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Research Article

Analysis of Factors Affecting Social Participation in Municipal Waste Management

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Abstract

Cities around the world face many challenges in urban waste management, the most important of which are increased energy consumption and greenhouse gas emissions, unsanitary public spaces and bad odors, and low recycling rates and limited spaces. Benefiting from social participation, along with integrated urban planning and strategy, can be a safe and physical solution in the optimal management of municipal waste. Extraction of effective components and effectiveness in this process is one of the most important management parameters in the implementation of effective urban management programs, which is one of the important goal of this reseach. In this study, using descriptive-analytical research method and examining the theoretical foundations and experiences and findings of research conducted in the world and successful case studies such as Istanbul, San Francisco, Guangdong, Mangalore was performed and first analyzed using the Delphi technique of effective indicators in public participation focusing on urban waste management in three rounds of a questionnaire and then by combining the questionnaire tools from the Fuzzy Hierarchical Analysis (FAHP) test based on Chang method. It was used to prioritize the components and factors affecting the social participation of municipal waste management. To determine the number of questionnaires, experts and specialists were used using Cochran's method in the form of simple random sampling method. The results show that the social component is in the first rank and the economic, educational and cultural components, laws and regulations are in the next ranks, respectively. Also, from the social components of people's lifestyle, food consumption pattern had the highest priority.

Keywords: Social Participation, Delphi technique, FAHP, Tehran Waste Management

Introduction

One of the most important environmental issues in developing countries is urban waste management (Vij, 2012). Due to rapid population growth and urbanization in most parts of Asia,

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Latin America and Africa have caused various concerns over the past (Rudel et al.,2009). Although the nature of urban waste management in developing countries is largely similar to industrialized countries, but special cultural, ideological, economic, environmental and climatic conditions of these countries have caused problems and perhaps problems in managing these systems (Marshall and Farahbakhsh, 2013; Booth et al., 2001).

Rapid growth of urbanization and lack of proper planning in creating urban infrastructures has caused serious and fundamental shortcomings in providing acceptable urban services such as waste management in these countries. The spread of household wastes in the streets, streets and streets, weakness in mechanization collection and consequently the dumping of waste materials and pollution caused by it, lack of the use of sanitary disposal, with various environmental and health problems threatening public health, is the main factors in the development of hazardous wastes in these cities.

The world annually produces about 2.1 billion tons of solid waste, at least 85 % of which (highly conservative) cannot be governed by an environmentally safe manner. around the world, the generated waste per person per day is averaging 30,000 kg, but it is widely used, ranging from ranges up to 250 kilograms. Although they constitute only 5 % of the world 's population, high-income countries account for about half of the world 's total population (Kaza et al., 2018; Ngoc and Schnitzer, 2009).

One of the most important parts of waste management is separation and collection. It has a great impact on the quality of material processing and recycling such as compost or energy. In contrast, different factors such as the type of reuse, consumer market and other components will affect the separation and collection system; and the collection operations depend on the separation operations and also the collection and separation operations will affect the subsequent stages of waste management (Guerrero et al., 2013).

Urban management, which has the coordinated and leadership role of this system, needs to study and understand the relationship between constantly changing needs of citizens in dynamic, extensive and complex and complex city. Recognizing the effective factors and their impact on citizen participation in urban management can be the first step. So that correct recognition and identification based on scientific investigation of effective components can result and lead to an increase in the amount of people 's participation in reducing waste generation and increasing the separation rate of wastes (Abbott, 2013; Jasanoff, 2005).

Considering that the issues related to participation are complex due to the various aspects and dimensions of social, economic, cultural, educational and … complex, the explanation and confirmation of the lack of necessary clarity based on scientific principles and lack of applied information as necessary tools in the framework of comprehensive waste management with emphasis on citizen participation ? (Starkey, 2019; Håkansson, 2019; Aung et al., 2019).

Importance and necessity of subject

In addition to the very high levels of wastes, which are imposed in the collection, transportation and disposal of countries, the hazards of their environmental issue are also very serious (Ali et al., 2019). Since the reduction in waste generation and separation of recyclable materials have been done without the participation of the people (households and other producers) on the basis of the studies and in spite of all the measures taken and implemented by municipalities, especially in the major cities of the cities, this challenge may be attributed to the lack of sufficiency and lack of applicable laws and power (Almasi et al., 2019; Kattoua et al., 2019). Lack of comprehensive waste management plans in the major cities of the country and lack of sufficient studies or methods and

programs and encourage public participation in addition to lack of attention to the principles and efficient participation of citizens, has caused the plans and programs not fully and efficiently (Mmereki, 2018; Das, 2019).

Enabling waste management plans through finding problems, rooting of causes and determining corrective actions, creating a mechanism for examining how to perform the plan, ensure the implementation of the impact of its sector and maintaining the system are the most important objectives of municipal waste management (Nižetić et al., 2019; Okes, 2019).

Research background

The city of Istanbul is considered as the largest city in turkey with a population of 8 million (with a growth rate of 1.5 % higher than the whole of turkey) and the production of approximately 87,000 tons per day as the largest city in turkey.

One of the most important programs and other projects that have been done in the last decade in Istanbul in the field of waste management is to create two sanitary landfill sites (in the European section of the city and one in the Asian region) or to correct the old landfills, create a gas collection system and create suitable final cover and leachate collection and treatment equipment (Coban et al., 2018; Ayvaz-Cavdaroglu et al., 2019; Guven et al., 2019) .

In addition to waste separation, the prevention of waste generation or minimizing it or encouraging the amount of hazardous waste is considered as the main priority.

These priorities are ensured by retrieving wastes through reuse, recycling, composting, energy production, so that a large amount of savings in production costs is achieved. On the other hand, conversion of materials by increasing recycling of waste materials which have economic value reduces waste disposal costs and reduces waste pressure in the environment or prevent economic activities in natural resources. However, weakness in garbage sorting and lack of public participation is important in this regard (Gurbuz and Ozkan, 2019).

In the metropolis of Guangdong, in Brazil, waste materials produce a large part of the greenhouse gases, i.e. about 70 percent, which makes authorities use new recycled plans to reduce carbon footprint. The officials established a plan for waste management and spent more than $ 250,000 for recycling waste. moreover, authorities used new strategies to attract methane from landfill and convert it into energy. Although it is not long before presenting these strategies, however, there have been many successes in the implementation of waste management programs in the city (Contreras et al., 2016; Coelho et al., 2018).

Mangalore officials in India have taken many steps to improve the city's public health, most notably by hiring private contractors to clean the city's streets and sewers. In 2012, poor waste management led to the production of highly unpleasant odors throughout the city, prompting Mangalore officials to outsource waste management to a private company (Baby and Mathew, 2020).

