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Designing a Model of Waste Management for Sustainable Rural Development (Case Study: Villages of Gilan Province)

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Abstract

Paying attention to waste management is one of the most important tasks defined for urban and rural officials around the world. These days, every small and large city or every village and hamlet you visit is faced with a problem called waste and waste management. This is all the more important when we know that most of this waste comes from seasonal streams and rivers; On the other hand, the mismanagement of this waste affects the social security and health of the people and is polluted. Because all this leachate and waste pollution is discharged into reservoirs and groundwater and surface water sources. Currently in Iran, 80% of the total waste management costs are related to collection, 60% of which is spent on workers' wages. This is important because a small improvement in collection operations can have a significant impact on reducing overall costs. The growth of urban population and increase in migration to cities, has led to uncontrollable development of urban areas, reducing the level of human welfare, achieving suburbanization and the emergence of many problems for various urban managers, especially in developing countries. Urban planners are worried about it, and it has given rise to a significant investigation involving managers, planners, and legislators.

Keywords: Pattern design, waste management, sustainable rural development, urban planners, Delphi method

INTRODUCTION

The yearly production of solid trash has increased significantly as a result of the quickening pace of urbanization, economic growth, and population growth. the protection of the village environment cannot be left alone; The increasing speed of daily waste production has exceeded the management capacity of municipalities and local urban bodies, especially in developing countries. The goal of the optimal waste management system is to reduce the environmental effects of waste materials and at the same time increase the recovery of materials and energy, taking into account cost optimization. Different optimization methods have been presented by different studies including environmental performance, location evaluation, and economic orientation for the optimal waste management system (Anwar et al. 2018) [1]. Preservation of the environment and natural resources is one of the most important challenges that humanity is facing on the threshold of the 21st century, and the biggest concern of humans is the need for more development and production. In the first step, environmental problems have many harmful consequences for individual human health, and in the next steps, it affects his economic, social and cultural development. For this reason, public concerns about environmental hazards are

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increasing. Today, attention to the environment has become important in all parts of the country, especially rural environments, so that it can be protected as much as possible while using the environment properly. Therefore, rural areas are very important due to their closer proximity to nature and the direct effects they have on nature and the effects they receive from nature. Considering the importance and status of the rural community and the problems and challenges that this community faces in its development process, it is necessary to know the features of rural development planning and address all its dimensions. Thus, it is imperative that the village ecosystem be protected; Instead, garbage and its management require specific attention in national programs. Neglecting rural waste will lead to adverse consequences such as the spread of various diseases, environmental pollution (water, soil, air), waste of resources and capital. Consequently, one of the most crucial issues that needs to be taken into account is rural trash management (Safari Alamouti and Shams 2016) [2]. During the recent decades, the inequality and lack of attention to the villages within the regions has caused the weakening and acceleration of the process of destruction of these residential centers and of course creating a spatial imbalance within the region and the one-way flow of services, capital, information and population towards the center. has become urban. In this way, rural settlements with the maximum range of poverty, inequality and double backwardness in comparison with other population centers of the country need to plan and provide suitable conditions and facilities to break the chain of poverty, spatial injustice and improve social welfare. (Shakur Ali 2013) [3]. In fact, rural areas are a way of shaping and ordering the spatial-spatial fields, which have been continuously discussed in a different scale and concept since the beginning of human life and since the use of basic resources. In this way, in the area of regional spaces, according to other spatial elements, the goals of land development are effectively realized (Timuri 2016) [4]. In the country of Iran, due to the existence of quantitative and qualitative inequalities between urban and rural areas and their intensification during the transformative trends of recent decades, the need to find ways out of the problem and to adjust the inequalities, especially in rural areas, is important. Is. Paying attention to the spatial vision in planning as well as paying attention to the size and modification of the spatial settlement of rural settlements, the role and function of each small and large village in the settlement complex of the land and its relationship with the distribution of facilities and facilities on the one hand and responsibilities on the other. On the other hand, it is emphasized as a practical solution by many experts and specialists. The formation of new functions in rural areas spontaneously and without any planned movement will leave adverse effects and consequences on urban and rural areas. It seems that with the acceleration of the internal and external factors affecting the rural environment and spaces, one of the first requirements for sustainable development and integrated management of the city and the countryside is to know the factors affecting the functional changes in the rural areas of the province. Especially the recognition, explanation and reconstruction of the phenomenon Spatial-spatial or structural and functional fields in rural areas in the last few decades have faced deep and wide-ranging changes including processes such as globalization, rural reconstruction, expansion of rural-urban relations and links, under the influence of which the structure and function It has more or less transformed rural areas in different parts of the world (Shapourabadi, Taghdisi, and Rezvani 2013) [5]. Therefore, the main question of the research is how to design a model based on waste management in the direction of sustainable rural development in Gilan province? Since the current research seeks to design a model based on waste management in the direction of sustainable rural development in the villages of Gilan province and wants to provide reliable guidelines to policy makers to take corrective measures, it is considered applied research. On the other hand, considering the increase in knowledge resulting from designing a model based on waste management in the direction of sustainable rural development and investigating the effects of variables that are effective in it, this research also has a fundamental orientation.

