highest effects on behavioral goal
2. Project's limitations had the highest effects on waste recycling success
3. From among the project's limitations, recycling costs had the highest effects on waste recycling success or failure
4. In addition to the project's limitations, economic satisfaction, government oversight, and technical factors had the highest effects on waste management success
5. From among economic satisfaction, saving and optimal use of recycled materials had the highest effects on waste recycling success
6. Among technical factors, tools required and machinery had the highest effects on waste recycling success.

According to the findings, since rising costs in the project's limitations affected successful waste recycling, it is thus suggested to managers pay more attention to recycling costs in the area of waste recycling and provide solutions in this regard. Economic satisfaction, especially saving and optimal use of recycled materials also affected successful waste recycling. Thus, the issue of recycling should be economically focused. The presence of tools required and machinery also affected successful waste recycling. Thus, in addition to costs and economic savings, there is a need to reduce

costs from tools and machinery so that the two major goals of economic satisfaction and the project's limitations are met. Future studies are suggested to identify and examine other factors that can affect successful waste recycling management. It is also proposed to use multi-criteria decision-making methods to rank factors affecting successful waste recycling management.

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