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A Strategic Model of Municipal Solid Waste Minimization Based on Decision-Making and Public Participation

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Abstract

The urbanization and population increase have led to a surge in the generation of significant amounts of solid waste across a majority of the cities in developing countries. Municipal waste management is a public issue with health, environmental, economic and social implications at the home, local, national and international levels, so the scope of management of this category is very wide and variable, for such an organization there is no other way but strategic management. So far, the authorities have made efforts to develop specialized criteria and meet the needs and implementation of management. However, in addition to planning, factors such as the allocation of funds and real facilities, education and information play a very important role in this regard. This qualitative-quantitative study was conducted with the aim of designing a strategic model of municipal solid waste management with a minimization approach through maximum participation of citizens, stakeholders in decision making. Participation of stakeholders, executive platforms and operational plans in the field of waste management, raising awareness and creating a culture is one of the main factors in waste management. Based on this, the strategic model of municipal solid waste management was designed with a minimization approach through maximum citizen participation of stakeholders in decision making. In the next step, in order to evaluate and validate the model, its applicability in the field of operation and fitting the model in measurement, structural and general dimensions was done with the help of smart pls2 software. This paper identifies and explores key elements for planning and implementing maximum public participation with decision making of stakeholders in the area of solid waste minimization. These can include stakeholders (e.g., citizen participation in decision-making, changing attitudes and behaviors), service providers (e.g., mobilizing all service providers, *i.e.* municipalities and non-municipalities, including the formal private sector) and informal and community), tackling corruption issues, sustainability of financial resources (such as awareness of related costs, cost-effective services, improving revenue processes, access to finance) and creating effective national policies and institutions and local (such as law enforcement, clarity of roles and responsibilities, job creation, information management systems).

Keywords: Waste management • Stakeholders • Decision making • Citizen Participation • Planning

Introduction

The management of municipal solid waste is a crucial issue to address as we move toward the decarburization of urban contexts. One of the environmental consequences of this pressure is due to changes in consumption patterns and eating habits and an increase in packaging materials for the reasons mentioned, which results in an exponential increase in the amount of municipal solid waste. So that now the disposal of waste due to this consumption is one of the major and costly problems of most city managers [1]. Currently, the increase in the amount of municipal waste, most of which consists of biodegradable materials, every year creates serious bottlenecks in choosing the optimal municipal solid waste management system [2]. The goal of sustainable solid waste management is to recycle as much valuable waste material as possible through less energy and less environmental impact. Orientation of comprehensive urban solid waste management hierarchy, which moves from the top of the pyramid to its base, respectively, to avoid waste production, reduce waste production, separation from the source, reuse, recycle and finally bury the remaining waste in the ground shows the fact that in finding a solution to the waste crisis in cities, we must move from supply-side policies (development of landfills) to demand-side

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(avoiding pollution and reducing waste production) and encourage producers to separate waste origin and recycling changed direction. Given that the decision of municipal waste minimization methods depends on the maximum participation of citizens and stakeholders in this field, designing a strategic model in the field of waste management is very important.

Lytinen emphasizes the importance of stakeholders and states that meeting stakeholder expectations is a key part of the success of information systems projects, so stakeholder analysis in the field of information systems is very important that it will be illustrated the interests of each stakeholder, the level of influence of stakeholders in decision making and the role of stakeholders in overcoming and preventing further in the future and it can also assist in mobilizing local resources and understanding the conflicts in the use of land resources. This analysis helps determine which actors are influential or influenced when making decisions [3]. Policymakers and managers can use the stakeholder identification model to identify key actors and examine issues such as knowledge, interests, situations, relationships, and policy-related importance [4]. Thus, it allows policymakers and managers to interact more effectively with key stakeholders and to support specific policies or programs. This is while the idea of citizen participation in the management of city affairs is as old as the establishment of the city; but the development of culture, knowledge and readiness of citizens in the world today has led to the social participation of citizens in all urban affairs as an effective solution to maximize the efficiency and effectiveness of organizations such as municipalities and the views of planners and experts be urban [5]. This potential has led development experts to recognize citizenship control as the highest level and type of participation. As a result, municipalities in many major cities around the world participate in various projects and risky investments with the people and provide their financial resources through participation in citizen's investments [6]. Despite the importance and necessity of the factor of social participation of citizens in the development of cities and while one of the main needs of our country for comprehensive development is to pay attention to the concept of social participation in urban solid waste management [7]. Annually, more than 61 million tons of various types of waste are produced in Iran, according to the DOE; an estimated 10 to 17 percent of the total produced waste is recycled. While in developed countries this number reaches up to 70 percent so that the role of people's participation in this regard is very small and weak. It is worth mentioning that one of the problems that most cities in Iran face is the lack of proper management of municipal solid waste. Naturally, these concerns in the city of Tehran, due to its special economic and political position as the capital of the country, its high population and migration to this city, are far greater than in other parts of the country.

Therefore, planning to improve the environmental situation in urban areas can prevent the growth of negative environmental consequences that exist in many urban areas, and allow policymakers and managers to interact more effectively with key stakeholders. When stakeholder identification and other key introductory tools are used to guide urban designers, policies or programs appear to be more successful [8]. Given that the decision of municipal waste minimization methods depends on the maximum participation of citizens and stakeholders in this field, designing a strategic model in the field of waste management is very important, so this study aims to design a strategic model of municipal solid waste management with the minimization approach was carried out through maximum citizen participation of stakeholders in decision making.

Proper waste management is seen in 17 principles of sustainable development. This is a strong reason why it is strategically important to pay attention to proper waste management. Therefore, setting and monitoring global goals for proper waste management will significantly contribute to achieving the goals of sustainable development [9]. The waste management pyramid was chosen as a strategy for waste management in communities after extensive studies and extensive research. As it is clear in this pyramid, the best option is not to produce waste, and in case of production, reducing the amount of waste produced has priority. In the next priorities, reuse and then recycling and recovery are discussed, and finally waste processing is collected and then disposal or disposal of unusable parts is discussed [10].

Today, with the increase of waste production in urban communities, waste management system can be considered as one of the most important issues of urban management and part of comprehensive management systems and has a valuable position in terms of social, economic and health [11]. Some researchers have tried to navigate based on the shortest distance; this system includes organizational structure, planning activities, definition of responsibilities, determination of methods and processes, as well as obtaining the necessary resources to prepare, implement, review and maintain the organization's environmental policy. Quality management systems are defined to maintain quality levels and improve quality through process modifications in every process and organization [12].