THEORETICAL BASIS

Abiyat conducted a research entitled "Ratification of rural areas in terms of optimal waste management indicators; (Case study: Abadan city)". Today, the environmental risks caused by the mismanagement of waste are considered as one of the basic problems of the country, and this problem is manifested more in the villages than in the cities. In rural environments, despite the differences in

lifestyle with urban environments, due to the change in people's lifestyle, waste management is considered as an important issue. Abadan city is facing many problems in rural waste management. Because despite the existence of different organizations in charge of village affairs, this problem is still considered as one of the most important problems of the villages of this city, and it is necessary to provide a model for optimal waste management in rural areas. Therefore, the present study has conducted a comparative study among its five rural districts with the aim of leveling the rural areas of Abadan city in terms of optimal waste management indicators. The approach used in this study is descriptive-analytical with an applied theoretical bent. Data and information were gathered using two fields and library techniques. The statistical population of the research is the inhabited villages of Abadan city, and the sample size was fulfilled through the Cochran formula of 63 questionnaires. And considering that the questionnaires should be distributed among the villages with dehiari or shura. After the investigation, 48 villages were estimated among the villages that have village councils or councils. Quantitative analyzes were performed through SPSS and EXCEL software, and quantitative-qualitative analyzes were performed through Fuzzy Topsis, Fuzzy Ahp, AHP weighting and GIS software. The findings indicate that, with regard to the best waste management metrics, there is a substantial variation throughout the five districts. In order to rank the indicators using the Fuzzy Ahp method, it showed that the separation index from the origin is the most important index. Also, in order to rank the indicators using Fuzzy Topsis, it showed that the indicator of comprehensive waste study is the most important issue in waste management in the rural areas of this city. Finally, in order to show the status of the studied villages in terms of optimal waste management indicators using the Fuzzy Topsis method, it showed that among the villages of Abadan city; North Bahmanshir Dehistan ranks first in terms of waste management. Finally, after conducting the necessary studies and investigations, in order to reduce the current problems caused by improper waste management in the rural areas of Abadan city, two types of solutions (macro-level solutions and micro-level solutions) have been presented (Abiyat 2016) Piri (2016) [6,7] conducted a research entitled "The role of waste management in ensuring the health of villagers (case study: Qaim Abad village, Nimroz city)". One of the problems that has developed along with the rapid population growth and development of villages in the third world countries, especially Iran, is the spread of production waste in the domestic, agricultural, animal husbandry and educational, health and treatment centers. The unhygienic environment of the country's villages, the existence of poverty in these areas, the lack of awareness of the causes of diseases through rural waste, the lack of health services related to the waste materials produced in the village, the lack or absence of a comprehensive system for collection, transportation and disposal. Garbage in the villages and... has caused an inappropriate and unsanitary environment in the country's villages. The purpose of this research is to investigate and analyze the status of waste management in the villages of Qaim Abad district, to determine the type of factors influencing the behavior of recycling and separation from family origin in the studied villages, to know the environmental effects of waste in the studied villages. The research with a descriptive-analytical method and with library research, field observations and distribution of questionnaires investigated the role of rural waste management in ensuring the health of villagers in Qaim Abad district of Nimroz city. From the statistical population of the research, 345 heads of rural households from 13 villages with the help of Cochran's formula was selected by random sampling method and 34 officials from these 13 villages were also selected as a sample. To analyze the data and information of the research, statistical methods (mean, Pearson correlation test and one-sample t test) were used in the software. SPSS was used. The results of the analysis of the role of waste management in ensuring the health of villagers showed that the social index has a great impact in increasing the role of waste management, but unfortunately, managerial, technical and instrumental, environmental and economic indicators have not had any positive effect on waste management at the level of the study area. Abiyat (2017a) [8] conducted research entitled "Selecting suitable areas for sanitary burial of rural waste; case study: Behbahan city". Rural solid waste due to population increase, development of economic and technical welfare, change in consumption patterns and the like has led to the production of large amounts of uncontrollable rural solid waste, and as a result, a new and serious crisis has arisen in the villages. This issue has the necessity of preserving the environment of rural areas

in environmental, social and economic dimensions, through waste management, with an emphasis on structural influencing factors such as the local management institution and technical factors such as landfill location. The current research, with a new and different approach compared to other studies, seeks to identify and analyze the influencing factors on rural waste management and adopt optimal strategies in this field, as well as the placement of sanitary waste disposal areas with the least harmful effects. The research is being conducted using an applied research technique, which is characterized by a descriptive and analytical nature and method. Data collection has been done through documents and surveys. In Behbahan City in 2015, there were 210 villages that make up the statistical population for this research. Cochran's method and the percentage of villages with households were used to get the sample size. In this regard, 155 villages were obtained as a sample volume, and for more certainty, the number of 145 sample villages or 69.05% of the villages of the city was selected. According to the axes of the research subject, two types of questionnaires were prepared, firstly, according to the importance of the issue of burial location, a 9-point Likert questionnaire, consisting of 28 variables in the form of 7 criteria, was prepared in the form of a pairwise comparison table and completed by 30 experts. became Weighting of the mentioned criteria was done based on hierarchical analysis method and Excel and Expert Choice software. Then, for the waste management department, Gutman's five-spectrum questionnaire, consisting of 120 items in the form of 10 factors, was completed by two groups of specialists or experts from the location department, as well as the managers of the sample villages. The weighting of the factors was done through the fuzzy hierarchical analysis method and the leveling operation of rural areas in terms of the managers' questionnaire by means of fifteen multi-indicator decision-making techniques and the set of rank integration. The spatial representation of the research layers was done in the geographic information system environment. The research results are presented in two levels; At the first level, the findings of the location section show the superiority of the human index over other criteria in terms of effectiveness in choosing a suitable place for waste burial. Also, it was found that the areas prone to sanitary landfilling of rural waste are located in the northeastern and southern parts of the city, and that the current areas of landfilling in Behbahan city have lacked appropriateness in terms of location criteria. At the second level, the findings of the management department show that the rural waste management activity is more effective than other factors. Also, it was found that most of the villages of the city are in a good condition in terms of waste management factors. The most important strategies for the optimal management of rural waste in Behbahan city can be obtained from the recruitment of technical experts in the field of rural waste management, the awareness of the people in the field of rural waste management, the cooperation of villagers with the organizations and departments responsible for waste management, attention to the issue of management and orderly methods. waste distribution, the ability of village assistance to prepare and implement rural solid waste management plans, the village has an internet website or social network at the population level in the matter of waste management, synchronization and coordination of source separation programs with the covered rural population, the efficiency of financial resources in The issue of waste recycling is the ability of rural residents to collect waste in a mechanized manner and to use new methods for sanitary disposal of rural waste. (Abiyat 2017b).Shatarabadi (2017) [9,10] conducted a research entitled "Investigating how to manage rural waste based on public participation, a case study of Darood Faraman village in Kermanshah". The excessive increase in the population in the villages on the one hand and the production of a large amount of scattered rural waste on the other hand has led to a serious and new crisis in the rural settlements. This issue has created the need to preserve the environment and, in turn, improve the development conditions of rural settlements through the waste management system. The aim of the current research is to investigate how to manage rural waste based on public participation, a case study of Darood Faraman village in Kermanshah city, and this research can be considered a type of descriptive-analytical research. The study method is survey analytical. The statistical population under study in this research includes the population of 6407 households in villages with a waste management plan, and the statistical scope of the entire region is in Darood Faraman village of Kermanshah city. The number of samples equal to 362 people was determined based on Cochran's formula and these 362 people were distributed among the villages according to the household