The employees of this company started by cleaning the sidewalks and sewers of the city and cleaned the city from any pollution in a very short time. Then another contract was signed between the municipality and a compost factory, according to which the company was obliged to produce and sell 20 tons of compost materials per day. Mangalore Compost Company installs a new waste machine before decomposing, separating and packing the waste for composting in plastic bags, which reduces the bad smell of waste and increases the quality of compost (Pullishery et al., 2016; Govindaraju, 2018).

The city of San Francisco in the U.S. state of California, the economic and administrative capital of the United States, has been the pioneer of the United Nations Environment Programme (UNEP), an area of 122 A kmA² and a population of 836 thousand, which is a pioneering city by

focusing on environmental issues in combination with the management of resources in the national and national dimension. High convergence among citizens allows managers to implement modern and creative plans. these features, along with strong contractors in the field of collection, efficient service system as well as the calculation of transportation costs, processing and burial on earth, has increased the increasing progress of waste management system in this city (Silva et al., 2017; Wagner, 2017). The creation of the Department of Environment and the Department of Public Affairs, with the co-operation of owners of the business sector and city dwellers, has implemented many creative programmes to design and implement an effective and fair waste management system that has dealt with specific issues, such as numerous street festivals and seasonal problems. The state of California is relying on an all-out agreement between senior managers and its officials, as well as the support and participation of the public, the business sector and government agencies, targets such as 50% of the waste and access to the city without waste.
Citing research in Germany on social participation, he concluded that; Differences in economic and social resources play a role in reducing participation (Farjad et al., 2015; Wenger, 2007; Andre, 1995). However, as people get older, their participation in participatory activities increases.

Miezah (2015), by studying the factors affecting the separation of household waste in Ghana, concluded that educational, motivational measures and the implementation of promotional and incentive programs in the field of public acceptance and increase public participation in waste separation processes, from such factors are effective. In addition, this study has shown that the level of citizen participation in separation of waste origin depends on their level of awareness.
Sherif and Azlina Shaairi (2013), regarding the destructive effects of leachate from food waste in urban areas on the environment and the problems and consequences associated with them regarding the factors affecting citizen participation in relation to separation of household waste based on TPB (Theory of planned Behavior Technique), have examined and concluded that the implementation of educational programs, incentives, providing facilities and tools for separation from the source of waste are effective factors in achieving citizen participation in relation to separation from the source of household waste (Sherif and Azlina Shaairi, 2013).

Shafiei (2002) in research results have shown that the variables of gender, age, education, job, sense of social belonging, satisfaction with municipal services and membership in organizations have a significant relationship with the variable of social participation. Hosseini (2005) in a study on social factors such as socio-economic status, education, people's lifestyle and also employment as factors affecting participation in non-governmental organizations emphasizes.

Lu et al., (2019), quoting Martin Lipest (M. Lipest) has stated that the results of studies conducted in different countries on the factors affecting participation; Variables include people's lifestyle, food consumption pattern, literacy level, age, marital status, high social status and membership in non-governmental organizations, which is very significant in creating and increasing social participation in society.

Zuhair and Kurian, (2016), in a study entitled "Barriers to public participation in environmental protection" has investigated the causes of failure and failure of programs of organizations and stakeholders in sustainable development, especially the environment in attracting public participation. In this study, barriers and limiting factors of public participation with the methodology of qualitative research and through interviews with experts in the environment, professors, experts and experts of participation, have been investigated that research results showed that the most important barriers to cooperation in the environment, organizational factors, knowledge (knowledge) and legal factors.

Table 1, summarizes the factors affecting the participation of citizens in waste management based on the research literature of researchers.

Table 1. A summary of the effective factors in citizen participation in waste management based on the background of studies

Concept	Indicator	References
The most important effective indicators of public participation in waste management	Trust other citizens and the system	Bouckaert and Van de Walle, 2003
	The extent of differences in economic and social resources	Billings and Moos, 1981
	Effective activities and financial support through investment by units responsible for municipal waste management	Schübeler et al., 1996; Limon et al., 2020
	Environmental awareness of people about the benefits of separation, food consumption patterns, satisfaction and satisfaction of people	Chung and Poon, 2001
	Educational, promotional and incentive measures, people's awareness	Richard and Meuli, 2013
	Number of family members, income Concern about the environment and the tendency to separate waste	Ebreo and Vining, 2001
	Implementing educational and incentive programs, providing facilities and tools for separation from the source	Boonrod et al., 2015
	Citizens' satisfaction with the performance of the municipality	Beeri et al., 2019
	Raising public awareness of citizenship rights	Archibugi and Benli, 2017
	Level of Education	Abdel-Basset et al., 2019
	Satisfaction, mental health and motivation	Vella et al., 2020
	Party solidarity and citizenship	Kirchhoff, 2020
	Level of education, food consumption pattern, ethnicities and traditional and moral relations	Minton et al., 2019; Watkins et al., 2016
	People's lifestyle, literacy level, food consumption pattern, marital status, social status, membership in non-governmental organizations	Lu et al., 2009
	Personal self-esteem, personal awareness, food consumption pattern, education and income level	Hughes and Demo, 1989
	Cultural and social capital	Smith, 2010; Zelekha and Dana, 2019
	Urbanization, literacy, access to media, moving from traditional to modern participatory society	Maleki, 2018
	Literacy, gender, employment, marriage, knowledge of duties	Chen et al., 2018
	Mental readiness and the existence of personal motivations	Oyserman, 2009
	Income, education level, food consumption pattern, education and information	Bhandari and Smith, 2000
	Literacy, people's lifestyle, residence, marriage, employment, awareness, satisfaction and awareness of citizenship duties	Li et al., 2019
	Proper education of citizens, creating coordination between citizens and executives of municipal services management, number of residents' households	Chun, 2010; Irvin and Stansbury, 2004
	Citizen satisfaction, motivational policies Social trust, type of municipal activity	Van Ryzin, 2004
	Training, information, advertising and providing facilities	Balogun et al., 2017
	Sense of power, awareness of participation in urban affairs, food consumption pattern, social network, social trust, membership in associations, socio-economic status and satisfaction with municipal performance	Sabet and Khaksar, 2020; Briguglio and Sultana, 2018; Kotsios, 2017; Holm et al., 2020
	Socio-economic variables	Jang et al., 2020; Hami et al., 2020

Method and Materials

Introduction of the study area:

Tehran is the most populous city and capital of Iran, the capital of Tehran province and the city of Tehran with a population of 8,693,706, it is the 24th most populous city in the world and the most populous city in West Asia. The metropolis of Tehran is the third most populous metropolis in the Middle East (Afshar et al., 2019).

In terms of natural roughness, Tehran is divided into two plains and the foothills of the Alborz and its current range extends from an altitude of 900 to 1800 meters above sea level. Tehran has a semi-arid climate.