Figure 1 shows the intentions of the companies. The top priority of the companies is to prevent waste creation. Disposal is the lowest priority. Researchers have conducted a literature review and an analysis of companies in the context of sustainable energy waste management for Australia, Bangladesh, Brazil, China, Egypt, and from a global environmental practices of companies are shown in Figure 1.

Figure 1. Strategic waste management pyramid (guiding principles of Australian law).

Municipal solid waste includes items such as durable and non-durable goods and materials, containers and packaging materials-are food wastes, tree leaves and other organic and inorganic materials discarded in residential, commercial, office and industrial areas. Residential waste is generated in residential units and by the people living in them. Sources of commercial waste generation include retailers, wholesalers, and community service centers. Office waste is generated by schools, hospitals and government centers [13]. The heterogeneous nature of municipal waste is a challenge for local authorities in urban planning. Defining long-term infrastructure has a significant impact on population change, consumer products, environmental knowledge and attitudes, as well as seasonal changes. At the same time, anticipating changes in regulatory conditions challenges long-term planning. Urban solid waste management efficiency has been one of the indicators for measuring the level of urban governance [14]. Waste management is a complex issue that affects many social and economic aspects and is strongly related to many other global challenges such as health change, climate change, poverty reduction, food and climate change, poverty reduction, food and resource security, sustainable production and consumption [15]. Waste management plan programs will affect a society in three ways: changing the natural environment, including the human living environment, and changing the socio-economic structure.

With over 9 million populations, challenges of Waste Management System (WMS) of Tehran can offer some lessons to other middle-income cities. Despite all the investments and trials, the recycling rate has been almost constant (about 18%) during the last decade. Short-term decisions, lack of true understanding of different parts of the system, and non-participation of other stakeholders are the most important weaknesses of governance of the WMS in Tehran, with inclusivity and financial sustainability that seem to be the most challenging aspects of Tehran's WMS. Inadequate waste management framework is another weakness of the governance system, which is considered a national challenge. Although the disposal methods have been improved to some extent and the capacity of composting plants have been increased, the quality of 3Rs (Reduce, Reuse, and Recycle) is still very poor [16].

According to statistics, about 8,000 tons of waste is produced daily in Tehran, nearly 17 percent of which is recycled and the rest is landfilled, while in the developed world 70 percent of the waste is recycled and 30 percent is buried.

Many countries have been so successful that some even claim to reduce waste to zero by 2030, and some are looking to generate energy from waste. Therefore, optimizing waste efficiency management, while speeding up operations, will require less cost and manpower. Municipalities in developing countries typically spend 20 to 50 percent of their municipal budget on municipal solid waste management, which provides only less than 50 percent of the population [17]. Urban solid waste collection plans vary depending on the type, composition and amount of waste produced, as well as social, cultural characteristics and urban priorities [18]. In Table 1 the average waste stream and in Table 2 municipal solid waste sources, the classification of materials used in the detection of MSW components is described.

Area	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
1	22	77	58	87	84	83	64	83	97	53
2	61	89	62	81	74	85	83	51	100	98
3	30	42	42	43	40	38	36	37	57	51
4	66	107	124	120	110	93	65	106	141	148
5	50	87	106	120	105	96	78	94	106	105
6	38	48	55	39	38	42	35	45	45	49
7	26	52	58	48	41	44	38	47	56	61
8	38	57	44	47	51	50	49	48	72	88
9	12	23	25	29	33	27	14	15	32	33

10	17	18	27	29	14	23	25	38	43	42
11	35	50	50	41	49	48	51	38	54	51
12	41	80	88	96	101	72	51	41	23	37
13	28	28	27	28	24	22	25	25	33	31
14	28	42	58	61	62	62	60	55	60	64
15	46	66	84	73	63	75	73	66	91	98
16	18	31	50	48	42	45	46	34	55	56
17	15	23	22	13	15	23	20	28	30	24
18	8	15	47	41	37	43	40	46	57	51
19	18	32	28	14	14	25	23	34	48	53
20	23	48	54	38	37	30	23	33	49	65
21	9	18	21	21	11	14	14	18	38	40
22	9	15	11	15	15	12	16	18	26	26
Total	638	1048	1141	1132	1060	1052	929	1000	1311	1326
Percentage		64%	9%	-1%	-6%	-1%	-12%	8%	31%	1%

Table 1. Daily average of waste separated at the origin of 22 regions (tons per day).

Sources	Types of solid waste produced
Residential	Household items, newspapers, clothing, disposable tableware, food packaging, cans, bottles, food waste, tree foliage
Commercial	Cartons, food waste, office paper, disposable tableware, horticultural waste
Official	Office papers, production waste in restrooms and buffets, classroom waste, garden waste
Industrial	Carton, production waste in dining rooms, office papers, wooden pallets

Table 2. Municipal solid waste sources.

Literature Review

Strydom conducted a study entitled "Barriers to household waste recycling: Empirical evidence from South Africa" in 11 major South African cities. In this study, 2004 people participated. The findings of the present study showed that 74% of households do not recycle their waste. The most important barriers to recycling were lack of space in the house, lack of time, contamination of recycled materials, lack of awareness and inadequate recycling facilities. According to 74% of households that did not recycle their waste, lack of awareness and lack of time were the most important obstacles.

In 2018, Ma et al., conducted a study entitled "analysis of factors affecting separate municipal solid waste collection behavior at origin" in Guilin, China. 848 people participated in this study. Findings of the study indicated that the attitude of individuals and situational factors are the most important predictors of individual's intention to separate waste. However, this study shows that perceived behavioral control in waste separation behavior is at the source.

In 2017, Chen et al. conducted a study entitled "separation of municipal solid waste at origin" in Changsha, China. The results of this study showed that the majority of people have a positive attitude towards participation in waste separation. The findings of this study also indicate that when waste separation containers are classified into two categories of food waste separation bins and other wastes, the separation behavior from the source of waste also increases.

Padilla and Trujillo conducted a 2018 study in Bogota, Colombia, entitled "Waste disposal and household heterogeneity. Identifying factors that create attitudes towards recycling from the source." In this study, it is reported that awareness of household attitudes toward waste segregation is a vital component in waste management. In addition, the study findings indicate that households with a higher socio-economic level are more inclined to separate solid waste. Also, according to the findings of households with low socio-economic level, a positive attitude towards waste segregation is affected by Internet access, the level of education of the head of the household, home ownership and membership in environmental protection organizations.