size. The Likert method was used to prepare the questionnaire, and then by using various statistical analysis software such as SPSS22, Excel, AMOS, etc., according to the research assumptions of the one-sample t-test, the path analysis for Data analysis and hypothesis testing were used. The results show that all the hypotheses of the research were confirmed in such a way that rural waste management is influenced based on people's participation and in various factors of participation rate, awareness and satisfaction have played a role in the optimal performance of waste management with a participation approach. Meanwhile, the status of the index of participation is in a better state with a higher average, and the satisfaction index is in a less favorable state with a lower average. Abiyat (2017) conducted research entitled "Location of suitable areas for sanitary burial and providing optimal management strategies for rural waste; case study: Shushtar city". Rural solid waste due to population increase, development of economic and technical welfare, change in consumption patterns and the like has led to the production of large amounts of uncontrollable rural solid waste, and as a result, a new and serious crisis has arisen at the level of villages. This issue has the necessity of preserving the environment of rural areas in environmental, social and economic dimensions, through waste management, with emphasis on structural influencing factors such as local management institutions and technical factors such as landfill location. The current research, with a new and different approach compared to other studies, seeks to identify and analyze the influencing factors on rural waste management and adopt optimal strategies in this field, as well as the placement of sanitary waste disposal areas with the least harmful effects. This study is an applied type of research, and its investigation method is descriptive and analytical, based on documentary and field data. The 162 villages in Shushtar City that have households make up the statistical population of the study. The sample size was determined based on Cochran's formula using the proportion of rural areas with households, which resulted in a sample size of 149 villages, and for greater certainty, 150 villages or 92.59 percent of the villages of the city were selected. According to the axes of the research subject, two types of questionnaires were prepared, firstly, according to the importance of the issue of burial location, a 9-point Likert questionnaire, consisting of 28 variables in the form of 7 criteria, was prepared in the form of a pairwise comparison table and completed by 30 experts. became Weighting of the mentioned criteria was done based on hierarchical analysis method and Excel and Expert Choice software. 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Also, it was found that the areas prone to sanitary landfilling of rural waste are located in the eastern and western half of the city, and that the current landfill areas in Shushtar city have lacked appropriateness in terms of location criteria. At the second level, the findings of the management department show that the rural waste management activity is more effective than other factors. Also, it was found that most of the villages in the city are in good condition in terms of waste management factors. The most important strategies for optimal management of rural waste in Shushtar city can be obtained from attracting technical experts in the field of rural waste management, awareness of people in the field of rural waste management, cooperation of villagers with organizations and departments responsible for waste management, attention to the issue of management and orderly methods. waste management, the efficiency of waste comprehensive plan studies in solid waste management, the success of Dehiary in creating a database in the field of optimal waste management, people's acceptance of waste separation plans and programs, attention to the importance of waste recycling and its high economic potential for rural areas, the ability Dehiari was named for the mechanized collection of waste and the use of new methods for sanitary disposal of rural waste. Imani (2019) [11] conducted a research entitled "The role of local management in the process of rural waste

