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Review and Prioritization of Investment Projects in the Waste Management Organization of Tabriz Municipality with a Rough Sets Theory Approach

Vahid Saeid Nahaei[1], Mohammadali Habibizad Novin[2], Mahdi Assadi Khaligh[3]

[1,2,3] *Center Municipality Building, Tabriz Municipality, Tabriz, Iran*

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ABSTRACT

Purpose: Prioritization of investment projects is a key step in the process of planning the investment activities of organizations. Choosing the suitable projects has a direct impact on the profitability and other strategic goals of organizations. Factors affecting the prioritization of investment projects are complex and the use of traditional methods alone cannot be useful, so there is a need to use a suitable model for prioritizing projects and investment plans. The purpose of this study is to prioritize projects and investment methods for projects (10 projects) considered by the Waste Management Organization of Tabriz Municipality.

Methodology: The method of analysis used is the theory of rough, so that first the important investment projects in the field of waste management were determined using the research background and opinion of experts and the weight and priority of the projects were obtained using the Rough Sets Theory. Then, the priority of appropriate investment methods (out of 6 methods) of each project was obtained using Rough numbers, the opinion of experts and other aspects.

Findings: The result of the research has been that construction project of a specialized recycling town, plastic recycling project, and recycled tire recycling project are three priority projects of Tabriz Municipality Waste Management Organization, respectively. Three investment methods, civil partnership agreements, BOT, and BOO can be used for them.

Originality/Value: Tabriz Municipality Waste Management is an important and influential organization in the activities of the city, in which the investment methods in its projects are mostly based on common contracts and are performed in the same way for all projects. This research offers new methods for projects and their diversity according to Rough Sets technique.

[1] Corresponding Author: v.nahaie@tabriz.ir
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1. Introduction

Waste management is the management of the collection, transportation, processing, recycling or disposal of waste (waste). The issue of waste management is very important in terms of environmental, cultural and economic issues and has been considered by researchers, capitalists, environmentalists, etc. from various aspects [1, 2]. Scientific concepts are needed in order to understand how waste management and treatment processes work and the nature of impacts resulting from waste disposal and dispersal in the environment. Since society's waste streams contain material and energy resources, waste management decision-making must be tied inextricably to resource conservation and utilization issues. Changes in the nature of wastes, concern for environmental protection, and the desire to recover resources from the waste stream have stimulated the development of new waste management technologies and processes [3].

Investigating and describing the barriers system that precludes the feasibility, or limits the performance of the waste management projects through the analysis of which are the declared barriers at the large waste management projects is one of the important issues. The main barriers classification in developing countries is in five types: sociopolitical, technological, regulatory, financial, and human resources constraints. Results also suggest that beyond the waste management industry, projects have disadvantages added related to the same barriers inherent to others renewable energies initiatives [4]. In view of the above, in the present study, inspired by the information of organizations affiliated with Tabriz city [5], we have reviewed and prioritized investment and participatory projects in the Waste Management Organization of Tabriz Municipality with a Rough Set Theory (RST) approach. The application of this theory in the field of investment and prioritization is done for the first time in this article [6].

Rough set theory is a set of new mathematical approaches to knowledge deficiency. The problem of imperfect knowledge has long been solved by philosophers, logicians and mathematicians. It has also recently become an important topic for computer scientists, especially in the field of artificial intelligence. There are many approaches to how to recognize and manage imperfect knowledge. The most successful, without a doubt, is the fuzzy set theory proposed by Zadeh [7], Rough set theory proposed by Pawlak offers another attempt at this problem [8]. This theory has attracted the attention of many researchers and experts around the world, which has fundamentally contributed to its development and application. Rough set theory overlaps with many other theories. However, we will discuss these connections here. Despite the above connections, the theory of rough sets may be considered as an independent discipline in its field. Rough set theory approach is of fundamental importance to AI and the cognitive sciences, especially in the areas of machine learning, knowledge acquisition, and decision analysis, knowledge discovery from databases, expert systems, endurance reasoning, and pattern recognition [9]. The main advantage of Rough set theory in data analysis is that it does not require any basic or additional information about the probability of data in statistics or the allocation of probability in Dempster–Shafer theory, membership degree or probability value in fuzzy set theory. The proposed approach of this theory is efficient algorithms to find hidden patterns in the data, reduce the data, evaluate the importance of the data, generate a set of decision rules from the data, easily understand and provide a simple interpretation of the results obtained [10]. Therefore, choosing the suitable project is a crucial decision for organizations [11], investors and stakeholders, and due to the many influential factors and variables [12], it is not easy and requires a model by which suitable projects for capital can be found the transition with multiple goals and limitations. For this purpose and considering all aspects and projects in the field of waste management organization of Tabriz