Asko et al., A study on the attitude of urban residents towards solid waste management in Nigeria "in this study, 150 questionnaires were distributed among the residents of the region and information such as types of waste, waste disposal, collection methods were examined. The findings of this study include. The size of households has a great impact on disposal and production as well as waste management, and the environmental vision of households has changed and people are paying attention to the way waste management is managed, although this participation is not maximal.

Saraber Gquist and Lizavisandra conducted a study entitled "waste management and health case study in Mbale, Uganda". One of the major public health concerns in developing countries such as Uganda is the management of municipal solids, the paper said. One of the main public health problems is a poor waste management system. A case study on waste management and its impact on public health in Mbale, Uganda, were conducted over a 10 weeks' period.

Interviews, observations and documents were reviewed and the main problems and how to manage waste in the industrial sector were considered. With the help of the development of age theory and model B. Murpy evaluated work and health promotion. Finally, they concluded that by prioritizing responsibilities and paying attention to infrastructure and sustainable and long-term solutions, the weakness of the waste management system can be reduced and the capability and health of the people can be affected.

Minakova in an article entitled improving solid waste management using technology and organizational principles. This article shows the problems in recycling solid household waste in Western developed countries such as Russia. A model and guide for developing countries to avoid wasting cost and time in solid waste management processing. The article showed that the current system based in Russia is an internal waste exchange system in which waste is collected, transported and transported. The transfer of solid waste takes place at the residence of citizens, because in order to maintain environmental standards for waste disposal due to the cold weather in Russia, this method should be used. Irregular methods of residential solid waste disposal lead to land compaction despite the small volume of incoming waste and significant areas allocated for its disposal, given Russia's environmental characteristics, structural and technological recommendations for improving the management of residential solid waste in the region consist of a complex processing method. For this purpose to manage waste the proposed residential solid waste is presented in the form of a waste management package as follows:

- The social effect (new jobs) of the selectors, the reference carriers, due to the increase in production volume in the existing processes of the companies).
- Ecological effect (reducing the volume of waste disposal) in cyberspace, increasing consumer knowledge of the environment through education, awareness and culture.
- Economic effect (reduction of waste transportation costs), (reduction of waste disposal costs on farms and transportation costs (due to waste of waste sorting and processing companies).

The waste management plan should have a specific program to promote adult motivation and create appropriate citizenship behavior for waste management as well as education for children. For example, supermarkets can store containers for collecting batteries, special machines for collecting plastic bottles and aluminum cans. Labels (coupons) are issued for the delivery of used products and batteries, and a manual is set up. With these stickers can be a gift (toys, sweets, movie tickets, attractions, shopping discounts, etc.) attractive to kids.

This program can bring financial benefits and be a source of funding for the municipality with targeted funds for sanitation and cleaning the city. The results of this program show that the identification and classification of residential solid waste will be reduced and the amount of landfilled waste will be generated as well as valuable raw materials for economic activities. The results and proposals of this plan are very important for the strategic and tactical plans of urban waste management through the management of social and economic systems of the regions in the development process.

In a study by Tai et al., on the separation of waste from two Chinese cities, the results showed that of the two cities surveyed, only Beijing and Shanghai were relatively successful in separating waste from the source. In this study, it was emphasized that stakeholder participation has the most important role in the management of municipal solid waste and stakeholder responsibilities should be clearly defined. Improvements in legislation, coordination mechanisms, and public education were other challenges in this study [19].

Zhan et al., conducted a study to investigate waste separation behaviors in Guangzhou, China. In this study, which was conducted using the theory of planned behavior, the results showed that attitude; abstract norms, perceived behavioral control, behavioral intention and situational factors are able to significantly predict behaviors of separation from the origin of households [20].

Rafiei and others conducted a study aimed at "the consequences of various ceremonies on the amount of recyclable waste" in Tehran. The results of this study showed that after the ceremony, in addition to increasing public awareness, appropriate management strategies and the necessary infrastructure should be used.

Ghanbari, et al., conducted a study in 2015 with the aim of "Strategic factors of waste management, awareness and citizen participation" in district 3 of Tehran municipality. Findings of the study showed that people are highly aware of the waste separation plan at the source and tend to separate their waste at home, but obstacles and problems such as not being equipped with a separate collection machine for separate collection of waste, not collecting separate waste by the municipality and the lack of separate bins for dry waste collection, has prevented the proper participation of citizen's in the waste separation plan at the source. An article entitled "Urban institutions and citizens participation in urban affairs management" citizen's participation in urban affairs. The results

show that most of the citizens of Isfahan have a high level of participation in urban affairs. According to the results of this study, there is a significant relationship between institutional trust and social satisfaction with participation. In general, the performance of urban institutions has affected the level of citizen participation in urban affairs.

Ebrahimzadeh and Kazemizad in their article entitled "measuring the level of satisfaction and willingness of citizens to participate in the implementation of municipal infrastructure projects" to assess the level of citizen's satisfaction with the implementation of municipal infrastructure projects and their willingness to participate in the implementation of these projects in It is the city of Zahedan. In an article entitled "strategic planning of waste management in Zahedan city by SWOT method" in order to present the strategic plan of waste management in Zahedan city, SWOT method has been used and a quantitative strategic planning table called QSPM has been used. Expert opinions of experts have also been used. Findings show that the most important strategy with the highest score to achieve the goals of the organization and achieve sustainable development in the city of Zahedan, is the cooperation and support of the government to allocate the necessary funds. Providing opportunities for attracting and involving the private sector, the need for public education and culture, developing production procedures and software sectors and non-implementation of waste management rules and regulations, are other effective strategies in improving waste management in Zahedan.

Mirzaei, et al., presented an article entitled "study of strategies to attract public participation in the management of household waste in Tehran." The purpose of this study is to identify the level of citizen participation in household waste management. The results showed that there is a positive and significant relationship between the socio-economic status of citizens and the level of participation in household waste management. Also, the results of Kruskal-Wallis statistical test showed that there is a significant difference between different areas of the city in terms of participation in household waste management, so that the highest participation of citizens in household waste management in all components is related to area two and the lowest participation is related to area one. In order to identify the factors affecting participation, it was shown those factors such as satisfaction, trust, awareness, belonging to the place cause the difference between area two and other study areas in terms of participation in household waste management.