disposal, the studied area: Shahrabad district, Firuzkoh city". The purpose of writing this research is to identify and explain the role of local management in the process of waste disposal in the villages of Shahrabad village of Firuzkoh city. The research method and methodology of this research is such that the methods of collecting information are in the form of field and library surveys. Questionnaires, focused interviews, and field observations were employed in the field survey to gather the necessary data. In the documentary method, we used books, articles, maps, publications and all related documents available for use. Finally, the data obtained from the information collection was analyzed using spss quantitative software and analyzed in two quantitative and qualitative ways. The findings of the research, after collecting the raw data by the aforementioned methods and investigating the status of the waste collection system in the studied villages, this area is not in favorable conditions in terms of the environment and the waste disposal system and has many underlying problems. Among the problems of this village are the lack of basic facilities to collect garbage from the village, the neglect of the local administration regarding the existing problems in this field. Failure to follow up and feel the responsibility of local management in villages causes irreparable damages and consequences. Therefore, we come to the conclusion that local management plays a key role in the process of improving and organizing the village and can solve problems in the best way. Unfortunately, the performance of local management in the studied villages is very weak and this weak performance has caused such problems in the village. In 2017, Bandur et al. conducted a research titled "Survey and methodology for environmental and ecosystem services in land use planning in the United States". The purpose of this research is to evaluate the way to integrate the concept and ecosystem services in the direction of land use and related planning. Ecosystem services provide better products and better performance to human society. It improves urban and environmental planning by using land surveying and planning and investment strategies. Using a diverse, comprehensive and innovative program in this area can improve the evaluation and communication of planning exchanges and its results (BenDor et al. 2017) [12]. A study named "Optimization of solid waste management in rural villages of developing countries" was carried out in 2020 by Anwar and his associates. In the setup taken into consideration in this study, all trash is collected and processed at one single site using a centralized system. A waste treatment center is constructed in each of the locations designated in the second configuration, which is a cluster system. Finally, decentralized, where smaller health centers are built in each village. A case study was conducted in Dessouk area, Kafr El Sheikh, Egypt. This city has a population of about 0.5 million people. Fifteen scenarios are created to explain different combinations of system configurations and types of waste treatment and disposal units. It has been decided to carry out the optimization using a mixed integer linear programming model. The results showed that increasing the type and degree of treatment increases the net profit. This indicates that the integration of waste-derived fuel production, sorting, recycling, and composting yields larger revenues than landfilling. It turns out that centralized systems yield more net profit than decentralized and clustered systems. The optimal scenario with the maximum net profit value was the centralized system with sorting, composting, waste to energy facilities and a landfill with a net profit of 3.864 USD/t/d. The best place for this kind of centralized system is between Desoq and the wastewater treatment plant. and the cities of Senhor, the same model can be used in other rural areas in developing countries. Mesjur and his colleagues conducted a research entitled "Rural waste management system in the southern region of Gunungkidul" in (2021). The southern Gunungkidul District, which has seen population and economic growth as a result of more tourism and better access, is the subject of this paper's descriptive research of rural solid waste management. In eighteen randomly chosen communities, a field survey was carried out. 43 important informants were asked structural questions about the waste management system's institutional, financial, regulatory, and operational engagement. Relevant reports and documents were gathered from the appropriate institutions. Next, text, tables, graphs, and images containing primary and secondary data were examined using qualitative descriptive analysis. The findings demonstrated that the locals illegally accumulate trash and manage their waste by burning it and throwing it in the backyard. The reason for this traditional processing is the absence of village-level waste management legislation. The technical executive unit of cleaning and landscaping is the entity in charge of waste management. They

exclusively operate at public marketplaces and tourist destinations, and they are fee-based. To become self-sufficient in trash management, the locals require socialization and assistance. Every facet of the SZGR rural solid waste management system is flawed. Developing the best solid waste management strategy in rural areas necessitates a different strategy than in metropolitan ones. The socio-cultural conditions and characteristics of production waste can be of more interest and research (Masjhoer, Syafrudin, and Maryono 2022) [13]. Brutusosilo and his colleagues conducted a research entitled "Policy for optimizing household waste and hazardous waste based on community empowerment at the local level" in (2022). The aim of this study is to optimize the management of household and hazardous waste at the local government level. This research used policy analysis, field survey and in-depth interviews regarding Jakstrada issuance. However, Jakstrada is not necessarily the answer to the garbage problem. This is in line with the goal of preparing the Jakstrada, whereby by 2025 the national waste problem will be 100% managed, without any more waste being dumped into the river or burned in the open. Waste management is encouraged by applying the principle of R3 (Reduce-Reuse-Recycle) with a key strategy by changing the pattern of society to create awareness in waste management. While the hierarchy of sustainable waste management places a strong emphasis on getting the public involved and redefining trash management as the first step toward achieving waste reduction, recycling and reuse of waste also require stable technological support. Brotosusilo and Naldi (2021) [14]. Chen and his colleagues in (2021) conducted research entitled "Optimization of waste transfer station locations in rural areas".This study investigates the effect of the traffic network on the ideal placements of garbage transfer stations in rural areas, building on earlier research. This study aims to minimize the costs associated with waste transportation for each population center, the construction of waste transfer stations, the construction of new roads within a center, and the maximum Euclidean distance between the waste transfer station and the center. This challenge was solved using an enhanced multi-objective simulated annealing approach and the traffic network of a multi-objective facility location network design model. The suggested mathematical model was applied through a thorough, real-world case study. The findings demonstrate that the transportation network is crucial for optimizing facility locations and that enhancing traffic network conditions can significantly lower the cost of transporting garbage (Chen et al., 2021) [15]. Savitri and his colleagues in (2020) conducted a research titled "Execution of waste processing at the source by Kagan traditional village, Tampaxring district, Gianyar Bali".According to the report, one of the traditional villages actively enhancing its potential as a tourism destination is Kagan, a traditional village in the Tempek Siring region. It is situated in Pajang Kongin village. The cleanliness of the community is one of the steps being taken to make it better. Unfortunately, the majority of the garbage generated by villagers cannot yet be managed by any comprehensive method. At the moment, this village has a waste bank, but it only handles roughly thirty percent of the waste produced. Even though it is much more abundant, organic waste is still disposed of in the backyard, or "teba". An additional issue is the leftover waste that has been gathered and disposed of in a landfill. This "social service program" highlights the issue of people's misunderstanding about government waste management policies and appropriate source-specific waste management techniques. Thus, training on waste management from sources was implemented in the traditional village of Kagan Pejeng Kangin in order to support the government's efforts to realize the waste management system from sources and to support the efforts of traditional villages to develop their capacities as a tourist village. The government's rules on trash processing at the source have been publicized, garbage banks have been optimized, and organic waste has been processed using the compost method. The implementation of the waste processing process at the source by Kagan Traditional Village, Tampaxring District, Gianyar was well received by the community and fully supported by the management of Kagan Traditional Village (Sawitri, Suryawan, and Andriani 2020) [16]. In other research, the following can be mentioned: Taghipour et al.'s (2015) [17] investigation Risk analysis from the contractor's and employer's points of view in managing urban construction projects. The study by Mahboobi et al. (2020) [18] evaluating ergonomic risk factors for a manufacturer of auto components utilizing standard methodologies along with combined data envelopment analysis.The impact of ICT on information sharing barriers in the knowledge management process