Tehran is a city with a variety of ethnic groups, but its foreign population is small. Administratively, Tehran is divided into 22 districts and 122 urban districts and includes the cities of Tajrish and Rey (Figure 1).

In recent decades, the absolute size of Tehran's population has increased significantly, from about 2 million people in 1345 to 8.5 million people in 2016 and currently the city of Tehran alone accounts for more than 10.9% of the country's population.

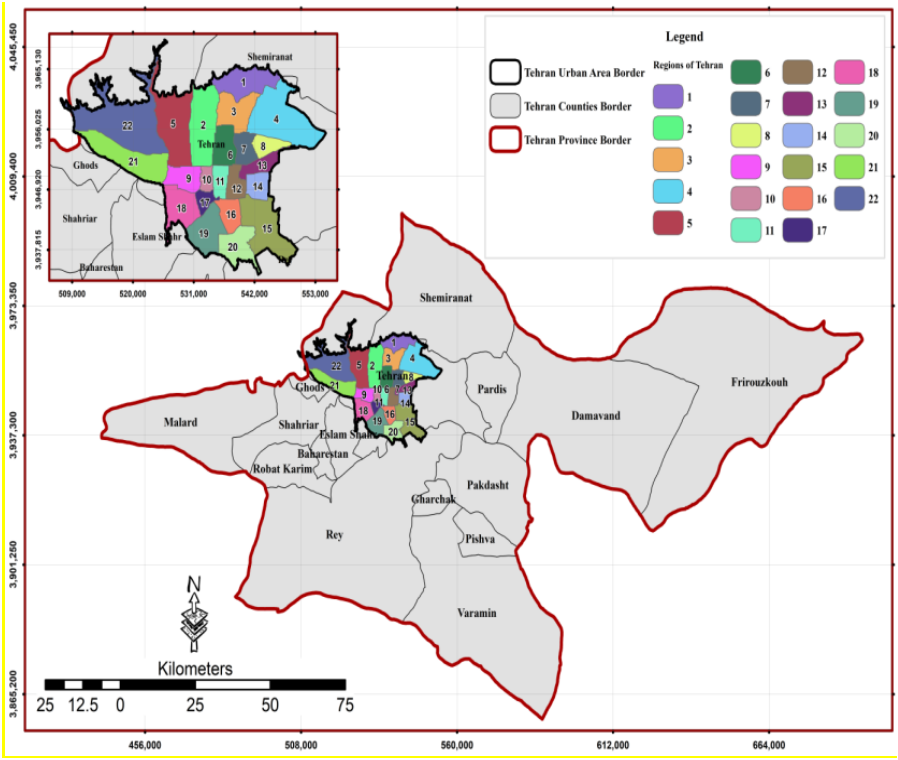

Figure 1. Location map of the research site within the Tehran province

Framework for identifying factors affecting social participation in municipal waste management by Delphi method

The Delphi technique is a powerful process based on the structure of group communication. The steps of Delphi method in this research are (Flostrand ET AL., 2020; Hohmann et al., 2020; Shawahna, 2020)

1) Forming a team to perform and monitor Delphi
2) Select one or more delegations to participate in the activities. The members of these committees are usually experts and experts in the field of research.
3) Launching questionnaire preparation activities for the first round
4) Examination of the questionnaire in terms of writing (removing inferential ambiguities and…)
5) Sending the first questionnaire to the members of the delegations
6) Analysis of the answers received in the first round
7) Preparing the second-round questionnaire (with required revisions)
8) Sending the second-round questionnaire to the members of the delegations
9) Analysis of the answers received in the second round (steps 7 to 9 continue until stability is obtained in the received answers)
10) Identifying the effective factors of social participation on waste management
11) Enter the results of data analysis for analysis with the FAHP method

Among the strengths of the Delphi method are the following: 1- The flexibility of the method. 2- Cost savings. 3- Creativity of the participants due to their anonymity. 4- The Delphi method, despite time and space constraints, makes it possible to communicate in a group. 5- Reducing the influence of people on each other's ideas (Lund, 2020).

Framework for prioritizing factors affecting social participation in municipal waste management by FAHP method

At this stage, the opinions of 40 experts have been used to prioritize the components and effective factors in public participation in Tehran municipal waste management. To perform these pairwise comparisons based on the hourly scale (table 2), the expert point of view obtained from the Delphi method was analyzed and then the expert opinion based on the next issue questionnaire and the experts' opinion analysis based on the frequency of consensus equal to or greater than 62%. The final list of related indicators and components was identified (Padash and Ghatari, 2020; Afshar et al., 2019; Giusti et al., 2020; Padash and Ataee, 2019; Zhu, 1999)

Table 2. The verbal scale and their corresponding numerical values based on the hourly scale

Verbal scale	Not important	Minor important	A little important	A little important to important	important	important to very important	very important	very important to important	Quite important
Corresponding Numbers	1	2	3	4	5	6	7	8	9

Also, the fuzzy pair comparison matrix of components based on the fuzzy triangle method is presented in table 3.

It should be noted that in cases where multiple decision makers are used in decision making, the elements of the comprehensive pairwise comparison matrix used in the fuzzy hierarchical analysis method should be a triangular fuzzy number (Ghodsi Pour, 2007). The general framework of the research is shown in figure 2.

Table 3. Numeric values based on the Chang FAHP's model

1	2	3	4	5	6	7	8	9
1,1,1	1,2,3	2,3,4	3,4,5	4,5,6	5,6,7	6,7,8	7,8,9	8,9,9
L,M,U	L,M,U	L,M,U	L,M,U	L,M,U	L,M,U	L,M,U	L,M,U	L,M,U
Not important	Minor important	A little important	A little important to important	important	important to very important	very important	very important to important	Quite important