Mohseni and Naeimaei in an article entitled "Study of the role of urban management in increasing social participation with emphasis on the central neighborhood" state; every year, various development, social and cultural programs are implemented in which the role of citizens is somewhat effective. But the share and participation of citizens can increase more than before. This event can further strengthen the feasibility of the municipality's programs and social approach. Findings of this study show that on average, about 60% of the programs implemented by different areas of the municipality have had public participation, but the instability and change of priorities has led to a decrease in participation and its continuation. Also, the incorrect definition of the position of councils and neighborhood halls has formed an incomplete form of popular and local participation. The results show that urban management measures, which have a higher rate of information and awareness process, face more citizen support.

Malekzadeh et al., in an article entitled "assessing the participation of stakeholders and stakeholders in urban development strategy" after using the theoretical foundations of the issue, the stakeholder and stakeholder participation in district 22 of Tehran municipality in the framework of urban development strategy approach been investigated. In the framework of the research approach, four environmental, social, economic and managerial dimensions as the field of stakeholder and stakeholder participation. Infiltrators have been studied and analyzed in this research. Findings show that the level of stakeholder and stakeholder participation in the development of region 22 has been growing in recent years and the tendency of economic investment (with an average of 15.3) in the region is high. However, due to social ignorance and lack of trust between government organizations and citizens, the social inclination of stakeholders and influential people in the region (with an average of 82.3) is low. This study believes that the urban planning system in Iran should be directed towards the urban development strategy approach by emphasizing the participation of stakeholders and stakeholders in all aspects of development. Also in Shiani article entitled "study of social factors affecting citizen participation in the management of urban affairs in Tehran" the results showed that citizen participation in urban management should be done voluntarily and purposefully. Urban planners must first emphasize mental participation and change in citizens' beliefs and attitudes. Participatory behavior in urban programs should also be done in two parts. In the first stage, it is necessary to recognize the factors influencing citizen participation, and in the second stage, it is necessary to maintain participation in the plans and programs that have been implemented.

Mirela, et al., in a dissertation entitled "study of strategies to attract public participation in household waste management in Somehsara" states. Waste management has gained considerable importance in the new era due to changes in the pattern and lifestyle. Movement and activity, as necessary for life, leave side effects that are sometimes not desirable, and in order to continue living, human beings must inevitably eliminate those side effects. Therefore, cleaning the environment is a necessary condition for survival. The purpose of this study is to investigate the role of public participation in household waste management. In this study, at first, during the interviews of 60 officials and citizens in the statistical population, the main variables of the research were identified and then divided into 4 dimensions of education, culture, structure and technology. The statistical population of this study consists of all people who live in the city of Soomehsara. The results showed that all four of the above factors are not in a favorable position in terms of public participation in municipal waste management.

In their research, Mafi, et al., formulated and evaluated the optimal methods in the field of municipal services with emphasis on urban waste management. The results of their findings showed that recognizing the needs and priorities of citizenship and creating a healthy and sustainable environment should be the basis and criteria for decision-making with a strategic approach. For the control and management of solid waste, Halton solid waste management in its final report program for 2012 to 2016 points out that the most important strategy for the control and management of municipal waste, recycling materials, educating the community and the proper disposal of complex waste residential buildings are correct. The government of Canada has targeted four programs in a project called solid waste and waste management complexes in Vancouver, the most important of which is the proper disposal of waste and waste after recycling. In this regard, in the city of Kanti in the Netherlands, a strategic plan has been presented for its waste management, in which many internal and external factors affecting waste have been examined in the form of "SWOT" approach. Considering the mentioned cases, it can be said that with the studies conducted during the last ten years, the subject of this research is one of the needs of urban management, which with the correct application of the recommendations provided in it, can be wasted annually with proper management of municipal waste. Financial and non-financial resources prevented and carried out urban development in acceptable ways. Therefore, with proper management of municipal waste, factors such as waste generation, collection, transportation, disposal, landfilling and recycling can be expertly and properly managed and engineering principles can be designed for each of them.

Methodology

The research method used in this study is based on the qualitative-quantitative paradigm with an exploratory approach and is applied in terms of purpose, in terms of monitoring and degree of control of variables, field and in terms of data collection and information is descriptive research. The statistical sample of this research includes key informants, experts, experts and stakeholders in decision making in the field of waste management who have experience in cooperation in this field. The data of this study were done in the qualitative part using interviews with stakeholders. The number of subjects was determined according to data saturation and theoretical adequacy. The process of data collection and interviews continued until data saturation and adequacy, and the interview questions were openly selected and asked. The data coding process was performed using NVivo quality software. Then, the strategic model of municipal solid waste management was designed with a minimization approach through maximum citizen participation, stakeholders in decision making. In the next step, in order to evaluate and validate the model, its applicability in the field of operation and fitting the model in measurement, structural and general dimensions was done with the help of smart pls2 software. Data collection tools were done through semi-structured individual interviews, note-taking and audio recording.

Thus, in order to ensure the validity of the present study, the researcher first carefully studies the theoretical foundations and research background on the subject of strategic alliance, and before designing the interview questions, carefully studies how to design the interview questions and how to design and conduct the interview. Has done also, in the stage of designing interview questions, the researcher first collects interview questions designed by previous researchers in this field, in order to get guidance in designing questions appropriate to the research topic, and after designing interview questions, they are approved by professors. This field has been used and their guidance has been used in formulating and correcting questions. During the interview process, the researcher has set the framework to prevent the interviewee from leaving the subject and directed them to the main purpose of the question. To prevent the loss of information from the interview, the researcher, with the permission of the interviewees, recorded the interview session so that all the information was given correctly and exactly in the transcript of the interview. In the analysis stage, the researcher has tried to do this stage with maximum accuracy by carefully studying the field of analysis method and getting guidance from professors, and to be sure, some of the cases were examined by an assistant and professors. For the validity of reporting the findings, the researcher has tried to ensure that the material presented to the researchers and readers of the present work in the form of results is highly accurate.

The methods of providing credibility and trust in this study are the review of the findings by the participants and the triangulation technique. To measure validity and reliability, four tools are acceptable (presenting the findings to the interviewees and discussing them to ensure the interview findings and using confirmatory sources (trinity), portability (giving sufficient information to the reader, and explain the steps of finding data to understand the subject, structured coding), reliability (recording and taking notes during the interview, researcher self-review), verifiability (permanent data comparison, corrections after each coding step and model testing at the end of the work) And reliability (getting approval and making corrections after each step of coding and testing the model at the end of the job by employing new people.) Acceptability, transferability, reliability and verifiability replace internal and external validity, respectively and are objectivity (Table 3).