(including case studies) was examined by Taghipour et al. (2016) [19]. Taghipour et al.'s 2020[20] investigation Considering resource constraints, evaluating the project planning and control system in multi-project organizations using a fuzzy data approach (Case Study: Wind Tunnel Construction Project). Hevelayi Abdi et al. (2019) [21] investigated Strategic planning as a means of forecasting entrepreneurial marketing (with case study). According to Baghipour Sarami et al. (2016) [22], An example of how to model shift work schedules for nurses based on ergonomics is seen in the Imam Sajjad (As) Hospital in Ramsar. The study by Mohammadi et al. (2021) [23] looks into how ICT technologies are used and what effect they have when assessing service firms' effectiveness. Khodakhah Jeddi, et al.'s (2016) [24] investigation The Analysis of Effect Colour Psychology on Environmental Graphic in Childeren Ward at Medical Centers. The study by Ghadamzan Jalali et al. (2020) [25] Explain the Relationship Between Intellectual Capital, Organizational Learning and Employee Performance of Parsian Bank Branches in Gilan province.

METHOD, TECHNIQUES AND TERRITORY

Since the current research seeks to design a model based on waste management in the direction of sustainable rural development in the villages of Gilan province and wants to provide reliable guidelines to policy makers to take corrective measures, it is considered an applied research. . On the other hand, considering the increase in knowledge resulting from designing a model based on waste management in the direction of sustainable rural development and investigating the effects of variables that are effective in it, this research also has a fundamental orientation. Also, due to the fact that the research implementation strategy is of a qualitative type, for this reason, the approach of this dissertation is an inductive approach, and accordingly, qualitative research strategies are used in its implementation. Grounded theory is the qualitative approach that was employed in the initial phase of the study. In terms of the type of research, this study is one of the field researches in which the researcher collected the required primary data in the form of interviews and used exploratory mixed methods as a research strategy. The participants in this research were selected from among the professors of public administration, geography, rural planning, and ABFA managers and villagers. The initial phase of the investigation employed theoretical sampling as a method of sampling. Until the categories attained theoretical saturation, theoretical sampling persisted. Their coding was completed concurrently with data collection. In this section, 30 people were considered as samples and interviews were conducted with 30 public administration professors and geography professors in rural planning and ABFA managers and villagers. This research was limited to about 10 academic and organizational experts. From the initial interviews that were conducted gradually and according to the previous attendance and knowledge of the interviewees, it can be seen that these people are among the most knowledgeable people in the field of sustainable development and sometimes the most active and decisive. are the most In addition, his nobles helped to collect the primary data of the research by referring to the events related to the research phenomenon, which was accompanied by various examples from the field of sustainable development and rural planning. 30 participants were present at this stage, the opinions of 30 of them, according to the topics raised in the wide-ranging interviews that were conducted with them, in order to increase the range of perceived differences, are very helpful and enlightening. Was. At this stage, the same 30 people were referred and no need to refer new participants was felt. During the initial phase of the study, participants in-depth interviews were used to gather qualitative data. In the process of open coding, many themes were obtained, and during the back-and-forth process of data analysis, the set of these initial qualitative data was reduced to fewer categories, and to extract data from the interviews, key points coding method was used. used. In this research, causal conditions were identified as the main drivers of waste management and include five groups of organizational conditions, social conditions, cultural conditions, technical and equipment conditions, and economic conditions. Also, the results of the opinions of the participants of this research lead to the fact that the central phenomenon in the design of the waste management model is that eight groups: studies of the comprehensive plan of waste management, human resources specializing in waste management, attracting public participation and the private sector, creating a waste management information bank , separation from the origin of production, cultural programs and waste management training, collection and transportation of waste

and final disposal of waste have been identified for this sector. In fact, in this research, based on the analysis of the qualitative findings of five groups of factors under the title of contextual factors or the governing platform, including: identifying the lack of policies and regulations related to waste problems, the lack of approval of amendments to laws, the lack of implementation of green practices in product design. , lack of funding for recycling operations and lack of knowledge sharing between companies for recycling practices. Further, based on the analysis of the qualitative findings of the research, five groups of factors emerged under the title of intervention conditions, including the improvement of the production and separation system, the improvement of the waste collection and transportation system, the improvement of the processing system, the improvement of the recycling system, and the improvement of the burial system. The four main strategies for waste management considered in this research include the use of new methods of disposal, the use of new methods of recycling and the use of new methods of reducing waste production, and the macro functions of waste management in this research as The consequences of the foundation's data model were considered, and as a result of the analysis, the interviews were divided into four groups of economic consequences, social consequences, environmental consequences and cultural consequences.

FINDINGS AND DATA ANALYSIS

In this research, the fuzzy Delphi method was used to validate the model, and the rating scale and Likert scale were used to get the respondents' opinions. In the Delphi method used in this research, 10 people were selected as experts to rate the 30 categories identified in the questionnaire according to their importance. A five-choice Likert scale is employed in this survey. Also, in the first round of the questionnaire, the experts were asked to add another criterion in their opinion other than the mentioned criteria and sub-criteria. This questionnaire was sent to these ten experts during the initial round of Delphi and subsequently gathered. These ten experts were given this questionnaire during the first round of Delphi, and it was subsequently gathered. The results of the first round are presented in Table 1 and Figure 1.