L: low level, M: middle, U: high level

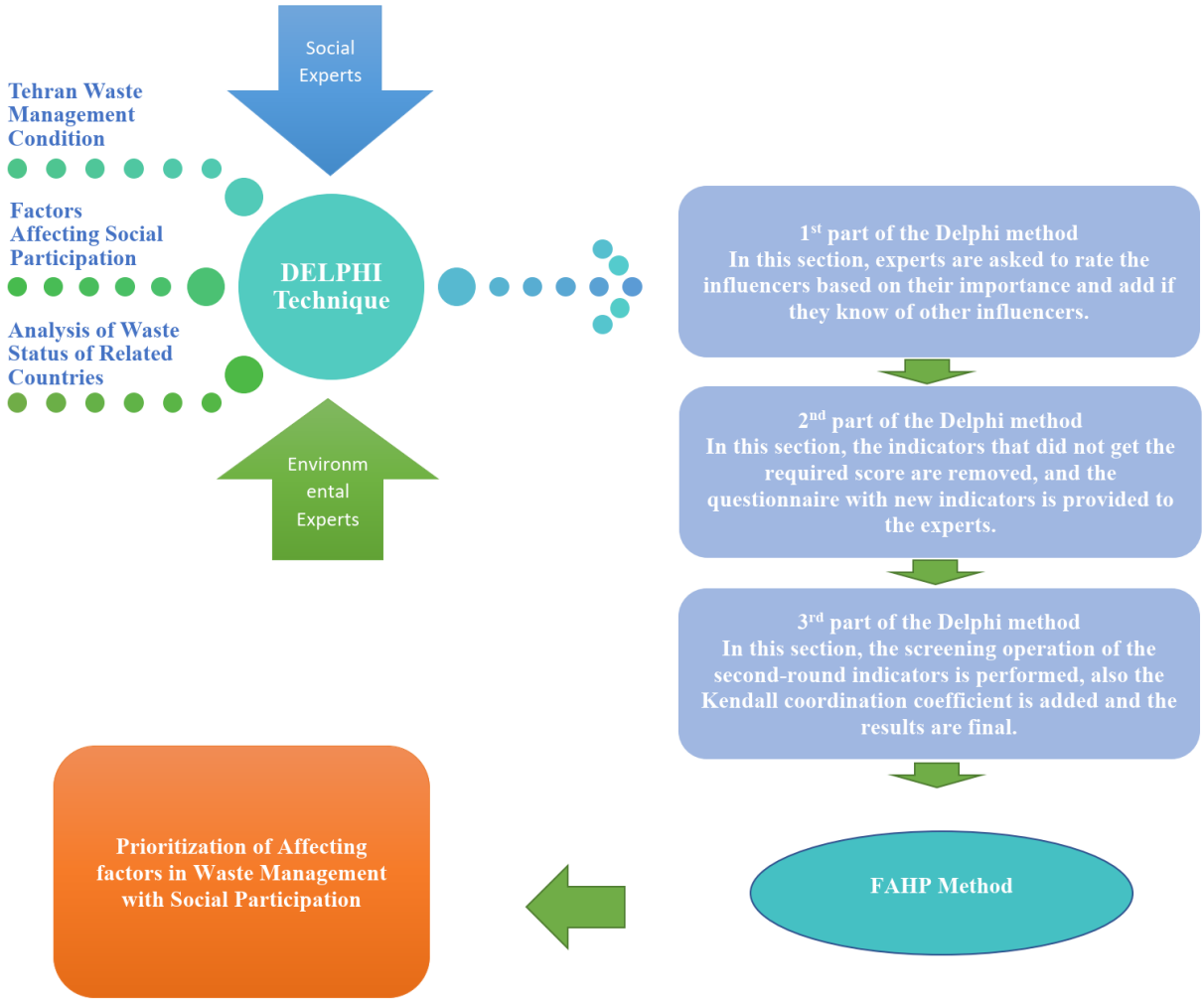

Figure 2. The general framework of the research

Result and Discussion

After reviewing the research findings and related studies, questionnaire and screening items were extracted and provided to experts and experts in executive, research and educational sectors and

finally the Delphi method led to the preparation of the final list of components and factors affecting the origin of wastes with the participation of the people.
The questionnaire required to survey the experts was provided to them in person and sometimes by email. After sending 75 questionnaires and negotiating with experts, the number of the statistical population reached 40, which was distributed using the Morgan table, based on the Cochran method.

Ranking of components and effective factors in attracting people's participation in the field of separation from waste source

List of components and effective factors in attracting social participation in the field of separation from the source of waste based on the results of research conducted for screening and ranking them through the development of a questionnaire to survey experts using Delphi methods, the frequency of consensus More than 50% opinion and fuzzy hierarchical analysis (FAHP) have been performed, the results of which are as follows:

Considering the identification and announcement of the readiness of 40 experts (experts in terms of science and experience) to cooperate in determining the components, the effective factors in attracting people's participation in the field of separation from the source of waste and their ranking were finalized.

The result of screening the components and effective factors in attracting people's participation in the field of separation from the source of waste obtained from a survey of experts was obtained as Table 4, which is based on the following:

- Subset of social components including: people's lifestyle, food consumption pattern, education rate, job (4 factors in total).
- Subset of economic component includes: forecasting and allocating the necessary financial credit and average monthly income. (In total, 2 factors).
- Educational and cultural components include: education and public information on the environmental effects of plastic waste, education and public information on waste management and its process, education and public information on the importance and benefits of separation from the origin and implementation of programs Promotional and incentive advertisements for children and adolescents (4 factors in total).
- A subset of the component of laws and regulations, including: enacting and developing protection and public participation laws and social responsibilities, and developing support and financial incentive mechanisms to increase public participation (a total of 2 factors). Which in total consists of 4 components and 12 factors.

The scoring results based on the pairwise comparison of components and factors, using the fuzzy hierarchical analysis model, in the screening of components and research factors using the triangular fuzzy hour scale, are presented in tables 5 to 8, respectively.

As is evident from the results of the analysis of the expert’s point of view, the social component with a weight of 0.267 has the highest score (table 5).

Considering the results of ranking each component and the factors related to each of them, the prioritization of components and factors affecting the separation of the waste source with the participation of the people based on the calculation is relative, the result is described in Table 8.

Table 4. The results of a survey of experts in order to determine the effective factors in separating the source of waste with the social participation

Component		Factor	Agree		Disagree		Sum
			No.	Percentage	No.	Percentage	No.
Social	Individual and social characteristics and patterns	People's lifestyle	36	90	4	10	40
		Food consumption pattern	36	90	4	10	40
		Education rate	20	50	20	50	40
		Job	16	40	24	60	40
		Location in the city	4	40	4	40	10
		Number of household members	2	20	4	40	10
	Social capital	Individual knowledge and awareness	36	90	4	10	40
		Trust in the actions and their principledness by the responsible organizations	36	90	4	10	40
		Individual desire and interest in participatory affairs	36	90	4	10	40
Economic		Anticipate and allocate the necessary financial credit	32	80	8	20	40
		Average monthly income	28	70	12	30	40
		Creating economic incentives	16	40	24	60	40
Educational and cultural		Implementation of promotional and incentive advertising programs for children and adolescents	38	95	2	5	40
		Public education and information on the environmental effects of plastic waste	32	80	8	20	40
		Public information about waste management practices and processes	32	80	8	20	40
		Implementing educational and cultural programs for different groups in the field of raising awareness about the importance and benefits of separation from the origin	36	90	4	10	40
Terms and Conditions		Establish and develop protection laws and public participation and social responsibilities	36	90	4	10	40
		Develop financial support and incentive mechanisms to increase public participation	32	80	8	20	40

Table 5. Ranking of effective factors in separation of waste with social participation under the main components