The level	A description of the process
Familiarity with data	Copy data (if necessary) read and re-read data, referring to basic ideas

Create basic codes	Coding interesting features of data in a regular way across the data set, integrating the data associated with each code
Search for themes	Integrate codes into potential themes, gathering all the information about each potential theme
Review themes	Check that if the themes work in conjunction with the coding summary (level 1) and enter the data set (level 2) to create a thematic map for analysis.
Defining and naming themes	Continuous analysis for the term features of each theme and general story analysis statements, compliments and clear names for each theme
Write a report	The final opportunity for analysis. Clear selection, creating summary examples, final analysis of the selected summary, linking the analysis to research and literature questions, producing practical reports of the analysis.

Table 3. Thematic analysis steps.

Data analysis

The first part of qualitative findings: According to Tables 4 and 5, 14 (26.4%, most frequent) interviewees had a history of 10 to 15 years. 24 (45.3%, most undergraduate and 20 (37.7%) percent) had a master's degree or higher, 31 (58.5%) had the highest frequency of study in the humanities and 22 (41.5%) had a degree in engineering and basic sciences. It should also be noted that 40 (56.6%, the highest frequency) of the interviewees were undergraduates (Tables 4 and 5).

Variables	Scale	Abundance	Percentage
Age	20 to 30 years	7	13/2
	30 to 40 years	19	35/85
	40 to 50 years	16	30/2
	50 years and up	11	20/76
	Total	53	100
Gender	Male	37	69/8
	Female	16	30/1
	Total	53	100
Marital status	Single	9	17
	Married	44	83
	Total	53	100

Table 4. Describes the studied samples in terms of age, gender and marital status.

Variables	Scale	Abundance	Percentage
History	Less than 5 years	9	17
	5 to 10 years	12	22/6
	10 to 15 years	14	26/4
	15 to 20 years	10	18/9
	More than 20 years	8	15/1
	Total	53	100
Education	Diploma and post-diploma	9	17
	Bachelor	24	45/3
	Master's degree and higher	20	37/7
	Total	53	100

Field of study	Engineering and basic sciences	22	41/5
	Humanities	31	58/5
	Total	53	100
Job side	Managerial	23	43/4
	Masters	30	56/6
	Total	53	100

Table 5. Describes the studied samples in terms of background, education, field of study and job position.

Discussion

According to Table 6, 35 (66%) of the interviewees participated in the discussion of waste management activities. However, only 29 (54.7%) of the interviewees participated in waste management decisions. Given that the selection of individuals was such that their introduction was based on the recognition of other interviewees and as the interest of sample members in the discussion of waste management, it can be seen that a significant number of interviewees did not participate in activities and decisions. This in itself can reflect the fact that not all stakeholders are involved in this area.

Variables	Scale	Abundance	Percentage
Participation in waste management activities	No	18	34
	Yes	35	66
	Total	53	100
Participate in waste management decisions	No	24	45/3
	Yes	29	54/7
	Total	53	100

Table 6. Describes the studied samples in terms of participation in activities and decisions in the field of waste management.

In fact, identifying the goals will help to create sufficient infrastructure for private sector investment in the source separation plan and waste reduction plan (CAP), using specialized manpower and entrepreneurs for entrepreneurship,revising the plan for self-sufficiency of municipalities and solutions to increase the share of municipalities in the government budget and allocate appropriate budgets to municipalities in the field of waste management (Table 7 and Figure 2).

A Strategic model of municipal solid waste management based on decision-making and operational participation.

Actions	Required arrangements and organization
Policy and staff actions	Clear redefinition and classification of types of municipal waste
	Efforts to create a systematic approach to the issue of waste management and avoid one-dimensional approaches to this issue
	Develop relevant laws, instructions and regulations and its executive guarantees
	Creating executive guarantees to collect the cost of waste collection and disposal and...
	Planning for the adoption and implementation of laws that lead to the obligation of manufacturing companies to use different consumer products to use minimal and absorbable packaging or multi-use
	Development of consumption pattern based on cultural, social and economic indicators
	Establishment of policy committees in the field of identifying municipal solid waste recycling cycles
	Determining time periods for allocating facilities for the collection and recycling of some small but dangerous products
	Preparing how to collect tolls and some kind of tax on waste produced for over-conventional waste producers

	How to calculate and obtain the cost of waste management services
	Use of economic tools in relation to grammatical mechanisms
	Develop guidelines for educating and cultivating citizens on how to collect and
	recycle waste in order to attract people's participation
	Develop guidelines for operational and executive measures of waste management in order to attract people's participation
	Planning to finance waste management projects
	Policy-making to reduce solid waste production through process modification, consumption savings and change in raw materials
	Policy-making to avoid waste generation from the beginning of the production chain to consumption
	Identify problems, find the root causes and determine corrective actions
	Evaluate the most appropriate method for billing and pricing waste management services
	Evaluate the effectiveness of implementation, cultural and educational measures and operations
	Development of recycling infrastructure at source
Operational and executive measures	Concluding a memorandum of understanding with guilds, offices, companies, hospitals, etc. to form a dedicated recycling network
	Development of recycling stations in neighborhoods
	Take measures to identify a different pattern in the consumption behavior of citizens in different urban areas and how to recycle in accordance with the types of waste produced in each area
	Adopt measures to identify the types of waste of different guild units and how to recycle in accordance with the types of waste produced in each of the categories of separate collection in detail and recycling of different types of waste.
	Take measures to identify infrastructure appropriate to the needs of citizens to develop waste segregation at source
	Interacting with trade unions to set a schedule and how to collect and deliver recyclable waste
	Identification and implementation of efficient and hygienic solid waste collection system based on periodic review
	Implement waste management plans according to social, cultural characteristics and urban priorities
	Development of recycling industries
	Receiving the cost of waste management services
	Stimulating people's economic incentives to change the behavior of waste producers
	Use as animal feed
	Development of available recycling booths
	Provide a regular schedule of recycling contractors equipped with melodic vehicles
	Organizing (agents of car contractors, motorcycles, scooters, handcarts, etc.) at the regional level
	Observe the schedule and blocking to establish full coverage of the waste collection system
	Recycling patrol vehicle activity to monitor contractors agents
	The commission of crimes by the monitoring body for violators of the executive laws of waste management
	Necessary and adequate supervision by supervisors on executive and contracting agents
	Restrict their movement and transportation