Municipality by obtaining the opinion of experts regarding the review and prioritization of investment and participatory projects in this article, Rough theory was used.

2. Literature Review

Assessing water quality in streams is usually measured at the local scale and often it is spatially restricted. To scale-up water-condition assessment, there is a need to use new tools that enable prediction of large-scale changes in water quality by expanding the analysis to landscape-levels and bioclimatic predictors. In addition, the traditional use of linear models in biomonitoring can be inappropriate in detecting complex relationships, such as changing patterns of aquatic community structure and complex environmental gradients. In this context, Artificial Intelligence (AI) techniques such as Rough sets theory can be particularly useful for dealing with vague, imprecise, inconsistent and uncertain knowledge involving biotic and abiotic data to enable the classification and prediction of changes in stream water. Here, a paper applied RST to estimate the water quality in streams of the Brazilian Atlantic Forest by analyzing connections between landscape and climate data with the inclusion of up to 15 families of aquatic insect groups from the orders Ephemeroptera, Plecoptera and Trichoptera (usually known as EPT taxa). Depending on the initial stream condition, this approach on a large-scale led to variable accuracy. By combining the development of different decision sets, the application of the best one on a large-scale, and the use of open-access data (landscape and climate predictors), this study approach demonstrated the potential applicability to evaluate streams in an objective with low-cost manner. This method can complement the environmental assessment of streams based only on local variables. Its framework also creates new perspectives in the analysis of water quality to generate scenarios of changes in streams based on landscape measurements to optimize monitoring networks [13]. Another study provides a useful tool to enable local decision makers to define territorial sustainable policies. For this purpose, using selected indicators, it analyses, at the municipal level, the behaviour of and interactions among the socio-demographic, environmental, economic, and accessibility dimensions in two northern Italian provinces in the Alpine Chain, which are identified by the EU as predominantly rural areas. It adopts the dominance-based rough set approach, which allows for the discovery of hidden patterns among the data by means of the generation of decision rules. The population variation over time and number of foreign citizens are the decision attributes considered together with condition attributes belonging to the socio-demographic, environmental, economic, and accessibility dimensions. Its selected areas (rural, mountainous, and peripheral) present various facets at the sustainability level, largely due to their complexity, which was confirmed by the rules we found. Moreover, the socio-demographic and accessibility attributes are more commonly present in the rules and a low interaction characterizes the four dimensions. Finally, economic growth is often at odds with environmental sustainability [14]. Healthcare waste disposal management is one of the biggest day-to-day challenges faced by healthcare providers and urban municipalities. Poor management of healthcare waste can cause serious problems for healthcare workers, patients, and the general public. Healthcare providers and urban planners usually struggle with the action of locating an appropriate waste disposal center in a municipal area. Healthcare waste disposal location planning is a difficult task due to complexities inherent in the evaluation of alternative locations according to multiple and often competing criteria. This study proposes a new best-worst method with interval rough numbers (IRN) for healthcare waste disposal location decisions. A new IRN Dombi-Bonferroni (IRNDBM) means the operator is also introduced to process the rough data because of the unavailability of precise information. A case study at a private hospital in Madrid is presented to demonstrate the applicability and exhibit the efficacy of the proposed multi-criteria evaluation method [15]. All current work on calculating approximate sets of a rough set inevitably requires the participation of all elements in the universe. However, it is cumbersome and causes a huge waste of resources when the universe is quite big and the computed set is small enough. By introducing the notion of invariant subspace in rough set theory, a