Components	Ranking	Component weight	Normalization of preferences	Degree of preference		Preference Degree Si over Sk	
A	1	0.287	0.2866	1.000	1.000	1.000	
B	2	0.269	0.2689	0.990	1.000	1.000	0.991
C	3	0.249	0.2376	0.906	0.949	0.916	0.912
D	4	0.245	0.2528	0.904	1.000	0.923	0.922
* A: Social, B: Economic, C: Educational and Cultural, D: Laws and Regulations							
Incompatibility Rate							
CRm		CRg					
0.025465		0.057676		Situation		Compatible	

Table 6. Ranking of effective factors in separation of waste with social participation under the social component

Components	Ranking	Component weight	Normalization of preferences	Degree of preference		Preference Degree Si over Sk	
A	1	0.271	0.2707	1.000	1.000	1.000	
B	2	0.262	0.2617	0.967	1.000	1.000	0.967
C	3	0.238	0.2382	0.880	0.952	0.893	0.880
D	4	0.229	0.2295	0.848	1.000	0.875	0.848
* A: People's lifestyle, B: Food consumption pattern, C, Education rate, D: Job							
Incompatibility Rate							
CRm		CRg					
0.024127		0.058777		Situation		Compatible	

Table 7. Ranking of effective factors in separation of waste with social participation under the economic component

Components	Ranking	Component weight	Normalization of preferences	Degree of preference	Preference Degree Si over Sk
A	1	0.632	0.632	1.000	1.000
B	2	0.368	0.368	0.581	0.581
* A: Anticipate and allocate the necessary financial credit, B: Average monthly income					
Incompatibility Rate					
CRm	CRg				
0.00381	0.009292		Situation		Compatible

Table 8. Ranking of effective factors in separation of waste with social participation under the terms and conditions component

Components	Ranking	Component weight	Normalization of preferences	Degree of preference	Preference Degree Si over Sk
A	1	0.734	0.734	1.000	1.000
B	2	0.266	0.266	0.362	0.362
* A: Anticipate and allocate the necessary financial credit, B: Average monthly income					
Incompatibility Rate					
CRm	CRg				
0.00309	0.00912		Situation		Compatible

Table 9. Prioritization of components and effective factors in separation from waste source with social participation

Component	Rating	Factor	Rating	Relative Priority
Social	1	People's lifestyle	1	3.2
		Food consumption pattern	2	1.4
		Education rate	3	1.2
Economical	2	Anticipate and allocate the necessary financial credit	1	2.1
		Average monthly income	2	-
Educational and Cultural	3	Implementation of promotional and incentive advertising programs for children and adolescents	1	1.6
		Public education and information on the environmental effects of plastic waste	2	1.4
		Public information about waste management practices and processes	3	1
		Implementing educational and cultural programs for different groups in the field of raising awareness about the importance and benefits of separation from the origin	4	-
Terms and Conditions	4	Establish and develop protection laws and public participation and social responsibilities	1	3.1
		Develop financial support and incentive mechanisms to increase public participation	2	-

Data analysis showed that the average per capita annual waste of waste produced in Tehran is 32 kilograms and the daily value of the waste produced in Tehran is 1800 million riyals. The per capita waste of waste in the world is 250 - 300 g, 600 g and north of Tehran 1200 grams per day;

According to futures studies, estimates indicate that from 2016 to 2030, about 766 thousand people will be added to the country's population annually, of which 129 thousand of them are related to Tehran province each year. Considering that waste production in urban communities, including in the city of Tehran, refers to the lifestyle of living people and type of activity in different urban areas, the analysis of lifestyle practices in urban areas can explain the causes of variation in the amount of waste. the percentage of urban households with minimum gas consumption during 2006 are mainly in 8, 9, 14, 15 and 17 districts.

According to the fact that the minimum gas consumption is directly proportional to household income, the amount of waste production in these regions is less than the northern areas of Tehran.

Also, the amount of waste production depends on the pattern of food consumption and packaged drinking. Considering that the consumption of these substances in the northern regions of Tehran is much higher than the southern regions, it is obvious that the production of waste due to this type of consumption pattern is higher in the north of Tehran. Its obvious moisture can be mentioned in the amount of closed water consumption in 1 and 3 municipal districts, which is much more than the southern regions of Tehran. Due to the high ratio of using the central heating system in the northern areas of Tehran compared to the southern areas of the city, providing fuel for the northern areas is easier than residents of the southern areas of the city.

Considering that normally the consumption rate is also higher in the northern areas of the city than in the southern areas; Therefore, the amount of waste production in the northern areas of the city is higher than that in the southern areas of the city.

According to the urban waste management hierarchy (Fig. 3), waste should be minimized on site, then used for animal feed, and finally used for compost or anaerobic digestion, as these are

the solutions that can reduce emissions the most greenhouse gases also have other benefits (O'Donnell et al., 2015; Papargyropoulou et al., 2014).

The Waste Management Hierarchy organizes all waste management activities based on environmental priorities and tells people how to deal with waste in order to have a better environment. As it is clear from this pyramid, the more people participate in waste management, the less waste production and its management costs will be. Therefore, informing and informing the public at different ages can lead to higher and greater progress in municipal waste management. The results of the study also confirm that increasing public awareness and participatory culture can have a significant impact on reducing municipal waste production.

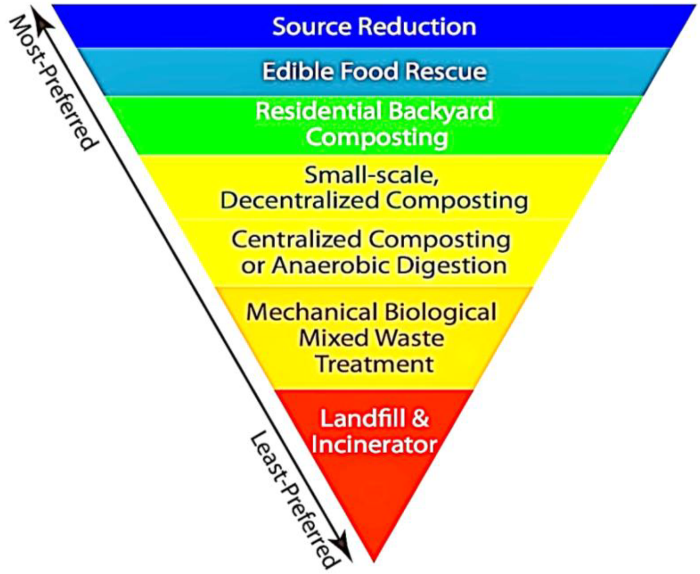

Figure 3. Hierarchy for reducing and recycling food scraps

Conclusions and Recommendations

The results show that the issue of citizen participation is one of the most important parts of waste management that failure to pay attention and analyze it, the realization of urban waste management goals, due to the essential role of citizen participation (not only as project beneficiaries but inherent partners It makes it impossible to reach the expected and desired level.
Reducing production and increasing waste recycling capacity through separation from the source will not be possible without the participation of their citizens at different levels.