	Prevent mixing of chemical, biological and radioactive waste in the production stage
	Reduce the return time of waste to the production cycle by manufacturers of packaged materials
Educational and cultural activities and bedding	Creating a permanent training base and implementing waste management in various organizations and institutions
	Creating awareness about the distinction between surplus and unusable materials
	Creating awareness in the field of material cycle in nature and the possibility of recycling different types of waste materials
	Creating awareness in the field of raw materials that can be extracted from waste materials
	Informing citizens about the real cost of collecting, transporting and disposing of each kilo of waste in Tehran
	Educate classes on waste segregation
	Appropriate information on how to collect and deliver segregated waste
	Publication of citizenship education books in the field of waste
	Production of citizenship education videos in the field of waste
	Execution of the program by Samans and groups of people
	Cultural context of waste management through students
	Naming some days of the year and implementing projects such as Nylex-free day, etc.
	Encourage citizens to use biodegradable bags instead of plastic bags
	Develop environmental insights and attitudes
	Develop the insight and attitude of cleaner production and change and modify production
	Increase the useful life of manufactured products
	Reduce the amount of packaging consumables to send the product to market
	Use of recyclable packaging materials

Table 7. Methods, arrangements and organization required for municipal solid waste management with a minimization approach to increase citizen participation.

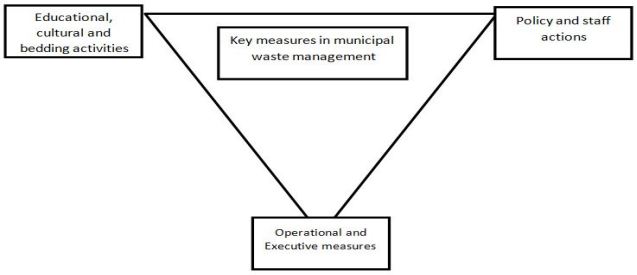

Figure 2. Strategic model of municipal solid waste management extracted from interviews based on decision-making and operational participation according to the explained actions.

Executive platformsin the waste management cycle: According to what was mentioned before and considering the maximum participation of stakeholders in the field of waste management, the executive contexts in the waste management cycle extracted from the interviews are described in Table 8 and Figure 3.

Agent code	Key concepts	Initial code	Basic executive concepts
A	Re-production chain	A1	Use of high-quality raw materials to reduce waste
		A2	Paying attention to transportation and packaging standards when supplying raw materials to enter the processing site
		A3	Paying attention to the necessary standards regarding time and temperature and other

			storage conditions in the storage of raw materials by manufacturers
		A4	Pay attention to proximity to raw material production centers or consumer markets to reduce waste
B	Operations during production	B1	Observance of production standards to increase the quality of products with a longer service life and longer shelf life
		B2	Use of skilled production force to reduce waste during processing
		B3	Use of up-to-date technology to increase production efficiency and effectiveness
		B4	Use of appropriate packaging to prevent loss of quality and waste products
		B5	Observe the optimal size of products for different uses in packaging
C	Marketing	C1	Use of recyclable packaging materials
		C2	Reduce the amount of packaging consumables to send the product to market
		C3	Move to reduce intermediary interventions and speed in product transfer from producer to consumer and direct supply of goods
		C4	Use of appropriate transportation equipment such as refrigeration and roofing equipment to reduce damage caused by impact, sunlight and weather conditions, etc.
D	Consumption control	D1	Awareness and obligation to observe the correct consumption pattern, especially in food products
		D2	Awareness and the need to reduce the culture of consumerism and more limited use of disposable products and provide more durable products
E	Consumption instruction	E1	Principled and correct use to increase the period of use and prevent damage and unusability
		E2	Paying attention to the types of product functions for optimal use
F	Purchase and transfer to the place of consumption	F1	Pay attention to the type of packaging and product quality when buying
		F2	Pay attention to consumption and buy to consumption
		F3	Paying attention to the amount of waste of the purchased product in terms of packaging and so on
G	Control of excess consumption and waste	G1	When shopping, choose products whose packaging is made from recyclable materials
		G2	Avoid accepting unnecessary packaging, such as items or fruits with lavish packaging
		G3	Creating awareness about the distinction between surplus and unusable materials
H	Redefine for use and reuse	H1	Creating a culture of correct consumption and use of goods until they are worn out and unusable

		H2	Redefine use for product and use in another case
		H3	Ability to provide unnecessary and usable goods to others
I	Separation and transfer to the recycling cycle	I1	Creating places to receive recyclable materials in neighborhoods
		I2	Enabling the separation of different types of recycling for different types of waste production centers (hospital, commercial, office, home, etc.)
		I3	Creating awareness in the field of raw materials that can be extracted from waste materials
		I4	Educate classes on waste segregation
		I5	Prevent mixing of chemical, biological and radioactive waste in the production stage
		I6	Development of available woven booths
		I7	Development of recycling industries and...

Table 8. Executive platforms in the waste management cycle.

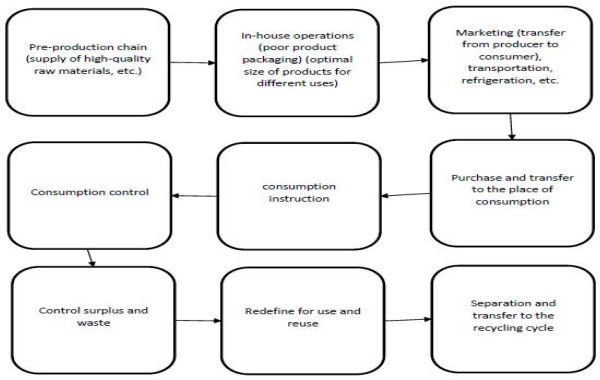

Figure 3. Strategic model of municipal solid waste management in the context of executive extracts extracted from interviews based on decision-making and operational participation according to the waste management cycle.

Quantitative section findings: In this section, first, the demographic characteristics of the interviewees in the quantitative section are presented in Tables 4-7. According to Table 9, the respondents of the second part who participated in the discussion of model validation had the following characteristics: A total of 384 people. The sample size was determined based on the maximum number of samples in unlimited communities based on Morgan table. People aged 30 to 40 years (31.5%, the highest percentage) were interviewed in terms of age status. The gender distribution of the interviewees was almost equal. It should also be noted that 67.2% of the interviewees were married.