paper skillfully reduces the range of elements involved in the computations of approximations of a rough set from the whole universe U to a suitable invariant subspace V of U, and then give the modular method within the reduced range. Moreover, it presents the modular Boolean matrix method, such that the calculation of upper and lower approximations of rough sets can be converted into operations on modular matrices. Finally, the results in covering approximation space are generalized to fuzzy β-covering approximation space to calculate the upper and lower approximations of the crisp sets. In particular, an algorithm for calculating the value of β is proposed to make the involved information has the highest distinction degree. This β is more reliable and meaningful than the empirical one, and an example about COVID-19 is put forward to simply illustrate its application [16]. Implementing effective risk assessment for public–private partnership (PPP) waste-to-energy (WTE) incineration plant projects promotes the sustainable development of WTE incineration plants. However, some studies fail to consider multi-individual's participation and handle mutual compensation among risk factors, which affects the reliability of evaluation results and increases decision risks. Thus, a study proposes a methodology based on weighted multi granulation fuzzy rough sets (MGFRSs) over two universes to perform risk evaluation for PPP WTE incineration plant projects. Firstly, alternative risk factors are detected from different dimensions to construct a risk evaluation index system. Secondly, the BWM (best-worst method) is utilized to determined subjective expert weights and an improved DEMATEL (Decision Making Trial and Evaluation Laboratory) method is developed to derive objective expert weights. Combining subjective and objective expert weights, an optimization model is built to form the collective expert weights. Thirdly, to avoid mutual compensation among risk factors, multi-source heterogeneous information system-based weighted MGFRSs over two universes are proposed to evaluate PPP WTE plant projects and select a promising one. Finally, a case study is performed to illustrate the feasibility of the proposed methodology. Sensitivity analysis and comparative analysis are implemented to demonstrate the robustness, effectiveness, and superiority of the proposed methodology [17]. Competitive situations in management of waste and expanding fuel emergency shall be tended at the same time with creation of fuel from plastic wastes. A worldwide temperature alteration and management of waste arrangements are constrained for utilization of elective energizes on engines. Plastics gotten from the petrochemical source have good amount of hydrocarbon and has high calorific value. Tests were done on engine utilizing 25%, 50% and 75% of Waste Plastic Oil and diesel. Combinatorial Rough Neutrosophic Multi Attribute Decision Making Approach (CRNMADM) was adapted to choose an optimum blend in regards to superior performance of engine. Engine performance ignition and emanation attributes under various loads for various test fuels are talked about. The results of RNMADM and experimental tests indicated that WPO25 is the optimum blend [18]. With the popularity of cleaner production and sustainable concepts, hybrid electric vehicle (HEV) has become the most popular alternative after fuel vehicles. Hybrid electric technology reduces air pollution and makes up for the shortcomings of battery life. When customers purchase HEVs, except for considering mechanical properties, Kansei consensus has become a key factor influencing communication between manufacturers and customers. Therefore, the purpose of this paper is to explore the mapping relationship between customer visual sensibility and HEV shape design based on Kansei engineering. First of all, the morphological analysis method deconstructs the appearance of HEV and establishes a Likert scale between it and representative perceptual appeal. Secondly, the attribute reduction algorithm in rough set theory is used to identify the key HEV patterns that have an important impact on customer satisfaction. Finally, support vector regression is used to establish a mapping model between customer Kansei and key morphological characteristics of HEV, and the optimal product design combined with the highest Kansei value is obtained. The research results enable designers to accurately grasp the customers' emotional cognition of HEV styling and reinterpret the future HEV body styling, thereby improving customers' purchase desire and satisfaction [19].