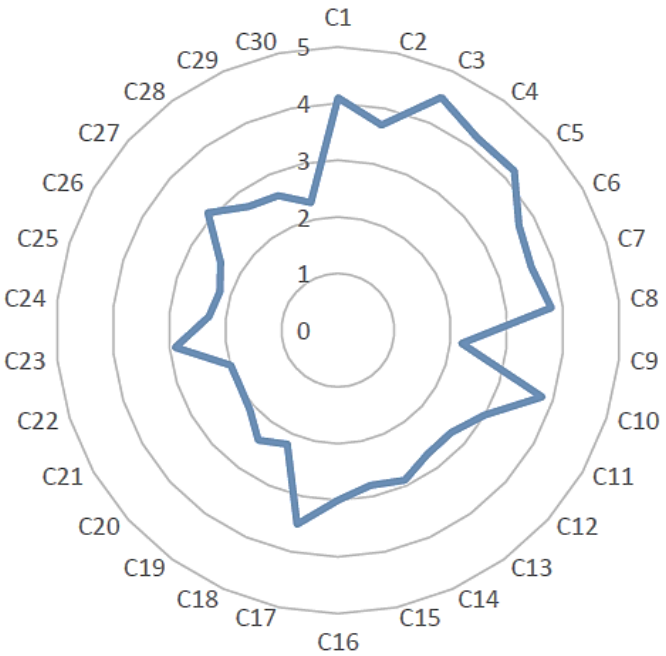

Figure 1. The results of the first round of the Delphi expert survey.

The second questionnaire and the first round's results were given to the experts after they had analyzed the first round's results. Also, the criteria where the differences of opinions between the respondents were significant were identified. The results of the second round of the Delphi method are presented in Table 2 and Figure 2.

Table 1. The results obtained in the first round of the Delphi method.

Row	Categories	Average	Standard deviation
1	Waste management master plan studies	4.20	0.87
2	Lack of policies and regulations related to waste problems	4.61	0.70
3	Organizational conditions	4.22	0.78
4	Economic consequences	4.15	0.67
5	Use of new disposal methods	4.51	0.71
6	Manpower specialized in waste management	4.50	0.78
7	Improving the garbage collection and transportation system	4	0.76
8	Environmental consequences	4.65	0.97
9	Separation from the origin of production	4.24	0.67
10	Lack of knowledge sharing between companies for recycling practices	4.80	0.74
11	Collection and transportation of waste	4.22	0.57
12	Social situation	4.44	0.72
13	Social consequences	4.20	0.81
14	Using new ways to avoid waste.	4.20	0.51
15	Failure to approve amendments to the laws	4.6	0.56
16	Improving the production and separation system	4.50	0.46
17	Use of new recycling methods	4.55	0.61
18	Upgrade the burial system	4.60	0.74
19	Economic conditions	4.55	0.21
20	Upgrade the processing system	4.20	0.91
21	Culture building and waste management training programs	4.6	0.37
22	Cultural conditions	4.20	0.76
23	Failure to implement green practices in product design	4.20	0.18
24	Attracting public and private sector participation	4.32	0.81
25	Creating a waste management database	4.30	0.92
26	Technical and equipment conditions	4.57	0.47
27	Final disposal of waste	4.71	0.32
28	Using new methods to reduce waste production	4.20	0.51
29	Cultural implications	4.61	0.53
30	Improving the recycling system	4.22	0.32

Table 2. The results obtained in the second round of the Delphi method.

Row	Categories	Average	The difference between the average of the first round and the second round
1	Waste management master plan studies	4.20	0.000
2	Lack of policies and regulations related to waste problems	4.55	0.11
3	Organizational conditions	4.32	0.1
4	Economic consequences	4.20	0.05
5	Use of new disposal methods	4.61	0.1
6	Manpower specialized in waste management	4.42	0.08
7	Improving the garbage collection and transportation system	4	0.00

8	Environmental consequences	4.51	0.14
9	Separation from the origin of production	4.20	0.04
10	Lack of knowledge sharing between companies for recycling practices	4.75	0.05
11	Collection and transportation of waste	4.40	0.18
12	Social situation	4.40	0.04
13	Social consequences	4.35	0.15
14	Using new ways to avoid waste.	4.22	0.02
15	Failure to approve amendments to the laws	4.44	0.16
16	Improving the production and separation system	4.45	0.05
17	Use of new recycling methods	4.48	0.07
18	Upgrade the burial system	4.65	0.05
19	Economic conditions	4.56	0.01
20	Upgrade the processing system	4.32	0.12
21	Culture building and waste management training programs	4.56	0.04
22	Cultural conditions	4.32	0.12
23	Failure to implement green practices in product design	4.18	0.02
24	Attracting public and private sector participation	4.50	0.18
25	Creating a waste management database	4.15	0.15
26	Technical and equipment conditions	4.48	0.09
27	Final disposal of waste	4.58	0.13
28	Using new methods to reduce waste production	4.28	0.08
29	Cultural implications	4.52	0.09
30	Improving the recycling system	4.35	0.13