To analyze this issue, it is necessary to identify and plan the components affecting citizen participation. As the results of the research show, the social component is ranked first; The factors of people's lifestyle, food consumption pattern, education level, which in fact shows the importance and necessity of paying attention to social issues.

With these interpretations, it is easy to identify the target groups in planning to attract participation, and in other words, the action plan of participatory projects in waste management with special emphasis on specific gender, age, education and occupational groups ranked, the program Planned and executed.

Based on the results of identifying and ranking and prioritizing the components and factors related to each of them using the FAHP model, it has been determined that 4 social components

(including: people's lifestyle, food consumption pattern, education and occupation community members); Economic (including forecasting and allocating financial credit, average monthly income of households); Educational and cultural (including: implementation of promotional and incentive programs for children and adolescents, education and public information about the importance and benefits of separation of origin, education and public information about the environmental effects of plastic waste, as well as raising awareness in the field Waste management and its implementation process) and laws and regulations (including: enacting and developing protection laws and public participation and social responsibilities and developing support and financial incentive mechanisms to increase public participation) in order of priority, in reducing production and separation of The origin of waste is effective with the participation of the people. In other words, the components and factors related to each of them should be included in the design and programs of public participation in the comprehensive management of municipal waste and guide the action of city managers in reducing waste production and increasing separation of waste source.

In the social and popular sector:

- Establishment of the Department of Environment and Public Department with the cooperation of residents, owners of commercial centers and other waste producers in the city and the implementation of various creative plans and programs such as street festivals and… to improve the waste management system.
- Continuous cooperation of relevant organizations and organs such as radio and television, education, environment organization and people.
- Establish high convergence between citizens and city managers and implement innovative programs and select topics such as achieving a city or region without waste.
- Invite and support NGOs, and environmental community.
- Appreciation of environmentally friendly campaigns and groups in the Islamic councils of the regions.

In the economic sector:

- Purchase of paper, plastic and glass separated from the people as well as construction of fixed stations for receiving solid waste in different areas.
- Purchasing waste and recyclable materials from people at a reasonable price that is worth separating for them.
- Not receiving waste that is not segregated or committing financial crimes.
- Increasing the level of citizens' satisfaction, for example, their share in the profit from recycling or replacing goods separated with goods from recycled materials.
- Allocating a part of the recycling revenues to beautifying neighborhoods or constructing parks and announcing it to citizens.
- Placement of special separation tanks next to waste collection tanks and also distribution of free garbage bags.

In the field of rules and regulations:

- Use of legal tools in order to better implement waste management.
- Encourage officials to provide economic opportunities to strengthen the recycling sector.
- Provide the necessary grounds for privatization of the collection process to complete separation and sale.
- Use of legal channels to provide credit and financial resources required by the waste field.

- Trying to pass laws with the priority of waste reduction policies like many countries in the world.
- Emphasis and national determination to adopt a comprehensive and integrated strategy for recycling and reuse of city waste by providing research and innovation costs.
- Enforcing the law of separation of waste and obliging all commercial centers, etc. to do so by the implementing companies with the aim of recycling the city's waste.

References

Abbott, J. (2013). Sharing the city: community participation in urban management. Routledge.

Abdel-Basset, M., Manogaran, G., Mohamed, M., and Rushdy, E. (2019). Internet of things in smart education environment: Supportive framework in the decision-making process. Concurrency and Computation: Practice and Experience, 31(10), e4515.

Afshar, F., Abbaspour, M., and Lahijanian, A., (2019). Providing a practical model of the waste management master plan with emphasis on public participation, Using the SWOT method, the QSPM matrix and the FAHP method. Advances in Environmental Technology, 5(2), 77-96.

Ali, H., Khan, E., and Ilahi, I. (2019). Environmental chemistry and ecotoxicology of hazardous heavy metals: environmental persistence, toxicity, and bioaccumulation. Journal of chemistry, 2019.

Almasi, A., Mohammadi, M., Azizi, A., Berizi, Z., Shamsi, K., Shahbazi, A., and Mosavi, S. A. (2019). Assessing the knowledge, attitude and practice of the kermanshahi women towards reducing, recycling and reusing of municipal solid waste. Resources, Conservation and Recycling, 141, 329-338.

Andre, J. M., Bishop, D. M., Ceperley, D., Dykstra, C. E., Hynes, J. T., Jorgensen, W. L., et al. (1995). 12th Canadian Symposium on Theoretical Chemistry 12ième Symposium Canadien sur la Chimie Théorique.

Archibugi, D., and Benli, A. E. (Eds.). (2017). Claiming citizenship rights in Europe: Emerging challenges and political agents. Routledge.

Aung, T. S., Luan, S., and Xu, Q. (2019). Application of multi-criteria-decision approach for the analysis of medical waste management systems in Myanmar. Journal of Cleaner Production, 222, 733-745.

Ayvaz-Cavdaroglu, N., Coban, A., and Firtina-Ertis, I. (2019). Municipal solid waste management via mathematical modeling: A case study in Istanbul, Turkey. Journal of environmental management, 244, 362-369.

Baby, A., and Mathew, S. (2020). A Correlative Study to Assess the Knowledge and Practice of Housewives Regarding Householdwaste Management in Selected Rural Community at Mangalore with a View to Provide an Information Pamphlet. Indian Journal of Public Health Research & Development, 11(3), 466-470.

Balogun, O. O., Dagvadorj, A., Yourkavitch, J., da Silva Lopes, K., Suto, M., Takemoto, Y., et al. (2017). Health facility staff training for improving breastfeeding outcome: A systematic review for step 2 of the Baby-Friendly Hospital initiative. Breastfeeding Medicine, 12(9), 537-546.

Beeri, I., Uster, A., and Vigoda-Gadot, E. (2019). Does performance management relate to good governance? A study of its relationship with citizens' satisfaction with and trust in Israeli local government. Public Performance and Management Review, 42(2), 241-279.

Bhandari, R., and Smith, F. J. (2000). Education and food consumption patterns in China: Household analysis and policy implications. Journal of Nutrition Education, 32(4), 214-224.

Billings, A. G., and Moos, R. H. (1981). The role of coping responses and social resources in attenuating the stress of life events. Journal of behavioral medicine, 4(2), 139-157.

Boonrod, K., Towprayoon, S., Bonnet, S., and Tripetchkul, S. (2015). Enhancing organic waste separation at the source behavior: A case study of the application of motivation mechanisms in communities in Thailand. Resources, Conservation and Recycling, 95, 77-90.

Booth, L., Aivazian, V., Demirguc-Kunt, A., and Maksimovic, V. (2001). Capital structures in developing countries. The journal of finance, 56(1), 87-130.