The representation and processing of uncertainty knowledge are among the most commonly investigated problems in the rough set theory. In this paper, authors apply the rough set theory to analyze the phase uncertainty of multi-tone stimulus scheme for nonlinear vector network analyzer (NVNA) phase reference frequency response in hybrid information system (HIS). The phase uncertainty experimental results revealed a significant correlation between the standard uncertainty and the response amplitude. Additionally, the lower amplitude in spectrum corresponded to higher phase uncertainty and vice versa. The measured results were in good agreement with the theoretical formula-based results, and therefore, confirmed the validity of the proposed work [20]. A smart city (SC) is a modernized urban community, which incorporates information and communication technology (ICT) into the existing physical infrastructure. It offers reliable and uninterrupted services such as-intelligent transport and energy conservation to its residents. Among the various services offered, a continuous and widespread supply of electricity draws the maximum attention. Moreover, a substantial amount of this electricity is utilized by heating and cooling loads, making them significant contributors of global warming. Keeping focus on these points, a SC is modeled in this paper, wherein electricity consumption is minimized by modifying the traditional heating and cooling system. Moreover, central energy management system (CEMS) is also modeled for monitoring, regulating and controlling the flow of thermal energy. The designed CEMS consists of a Fuzzy rough set controller for scheduling heat to cater the instantaneous thermal energy requirements. Fuzzy rough set has been used because it eliminates the issues of vagueness, uncertainty, and ensures efficient real-time computations. Results depict that the heat energy obtained from solar thermal collectors and industrial wastes is able to meet the requirements of the SC after scheduling it using Fuzzy rough set algorithm [21]. Current green productivity research focuses only on environmental green, which cannot fully cover the essence of green production. Based on the statistical data of the relevant yearbooks from 2008 to 2016, a study uses the correlation-fuzzy rough set and entropy weight method to quantify the green productivity related indicators and reconstructs the green productivity evaluation indicator system. This research has formed a brand new green productivity indicator evaluation system, which has important theoretical value and practical significance for the high-quality development of China's economy [22]. Quantitative research on disaster medical rescue from the perspective of disaster classification can provide a more accurate decision-making foundation for disaster medical rescue management. In a study, the medical features caused by various types of sudden disasters are utilized as the starting point to construct a disaster medical rescue decision table based on the rough set theory. Then, a genetic algorithm is used to analyze the common points of various disaster medical features upon which many disasters are classified. The common features and personality features of disaster medical rescue operations are explored, and systematic recommendations are proposed for medical emergency rescue management based on these features of disaster classification [23]. Sustainable development has gained much attention from various organizations. To improve competitiveness, enterprises often consider sustainability in their supply chain management (SCM) process. One of the critical issues in sustainable SCM is supplier selection and evaluation. However, accurate judgment is difficult to be made for decision makers due to the subjective and vague information in the process of supplier evaluation [24].

Although fuzzy-based methods are developed to deal with the subjectivity and vagueness, they need priori information. Moreover, the influence of decision makers' bounded rationality on evaluation is often omitted in the uncertain environment. To deal with the problems, a novel approach integrating rough set theory and TODIM (an acronym in Portuguese of Interactive and Multi-criteria Decision Making) method is proposed in this paper. The proposed method integrates the strength of rough set theory in flexibly handling vagueness, and the advantage of TODIM method in manipulating bounded rationality [25]. An adequate response to global climate change and low carbon economy development has become a worldwide concerned subject. As one of the energetically most intensive industries, construction industry is a key area to promote decarburization, which is an important path to realize national strategic goals on carbon reduction in China. A paper focuses on low carbon technology integration management, and analyzes the existing research status of green building or low carbon buildings on the related evaluation indexes, then proposes an evaluation system framework for the low carbon technology integration innovation from the perspective of the system management. The combined methods, adopted with exploratory factor analysis and rough set evaluation to determine the evaluation index and its weights, could well reflect the overall performance of low carbon project evaluation, the selected indicators have certain scientific and practical effectiveness, which could provide references for enterprise innovation management. An integration innovation management evaluation model is needed for the sustainability evaluation in the construction practice [26]. With the increased sustainable awareness and pressures from stakeholders, enterprises have realized the importance to implement sustainable supply chain management (SSCM) practices to pursue economic, environmental, and social benefits. In a paper, a novel framework is proposed, which identifies SSCM practices as the evaluation criteria for supplier evaluation. Because vague and subjective information often exists in decision-making of supplier evaluation, fuzzy-based approaches are frequently used to manipulate such vagueness and subjectivity. However, the previous fuzzy methods do not consider randomness in decision making and they require prior information. Thus, an extended TOPSIS (Technique for Order Performance by Similarity to Ideal Solution) method is developed in this paper for sustainable supplier selection, which integrates the advantage of cloud model theory in manipulating uncertainty of randomness (intrapersonal uncertainty) and the merit of rough set theory in flexibly handling interpersonal uncertainty without extra information [27].