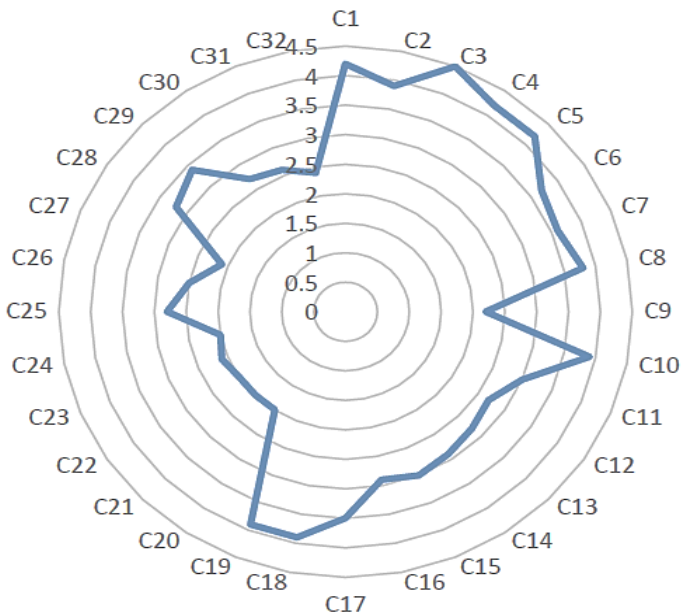

Figure 2. The results of the second round of the Delphi expert survey

According to the results of the second round, since the average difference is less than 0.2, the Delphi method is completed. It is clear from Table 3 that Kendall's coordination coefficient in each round compared to the previous round has improved The Delphi process can be stopped after the values of the Kendall coefficient become favorable, and a consensus is reached regarding the importance of the criteria.

Table 3. Values of Kendall's correlation coefficient for two rounds of the Delphi method.

Expert code	First round	Second round
1	0.586	0.706
2	0.634	0.710
3	0.628	0.741
4	0.549	0.707
5	0.572	0.761
6	0.549	0.706
7	0.668	0.710
8	0.655	0.749
9	0.685	0.761
10	0.601	0.736

Table 4. The results obtained in the second round of the Delphi method.

ردیف	Categories	First round results	Second round results	Result
1	Waste management master plan studies	4.20	4.20	Creditable
2	Lack of policies and regulations related to waste problems	4.61	4.55	Creditable
3	Organizational conditions	4.22	4.32	Creditable
4	Economic consequences	4.15	4.20	Creditable
5	Use of new disposal methods	4.51	4.61	Creditable
6	Manpower specialized in waste management	4.50	4.42	Creditable
7	Improving the garbage collection and transportation system	4	4	Creditable
8	Environmental consequences	4.65	4.51	Creditable
9	Separation from the origin of production	4.24	4.20	Creditable
10	Lack of knowledge sharing between companies for recycling practices	4.80	4.75	Creditable
11	Collection and transportation of waste	4.22	4.40	Creditable
12	Social situation	4.44	4.40	Creditable
13	Social consequences	4.20	4.35	Creditable
14	Using new ways to avoid waste.	4.20	4.22	Creditable
15	Failure to approve amendments to the laws	4.6	4.44	Creditable
16	Improving the production and separation system	4.50	4.45	Creditable
17	Use of new recycling methods	4.55	4.48	Creditable
18	Upgrade the burial system	4.60	4.65	Creditable
19	Economic conditions	4.55	4.56	Creditable
20	Upgrade the processing system	4.20	4.32	Creditable
21	Culture building and waste management training programs	4.6	4.56	Creditable

22	Cultural conditions	4.20	4.32	Creditable
23	Failure to implement green practices in product design	4.20	4.18	Creditable
24	Attracting public and private sector participation	4.32	4.50	Creditable
25	Creating a waste management database	4.30	4.15	Creditable
26	Technical and equipment conditions	4.57	4.48	Creditable
27	Final disposal of waste	4.71	4.58	Creditable
28	Using new methods to reduce waste production	4.20	4.28	Creditable
29	Cultural implications	4.61	4.52	Creditable
30	Improving the recycling system	4.22	4.35	Creditable

The results of the validation of the model obtained through the fuzzy Delphi method are presented in Table 4.

DISCUSSION AND CONCLUSION

The human population is constantly growing and now our population is more than seven billion people in the world. In addition, global prosperity has improved over the past decades, leading to more resources for consumption and more waste generation in the world. Waste management in urban areas received attention for various reasons, but according to the World Bank, 46% of the world's population still lives in rural areas. Various factors must be considered for proper waste management and resource recovery, including technical, social, legal, environmental and economic factors. These factors are considered completely different in rural and urban environments, as a result, the appropriate methods of waste management in rural and urban areas are considered completely different from each other. One of the main concerns for growing societies is the management of solid waste and the disposal of sanitary waste in rural areas. To the extent that even developed and rich countries are facing serious problems in landfills and waste management systems. The lack of control of rural waste such as human, animal and plant waste and their release in the village environment has caused water, soil and air pollution. And it provides a suitable environment for the growth and reproduction of all kinds of disease carriers, including insects, rodents, and domestic and wild animals. Executive suggestions: Waste, which is actually the fruit of technological growth and development and has different volumes in different societies, is among the problems that require macro management. In a way that has made the statesmen think for a solution. The abundance in the amount and type of these materials has caused the use of burying solutions to be unanswerable and even provides a platform for creating many environmental problems and destroying valuable underground water resources as well as soil. There is a general and comprehensive strategy in waste management that can be implemented anywhere in the world. In fact, a hierarchy has been considered for this task, at the top of which should be the reduction of waste production. In our country, a project named Cup is implemented for this purpose. Success at this stage requires a lot of cultural and social infrastructure. The reuse of waste that has this capability is in the next step. Waste recovery, which includes recycling and conversion to energy as well as composting, is examined in this article. If the waste cannot be used in the previous two steps, the only remaining solution is to bury them. With these interpretations, it is clear that this is the last solution of waste management. In general, there are three tools for waste management, which include education, monitoring and control, and economic tools. Education of people controls both consumption and production of waste. But the reduction of waste in the current situation is unprecedented due to the increase in prices and stagnant inflation. Of course, economists have considered price adjustment as a way to regulate consumption, provided they pay attention to macroeconomic variables. Price correction is a link in the chain and it is proposed at the level of micro economy, and at the level of macroeconomics, price correction should not be done without increasing people's income. Thirty million tons of industrial trash are produced annually in Iran, of which eight million tons are classified as "special industrial waste". Iran ranks first in the lack of industrial waste management. According to statistics, only 1% of industries are in favorable conditions, 20% are in improved conditions, and 79% are in unfavorable conditions, and this is due to the fact that many industrial units have problems in