Bouckaert, G., and Van de Walle, S. (2003). Comparing measures of citizen trust and user satisfaction as indicators of 'good governance': Difficulties in linking trust and satisfaction indicators. International Review of Administrative Sciences, 69(3), 329-343.

Briguglio, M., and Sultana, A. (2018). Man cannot live by bread alone: Cultural Participation and Life-Satisfaction in Malta. Journal of Mediterranean Studies, 10000(1), 15-36.

Chen, Y. C., Chang, L. C., Liu, C. Y., Ho, Y. F., Weng, S. C., and Tsai, T. I. (2018). The roles of social support and health literacy in self-management among patients with chronic kidney disease. Journal of Nursing Scholarship, 50(3), 265-275.

Chun, S., Shulman, S., Sandoval, R., and Hovy, E. (2010). Government 2.0: Making connections between citizens, data and government. Information Polity, 15(1, 2), 1-9.

Chung, S. S., and Poon, C. S. (2001). A comparison of waste-reduction practices and new environmental paradigm of rural and urban Chinese citizens. Journal of Environmental Management, 62(1), 3-19.

Coban, A., Ertis, I. F., and Cavdaroglu, N. A. (2018). Municipal solid waste management via multi-criteria decision making methods: A case study in Istanbul, Turkey. Journal of cleaner production, 180, 159-167.

Coelho, L. M. G., and Lange, L. C. (2018). Applying life cycle assessment to support environmentally sustainable waste management strategies in Brazil. Resources, Conservation and Recycling, 128, 438-450.

Contreras, M., Teixeira, S. R., Lucas, M. C., Lima, L. C. N., Cardoso, D. S. L., Da Silva, G. A. C., et al. (2016). Recycling of construction and demolition waste for producing new construction material (Brazil case-study). Construction and Building Materials, 123, 594-600.

Das, S., Lee, S. H., Kumar, P., Kim, K. H., Lee, S. S., & Bhattacharya, S. S. (2019). Solid waste management: Scope and the challenge of sustainability. Journal of cleaner production, 228, 658-678.

Ebreo, A., and Vining, J. (2001). How similar are recycling and waste reduction? Future orientation and reasons for reducing waste as predictors of self-reported behavior. Environment and Behavior, 33(3), 424-448.

Farjad, H. R., Daneshfard, K., Mazaheri, M. M., and Shirvani, A. (2015). Relationship of new public management (NPM) and citizens public participation on public policy in Iran. European Online Journal of Natural and Social Sciences: Proceedings, 4(1 (s)), pp-247.

Flostrand, A., Pitt, L., and Bridson, S. (2020). The Delphi technique in forecasting–A 42-year bibliographic analysis (1975–2017). Technological Forecasting and Social Change, 150, 119773.

Ghodsi Pour, S. H. (2007). Analytical hierarchy process AHP, 5th edition: University of Amir Kabir (Tehran polytechnic), Tehran

Giusti, A., Maggini, M., and Colaceci, S. (2020). The burden of chronic diseases across Europe: what policies and programs to address diabetes? A SWOT analysis. Health research policy and systems, 18(1), 1-7.

Govindaraju, B. M. (2018). Health issues among the Slum Dwellers of mangalore City. Asian Journal of Development Matters, 12(1s), 272-278.

Guerrero, L. A., Maas, G., and Hogland, W. (2013). Solid waste management challenges for cities in developing countries. Waste management, 33(1), 220-232.

Gurbuz, I. B., and Ozkan, G. (2019). Consumers' knowledge, attitude and behavioural patterns towards the liquid wastes (cooking oil) in Istanbul, Turkey. Environmental Science and Pollution Research, 26(16), 16529-16536.

Guven, H., Wang, Z., and Eriksson, O. (2019). Evaluation of future food waste management alternatives in Istanbul from the life cycle assessment perspective. Journal of Cleaner Production, 239, 117999.

Håkansson, M., Kronlid, D. O. O., and Östman, L. (2019). Searching for the political dimension in education for sustainable development: socially critical, social learning and radical democratic approaches. Environmental Education Research, 25(1), 6-32.

Hami, A., Tarashkar, M., and Emami, F. (2020). The Relationship Between Women's Preferences for Landscape Spatial Configurations and Relevant Socio-Economic Variables. Arboriculture & Urban Forestry, 46(2).

Hohmann, E., Angelo, R., Arciero, R., Bach, B. R., Cole, B., Cote, M., et al. (2020). Degenerative meniscus lesions: An expert consensus statement using the modified Delphi technique. Arthroscopy: The Journal of Arthroscopic and Related Surgery, 36(2), 501-512.

Holm, L., Nielsen, A. L., and Lund, T. B. (2020). Adapting to financial pressure on household food budgets in Denmark: Associations with life satisfaction and dietary health. Acta Sociologica, 63(2), 191-208.

Hosseini, F. (2005). Investigating the social factors affecting youth participation in non-governmental organizations. Master Thesis, Al-Zahra University.

Hughes, M., and Demo, D. H. (1989). Self-perceptions of Black Americans: Self-esteem and personal efficacy. American Journal of Sociology, 95(1), 132-159.

Irvin, R. A., and Stansbury, J. (2004). Citizen participation in decision making: is it worth the effort?. Public administration review, 64(1), 55-65.

Jang, W., Eskelson, B. N., Murray, T., Crosby, K. B., Wagner, S., Gorby, E., and Aven, N. W. (2020). Relationships between invasive plant species occurrence and socio-economic variables in urban green spaces of southwestern British Columbia, Canada. Urban Forestry and Urban Greening, 47, 126527.

Jasanoff, S. (2005). Technologies of humility: Citizen participation in governing science. In Wozu Experten? (pp. 370-389). VS Verlag für Sozialwissenschaften.

Kattoua, M. G., Al-Khatib, I. A., and Kontogianni, S. (2019). Barriers on the propagation of household solid waste recycling practices in developing countries: State of Palestine example. Journal of Material Cycles and Waste Management, 21(4), 774-785.

Kaza, S., Yao, L., Bhada-Tata, P., and Van Woerden, F. (2018). What a waste 2.0: a global snapshot of solid waste management to 2050. The World Bank.

Kirchhoff, M. (2020). Differential solidarity: protests against deportations as structured contestations over citizenship. Citizenship Studies, 24(4), 568-586.

Kotsios, V. (2017). LISADEMAS: A Life Satisfaction Decision-Making System for Integrated Community Development Planning. In Handbook of Community Well-Being Research (pp. 355-383). Springer, Dordrecht.

Li, J., Zhang, D., and Su, B. (2019). The impact of social awareness and lifestyles on household carbon emissions in China. Ecological Economics, 160, 145-155.

Limon, M. R., Vallente, J. P. C., and Corales, N. C. T. (2020). Solid waste management beliefs and practices in rural households towards sustainable development and pro-environmental citizenship. Global Journal of Environmental Science and Management, 6(4), 441-456.