3. Data and Methodology

This research is belonged to applied researches and in terms of implementation of descriptive-survey research in which library and field methods have been used to collect information, also 7 Likert scale tools have been used to evaluate the factors and interview with managers. Managers and officials are experts of Tabriz Municipality Waste Management Organization. Rough set theory has been used for modeling. With this model, prioritization and analysis of the appropriate investment method for projects has been done. One of the advantages of Rough sets theory is that it is based on raw data only and does not require external information. It is also used not only to analyze qualitative features but also to study quantitative features, and in this study, due to the use of experts with verbal variables and the existence of uncertainty, this theory was used [28]. RST is able to analyze the data table. Data that can be obtained by measurement or by experts. A set of data in this theory is represented as a table, where each row of the table represents an item, an event, an option, or something similar, and each column represents a property, a variable, an observation, and so on, which can be measured for any case. This table is arranged in RST with a pair of information system names, $S = (U, A)$. U is a finite non-empty set of features. If V_a is called a set of values, we will have:

$$A: U \to V_a \quad \forall a \in A \tag{1}$$

In order to convert an information system into a decision system, a decision class must be assigned. At this stage, the characteristic of the decision must be defined. The decision characteristic can be extracted in different ways that can be found using past data, expert opinions, other theories such as gray theory, and so on [29]. After probability theory, fuzzy set theory and evidence theory, rough set theory is a new mathematical tool for dealing with vague, imprecise, inconsistent and uncertain knowledge. In recent years, the research and applications on rough set theory have attracted more and more researchers' attention and it is one of the hot issues in the artificial intelligence field [30]. The basic premise in RST is that knowledge can be categorized. In other words, this theory is recognized as a standard framework for finding reality from within data. RST considers acquired and categorized knowledge as part of a data set [31]. Accordingly, two very important concepts in Rough's theory called low approximation and high approximation are proposed. RST using low approximation and high approximation can define unknown concepts of relationships between objects. By defining R as a Rough set, n as number of classes, and $Bnd(Ci)$ as border area, a rough number with the symbol RN is displayed as a closed interval below [32]:

$$RN = [\, \underline{lim}(C_i), \overline{lim}(C_i)] \quad C_i \in R\,, i = 1,2,3,..,n \tag{2}$$

The calculation of the upper and lower limits and the boundary area of this interval is as follows [30]:

$$\underline{lim}(C_i) = \frac{1}{M_L} \sum R(Y) | Y \in \underline{Apr}(Ci) \tag{3}$$

$$\underline{lim}(C_i) = \frac{1}{M_U} \sum R(Y) | Y \in \overline{Apr}(Ci) \tag{4}$$

$$s.t.:$$

$$\underline{Apr}(Ci) = U\{Y \in U | R(Y) \leq C(i)\} \tag{5}$$

$$\overline{Apr}(Ci) = U\{Y \in U | R(Y) \geq C(i)\} \tag{6}$$

$$Bnd(Ci) = U\{Y \in U | R(Y) \neq C(i)\} \tag{7}$$

Where M_L and M_U are member values $\underline{Apr}(Ci)$ and $\overline{Apr}\ (Ci)$, respectively. It is clear that the lower limit and the upper limit are the mean values of the elements associated with the high approximation and specifies is low in order. Their difference is defined as the rough boundary distance:

$$IRBND(C_i) = \overline{lim}(C_i) - \underline{lim}(C_i) \tag{8}$$

Rough boundary distance expresses the ambiguity of C_i, so that a larger number means ambiguity. It is more, while the smaller number is more accurate. So mental information can with express rough numbers. Because the generated rough numbers are similar to intermediate numbers, the rules computational distance numbers can also be used on rough numbers [33].