managing their waste. Garbage disposal in villages is usually done in three ways. Burning, cremation and burial are done. However, it is better to carry out the sanitary disposal of waste in the villages of Iran by forming the village health council and attracting the participation of the people of the village or neighboring villages, district administrations, agricultural jihad and the waste collection health center. Executive management of all wastes other than industrial and special in the village according to Article 7 waste management law is the responsibility of the villagers. Dehiari must plan the collection and disposal of garbage and waste in the village together with the Islamic Council of the village and the district administration with a suitable mechanism and compatible with the conditions of the region. Of course, each region requires specific conditions and planning. By assigning it to the contractor and with the supervision of the village assistant and the cooperation of the Islamic Council and the district administration, and according to the existing situation in the villages, it should be carried out using a wheelbarrow, a cart with four legs, a motorized cart, a tow truck with a tractor and a suitable motor vehicle (Nissan dump truck). And a monthly fee for waste disposal should be charged from the people. Rural garbage must be collected and emptied daily or every other day and at a certain time. Rural garbage can be collected from door to door (although this plan involves more effort and more cost) or suitable trash bins with a volume suitable (100 liters) should be installed in suitable places in every alley and street and at a suitable distance from the houses and taking into account the ease of access to it. As far as possible, the creation of a temporary stand in the city or village should be avoided. Temporary storage bins should be installed above the ground level on a concrete platform with a height of at least 20 cm or metal legs of one meter, and all bins should have a metal lid. The most basic way to reduce waste is to reduce people's consumption and educate them to separate their household waste. Actually, one of the most crucial things you can do to stop trash from increasing unnecessarily at home is to reduce it. Waste management should be able to provide solutions to reduce waste production to the people of society with proper planning so that they can prevent the accumulation of waste in the environment, in other words, people should play their important role in reducing waste. to know so that they can help in reducing waste. Among the useful solutions used to reduce waste production and which are very important in reducing them, are:

- *Reduction of waste production at the source:* The most important and first step to reduce the production of waste is the reduction of their production by the people of the society at the source, which can help to reduce the excessive amount of waste.
- *Waste recycling:* this method is in the second order of measures to reduce production and also the amount of waste, in this method, waste that can be reused, such as glass bottles, are returned to the production cycle and after the necessary decontamination and disinfection are used. The wastes that are made of PET containers are collected and ground, then they enter special molds and become healthy PET containers that are used in various industries. Paper wastes enter the company. The production of boxes and cartons are packed and after turning into a suitable pulp, they are shaped into different shapes by special molds and used for various packaging in different fields. Various fabric wastes are collected. And after going through different stages, they become new threads to be used in textile and carpet industries.
- *Reducing the moisture content of wet waste:* this solution is also very useful for reducing pollution and also reducing the volume of waste. Waste without moisture or dry, in addition to having less harm, collecting and reducing their volume is done better by using shredders.
- *Separation of waste from the source:* Separation of waste in each place by the people of that institution is one of the most important ways to reduce the amount of waste. In this case, many measures have been taken, especially in public places. each waste is placed in its own place, this method is one of the decisive methods to separate combustible waste from buryable waste as well as recyclable waste. In fact, this method helps us to Separate recyclable waste that is important to us from other wastes and return them to the cycle by performing decontamination methods, and in addition, in this method, hazardous wastes are identified and after decontamination They are buried in special pits. Among the methods that are very effective in reducing waste production, and the results of various studies in this field have confirmed it, is the separation of waste at the source of production. This method, in addition to reducing the level of greenhouse

gases, saves energy. Different and environmental protection also helps. Therefore, paying attention to this issue has made waste separation to be considered as a principle in all departments and institutions of the country to help our health and the environment.

LIMITATIONS AND SUGGESTIONS FOR FUTURE RESEARCH

Every research has its own limitations. The duty of the researcher is to express the limitations of his research and try to deliberately and courageously bring his scientific work to the crucible of criticism. This part of the dissertation is dedicated to this section, which states the limitations of the upcoming research from the perspective of the researcher and criticizes its shortcomings, so that the statement of the limitations determines a way to improve and advance the future research. In this regard, the limitations of the research and suggestions for future research were presented, which are:

- In this research, based on foundational data theorizing, the research model was tested in the relevant statistical population. Consequently, it is advised that the model described in this research be tested in other comparable organizations, such as other rural areas, and the results gained be compared with the findings of this research in order to provide a more accurate and consistent evaluation.
- Another limitation of this research is giving priority to conducting interviews and benefiting from the opinions of experts and professors rather than reviewing documents and documents related to waste management in a long time process. Therefore, it is suggested that in the future research, waste management documents and measures taken by the municipality for waste management should also be studied for a more detailed examination, and appropriate categories and concepts should be extracted from them.

In this research, a model for waste management was designed based on the foundation's data theory and using interviews with experts, which may have missed some important categories of these organizations, therefore it is suggested in Future research using other qualitative methods such as phenomenology, content analysis and qualitative meta-analysis, the model presented in this research should be developed with new categories and concepts.

Author Contributions

Conceptualization, ZS and MT; methodology, MH and MT; software, SL and MT; validation, ZS and MH; formal analysis, SL and MH; investigation, ZS and MT; resources, MH and MT; data curation, ZS and SL; writing—original draft preparation, SL and MH; writing—review and editing, ZS and SL; visualization, SL and MT; supervision, MH and MT; project administration, MH and SL. After reading the published version of the manuscript, all writers have given their approval.

Conflict of Interest

The authors declare no conflict of interest.

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