Variables	Scale	Abundance	Percentage
Age	20 to 30 years	116	30/2
	30 to 40 years	121	31/5
	40 to 50 years	95	24/8
	50 years and up	52	13/5
	Total	384	100
Gender	Male	194	50/5
	Female	190	49/5
	Total	384	100
Marital status	Single	126	32/8
	Married	258	67/2
	Total	384	100

Table 9. Describes the studied samples in terms of age, gender and marital status.

According to Table 10 in terms of education, 143 people (37.3%) had diploma and post-diploma education and 176 people (45.8%) had bachelor's degree and 65 people (16.9%) had master's degree and higher.

Variables	Scale	Abundance	Percentage
Education	Diploma and post-diploma	143	37/3
	Bachelor	176	45/8
	Master's degree and higher	65	16/9
Total		384	100

Table 10. Describes the studied samples in terms of background, education, field of study and job position.

Describing the opinions of the respondents regarding the importance of the goals and approaches proposed in the field of waste management.

In the following, the average scores provided by the respondents in terms of the importance of goals and approaches in the field of waste management are presented in Table 11.

Scores are evaluated in the range of 1 to 5. Using one-sample t-test, the significance of the proposed goals and approaches was evaluated.

Variable	Average	Standard deviation	The significance level
Minimization of the source of production of products	3/69	0/81	0/001
Waste minimization by consumers and waste producers	4/86	0/95	0/001
Recycling and recycling of generated waste 4/11		0/99	0/001
Restrict the handling, transportation and disposal of waste	3/53	0/83	0/001

Table 11. Examines the importance of the goals and approaches.

According to the results presented in the table above, all four approaches have an average score higher than 3. Also, a significant level indicates the importance and in other words, confirmation of the validity of all four approaches in the field of waste management.

Describing the respondent's opinions regarding the importance of key measures proposed in the field of waste management.

The average of the scores provided by the respondents in the field of key measures in the field of waste management is presented in Table 12. Scores are evaluated in the range of 1 to 5. Using one-sample t-test, the significance of the key measures was evaluated.

Variable	Average	Standard deviation	The significance level
Policy and staff actions	4/17	0/94	0/001
Educational, cultural and bedding activities 4/34		0/89	0/001
Operational and executive measures	4/83	0/91	0/001

Table 12. Examines the status of the studied variables of key measures in municipal waste management.

According to the results presented in the table above, the key actions have an average score higher than 3. Also, a significant level indicates the importance of key measures in the field of waste management.

Checking the combined validity of each structure: Due to the fact that in this study, the AVE index for all research variables is above 0.5, so the convergent validity of the model structures is confirmed.

Cronbach's alpha and combined reliability coefficient measure the validity and reliability of the measuring instrument. All these coefficients are higher than 0.7 and indicate the high reliability and validity of the measuring instrument (Table 13).

	AVE	Combined credit	Cronbach's alpha
0/811	0/823	0/626	Pre-production chain
0/801	0/858	0/707	Operations during production
0/908	0/816	0/695	Marketing
0/837	0/819	0/637	Consumption control
0/81	0/842	0/716	consumption instruction
0/828	0/873	0/743	Purchase and transfer to the place of consumption
0/710	0/862	0/722	Control of excess consumption and waste
0/715	0/845	0/686	Redefine for use and reuse
0/905	0/831	0/703	Separation and transfer to the recycling cycle

Table 13. Examines the combined validity of each of the research structures.

In the present study, in order to improve the separation of waste at the source, policies such as the implementation of regular training programs, information, and use of appropriate equipment for the stakeholders of the waste management organization were proposed. Consistent with the findings of this study, also suggested that to develop the habit of waste separation in households, develop policies such as providing equipment and a convenient place for waste separation, encourage market based recycling programs, and Promoting training and training campaigns can be effective.

It is worth noting that studies related to waste management should be purposeful and practical, and stakeholder participation in the preparation of a comprehensive waste management document should be carefully stated. The most important aspect of stakeholder management is value creation, and decision-making for municipal waste management is a process that involves several different stakeholders. Stakeholders have diverse interests and different goals, and the main goal is to respond to needs in priorities, build trust, increase skills and capacity building, and promote a sense of ownership among stakeholders. The purpose of public sector collaboration is to improve services for the community. Collaborative governance according to Duan et al., is a process in which stakeholders are involved and bound to place the interests of each agency to achieve common goals. It is critical that all stakeholders are well informed about the local SWM sector systems from inception, because they are responsible for waste generation, their cognizance is especially vital when it comes to the location of facilities such as SW transfer stations. Adopting appropriate policies to attract religious beneficiaries requires identifying their expected values. It is no exaggeration to say that in order to achieve the goal of quality improvement at the national level, good cooperation and participation of all internal and external stakeholders in waste management policy systems is essential, based on the findings of the present study by Henry et al. In Kenya, Regass, et al. In Ethiopia reported that one of the problems affecting the failure of the waste separation program at the source is the poor performance of the private sector. At the same time, the private sector, as key stakeholders, must play an important role in the successful implementation of solid waste segregation and recycling programs.

Contractors have reported poor performance due to improper transportation equipment, poor planning, poor implementation of municipal regulations and policies, and concluded contracts.

Scientific knowledge and selection of relevant methods based on the strategic model is very important. So that in case of identifying stakeholders involved in decision-making and operational processes of waste management, the role and description of duties of each stakeholder in content design, preparation, evaluation and implementation of waste management services are determined and then explanations related to duties and priority of legal obligations. Proportionate to their effectiveness clearly identified. Although the types of stakeholders may be similar in many waste management systems, stakeholders will vary from country to country and city to city and must be identified locally. Also, clear, transparent and segregated duties of related organizations and departments in the field of waste management services, such as waste management organization, definition and application of incentive mechanisms for waste producers who pay for services on time and impose fines for Waste producers who do not pay the price of services on time and become the municipality of the regions (in the form of collecting, transporting and disposing of waste and receiving the price of services).