Lu, Y., Jung, J. H., and Bauldry, S. (2019). Explaining the cross-national variation in the relationship between religious organization membership and civic organization participation. Social science research, 83, 102310.

Lund, B. D. (2020). Review of the Delphi method in library and information science research. Journal of Documentation.

Maleki, M. (2018). The Sociological Explanation of Economic Participation among Young People in Khalkhal City. Sociological Studies of Youth, 9(29), 27-46.

Marshall, R. E., and Farahbakhsh, K. (2013). Systems approaches to integrated solid waste management in developing countries. Waste management, 33(4), 988-1003.

Miezah, K., Obiri-Danso, K., Kádár, Z., Fei-Baffoe, B., and Mensah, M. Y. (2015). Municipal solid waste characterization and quantification as a measure towards effective waste management in Ghana. Waste Management, 46, 15-27.

Minton, E. A., Johnson, K. A., and Liu, R. L. (2019). Religiosity and special food consumption: The explanatory effects of moral priorities. Journal of Business Research, 95, 442-454.

Mmereki, D. (2018). Current status of waste management in Botswana: A mini-review. Waste Management & Research, 36(7), 555-576.

Ngoc, U. N., and Schnitzer, H. (2009). Sustainable solutions for solid waste management in Southeast Asian countries. Waste management, 29(6), 1982-1995.

Nižetić, S., Djilali, N., Papadopoulos, A., and Rodrigues, J. J. (2019). Smart technologies for promotion of energy efficiency, utilization of sustainable resources and waste management. Journal of cleaner production, 231, 565-591.

O'Donnell, T. H., Deutsch, J., Yungmann, C., Zeitz, A., and Katz, S. H. (2015). New sustainable market opportunities for surplus food: A food system-sensitive methodology (FSSM). Food and Nutrition Sciences, 6(10), 883.

Okes, D. (2019). Root cause analysis: The core of problem solving and corrective action. Quality Press.

Oyserman, D. (2009). Identity-based motivation: Implications for action-readiness, procedural-readiness, and consumer behavior. Journal of Consumer Psychology, 19(3), 250-260.

Padash, A., and Ataee, S. (2019). Prioritization of environmental sensitive spots in studies of environmental impact assessment to select the preferred option, based on AHP and GIS compound in the gas pipeline project. Pollution, 5(3), 671-685.

Padash, A., and Ghatari, A. R. (2020). Toward an Innovative Green Strategic Formulation Methodology: Empowerment of corporate social, health, safety and environment. Journal of Cleaner Production, 121075.

Papargyropoulou, E., Lozano, R., Steinberger, J. K., Wright, N., and bin Ujang, Z. (2014). The food waste hierarchy as a framework for the management of food surplus and food waste. Journal of cleaner production, 76, 106-115.

Platt, B., Goldstein, N., Coker, C., and Brown, S. (2014). State of Composting in the US. Institute for Local Self-Reliance.

Pullishery, F., Panchmal, G. S., Siddique, S., and Abraham, A. (2016). Awareness, knowledge and practices on bio-medical waste management among health care professionals in Mangalore-A cross sectional study. Int Arch Integr Med, 3, 29-35.

Richard, J. E., and Meuli, P. G. (2013). Exploring and modelling digital natives' intention to use permission-based location-aware mobile advertising. Journal of Marketing Management, 29(5-6), 698-719.

Rudel, T. K., Defries, R., Asner, G. P., and Laurance, W. F. (2009). Changing drivers of deforestation and new opportunities for conservation. Conservation Biology, 23(6), 1396-1405.

Sabet, N. S., and Khaksar, S. (2020). The performance of local government, social capital and participation of villagers in sustainable rural development. The Social Science Journal, 1-29.

Schübeler, P., Christen, J., and Wehrle, K. (1996). Conceptual framework for municipal solid waste management in low-income countries (Vol. 9). St. Gallen: SKAT (Swiss Center for Development Cooperation).

Shafiei, Sh. (2002). Investigating the effective factors on social participation of Ardabil citizens. New Season Online Magazine, Second Year, No. 50. pp. 17-24.

Shawahna, R. (2020). Quality indicators of pharmaceutical care for integrative healthcare: a scoping review of indicators developed using the Delphi technique. Evidence-Based Complementary and Alternative Medicine, 2020.

Sherif, M., and Azlina Shaairi, N. (2013). Determinants of demand on family Takaful in Malaysia, Journal of Islamic Accounting and Business Research, 4(1), 26-50.

Silva, A., Rosano, M., Stocker, L., and Gorissen, L. (2017). From waste to sustainable materials management: Three case studies of the transition journey. Waste management, 61, 547-557.

Smith, V. (2010). Enhancing employability: Human, cultural, and social capital in an era of turbulent unpredictability. Human relations, 63(2), 279-300.

Starkey, L. (2019). Three dimensions of student-centred education: a framework for policy and practice. Critical Studies in Education, 60(3), 375-390.

Van Ryzin, G. G., Muzzio, D., Immerwahr, S., Gulick, L., and Martinez, E. (2004). Drivers and consequences of citizen satisfaction: An application of the American customer satisfaction index model to New York City. Public Administration Review, 64(3), 331-341.

Vella, S. A., Benson, A., Sutcliffe, J., McLaren, C., Swann, C., Schweickle, M. J., et al. (2020). Self-determined motivation, social identification and the mental health of adolescent male team sport participants. Journal of Applied Sport Psychology, 1-15.

Vij, D. (2012). Urbanization and solid waste management in India: present practices and future challenges. Procedia-Social and Behavioral Sciences, 37, 437-447.

Wagner, T. P. (2017). Reducing single-use plastic shopping bags in the USA. Waste Management, 70, 3-12.

Watkins, L., Aitken, R., and Mather, D. (2016). Conscientious consumers: a relationship between moral foundations, political orientation and sustainable consumption. Journal of Cleaner Production, 134, 137-146.

Wenger, G. C., Dykstra, P. A., Melkas, T., and Knipscheer, K. C. (2007). Social embeddedness and late-life parenthood: Community activity, close ties, and support networks. Journal of family issues, 28(11), 1419-1456.

Zelekha, Y., and Dana, L. P. (2019). Social capital versus cultural capital determinants of entrepreneurship: an empirical study of the African continent. The Journal of Entrepreneurship, 28(2), 250-269.

Zhu, K. J., Jing, Y., and Chang, D. Y. (1999). A discussion on extent analysis method and applications of fuzzy AHP. European journal of operational research, 116(2), 450-456.

Zuhair, M. H., and Kurian, P. A. (2016). Socio-economic and political barriers to public participation in EIA: implications for sustainable development in the Maldives. Impact Assessment and Project Appraisal, 34(2), 129-142.