In achieving a proper solid waste management system, a wide range of governance issues must be considered. These can include stakeholders (e.g., citizen participation in decision-making, changing attitudes and behaviors), service providers (e.g., mobilizing all service providers, *i.e.* municipalities and non-municipalities, including the formal private sector). And informal and community), tackling corruption issues, sustainability of financial resources (such as awareness of related costs, cost-effective services, improving revenue processes, access to finance) and creating effective national policies and institutions and local (such as law enforcement, clarity of roles and responsibilities, job creation, information management systems). Waste management studies should be purposeful and practical, and stakeholder participation in the preparation of a comprehensive waste

management document should be carefully stated. The most important aspect of stakeholder management is value creation and trust building and decision-making for municipal waste management is a process that involves several different stakeholders. Involving all stakeholders in any strategic waste management planning model is an indisputable principle of entering the sustainability cycle and can guarantee a large part of the success of an activity. Stakeholders have diverse interests and different goals, and the main goal is to respond to needs in priorities, build trust, increase skills and capacity, and promote a sense of ownership among stakeholders.

In of waste management services and the description of duties and legal obligations should be specified. Then, stakeholders develop guidelines for operational and executive measures of waste management in order to attract people's participation. The extent to which stakeholders, resources, and their interests and pay attention to the necessary standards regarding time and temperature and other storage conditions in the storage of raw materials by manufacturers should also be considered. Recognizing stakeholders and analyzing their importance in municipal waste management is a prerequisite for creating a culture of correct consumption and use of goods until they are worn out and unusable for the development of sustainable development strategies.

In fact, the amount of waste production depends on the consumption pattern of packaged food and beverages. Properly managed, all wastes can be returned to the production cycle. This management starts with planning and paying attention to the necessary standards regarding time and temperature and other storage conditions in the storage of raw materials by manufacturers or consumer markets to reduce waste and increasing the quality of products with a longer fact, scientific identification and selection of the method of participation of religious stakeholders and policy makers based on a strategic model is very important. So that in case of identifying stakeholders who influence the decision-making and operational processes of waste management, the role and description of duties of each stakeholder in designing the contents, supply, evaluation and implementation service life and longer shelf life with use of skilled production force to reduce waste during processing.

Also, Legislation before the consumption phase of the citizens and even before the production of goods is also very important. Planning for the adoption and implementation of laws that lead to the obligation of manufacturing companies to use different consumer products, minimal and absorbable packaging or multi-use. Planning to finance waste management projects is so significant. Consumption pattern based on cultural, social and economic indicators, establishment of policy committees in the field of identifying municipal solid waste recycling cycles is developed. Using of economic tools in relation to grammatical mechanisms and preparing how to collect tolls and some kind of tax on waste produced for over-conventional waste producers and how to calculate and obtain the cost of waste management services are evaluated based on the findings of the present study by Hanrahan considers financial and institutional problems to be the main obstacles to the improvement of waste management services in different countries and believes that there is an urgent need for a medium-term plan by municipalities to improve and implement investment projects in this area. The result of financial inadequacy is certainly poor waste management, which leads to environmental degradation and has direct negative consequences for the quality of life in cities. One of the main challenges municipalities have traditionally faced when it comes to waste management services is the lack of financial resources.

The analysis has shown that institutions responsible for waste management regard strategic planning, inclusivity, transparency, continuity, and resources as particularly important for reaching the objectives of citizen involvement. Various guidelines for educating and cultivating citizens on how to collect and recycle waste in order to attract people's participation and guidelines for operational and executive measures of waste management in order to attract people's participation are developed and the effectiveness of implementation, cultural and educational measures and operations are evaluated for public citizen. Public participation should be done scientifically, there was deviance where the managers had records of doing public participation but the respondents were not aware of such activities. So, Collaboration in the public sector can be done as an effort to produce public goods and services to fulfill the rights and needs of the public, where the parties involved have the same goals. Also, creating awareness in the field of raw materials that can be extracted from waste materials based on the findings of the present study by Qu, et al., stated that professional e-waste operators generally encounter significant hurdles because of poor public participation percentages and unreliable collection systems. The key significant component in achieving high amount of e-waste produced seems to be household participation.

It is crucial that all stakeholders are well informed about the local SWM sector systems from the outset. As they are responsible for the generation of waste, their knowledge is particularly important when it comes to the location of facilities. The study involved all the stakeholders participating in solid waste management. Considering that the amount of waste production in urban communities, including in Tehran, is related to lifestyle, people living and type of activity in different urban areas, the analysis of lifestyle of households living in municipal areas can cause fluctuations in the amount of waste generated to justify.

Also, legislation before the consumption stage of the citizens and even before the production of goods. Various countries, along with the manufacturing sector, have enacted laws to recycle waste, especially electrical and electronic waste. On the policy makers, they view waste managers as making huge amounts of money. While households feel that the paid service is not provided efficiently and according to the standards. This creates a problem where each stakeholder will do everything in their power not to be interfered with in the way they operate. This therefore requires an inclusive stakeholder engagement in the formalized waste minimization. For

example, in a country like Japan, when buying this type of equipment, the cost of its removal is also received from the customer. Therefore, it is suggested that before any action in waste management, the necessary conditions be created to increase the participation of stakeholders and citizens in the region and the urban planning system should move towards an urban development strategy approach with emphasis on stakeholder and citizen participation in all aspects of sustainable development. Industries and producers that produce goods should pay attention to the waste reduction approach in the packaging and process of their products from the beginning and the moment of production, the precondition of which is the amendment of articles of the waste management law approved in 2005, which are legal and executive guarantees and incentives and punishment should be considered. Public participation should be scientific, and participant education on waste management should be public to minimize bias and distribute information equitably to incentivize waste and encourage behavior change. In fact, for reduction of solid waste is necessary to lunch a site platform for stakeholders with using smart technology to ensure accountability of stakeholders and identify illegal waste managers who may be illegally dumping waste. At the same time, stakeholders should be also looking for new ways to share their traditional responsibilities in these areas with neighborhood communities, Micro and Small Enterprises (MSEs) and large private entrepreneurs and industries for maximum public participation. In addition, promoting waste separation behavior among citizens by reducing psychological distances and improving environmental information campaigns could constitute an effective strategy to raise individual good practices in achieving a proper solid waste management system, a wide range of governance issues must be considered.

Conclusion

Waste minimization studies should be purposeful and practical, and stakeholder participation in the preparation of a comprehensive waste management document should be carefully stated. The results showed that influencing human geography even by taking advantage of the optimal role of religion and indigenous beliefs in different parts of the country is one of the operational strategies to reduce the production of primary waste. For this reason, given the difference between the geographical environment and the type of waste generated, which varies according to the culture and economy of different parts of the population in cities, it cannot be claimed that one version can solve all problems.

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