It should be noted that another advantage of RST is that a rough number considers not only the opinion of one expert but also the opinion of other experts. For example, the rough number equivalent to a definite number can be different in different criteria (for example, the number 4 in one project and the number 4 in another project can have a different rough equivalent) due to the opinion of all experts. In relation to that, in fact, the rough number has the ability to provide an overview of the importance rate of each project [34]. The projects defined in this article as well as investment plans methods in accordance with the study work entitled "Fuzzy clustering of investment projects in Tabriz Municipality Waste Management Organization with ecological approach" are as follow [35]:

A- Energy extraction project from waste (electricity and heat)

B- Project for organizing informal recyclers

C - Construction waste recycling project

D- Construction project of a specialized recycling town

E- Project to replace gasoline motorcycles with electric ones

F- Project of scrapping used cars

G- Recycled tire recycling project

H- Glass recycling project

I - Electronic waste recycling project

J - Plastic recycling project

Method 1: Civil Partnership Agreements.

Method 2: Build-Operate-Transfer (BOT) Contracts.

Method 3: Built-Own-Lease-Transfer (BOLT).

Method 4: Build-Own-Operate (BOO).

Method 5: Partnership contracts (property from the municipality).

Method 6: Partnership contracts (property from the private sector).

4. Results and discussion

Table (1) is the opinions of experts and the equivalent rough number for projects. First, the experts' opinions on the projects are collected (each expert assigns a scale of 1 to 7 to the benchmark) and categorized into the corresponding classes. Then, using the formulas mentioned above, the rough numbers are obtained. This Table shows the rough numbers equivalent to the expert opinion for all projects. In this study, MATLAB software was implemented. The survey of experts with the Likert scale (1-7) is as shown in Table (1).

Table 1. Expert Comments and Rough Numbers for Project

project	A	B	C	D	E	F	G	H	I	J
Expert 1 Score	6	4	6	7	3	2	6	5	7	6
Upper limit Rough	6	4/71	6/42	7	4/55	4/4	6/25	6	7	6/44
Lower limit Rough	5/5	3/66	5/33	6/7	2/75	2	5/62	4/25	5/6	5/83
Expert 2 Score	6	5	7	7	7	5	4	4	5	5
Upper limit Rough	6	5/66	7	7	7	5/33	5/9	5/4	5/88	6/3
Lower limit Rough	5/5	4	5/9	6/7	4/3	4	4	4	4/5	5
Expert 3 Score	5	7	7	7	6	4	6	7	6	6
Upper limit Rough	5/77	7	7	7	6/5	5/14	6/25	7	6/33	6/44
Lower limit Rough	4/33	4/3	5/9	6/7	4/1	3	5/62	5/4	5/25	5/83
Expert 4 Score	5	3	6	7	2	3	6	4	3	7
Upper limit Rough	5/77	4/3	6/42	7	4/3	4/66	6/25	5/4	5/6	7
Lower limit Rough	4/33	3	5/33	6/7	2	2/66	5/62	4	3	6/3
Expert 5 Score	6	4	7	6	5	5	7	6	5	7
Upper limit Rough	6	4/71	7	6/7	5/6	5/33	7	6/16	5/88	7
Lower limit Rough	5/5	3/66	5/9	6	3/75	4	5/9	5/22	4/5	6/3
Expert 6 Score	6	4	6	6	3	3	6	6	6	7
Upper limit Rough	6	4/71	6/42	6/7	4/55	4/66	6/25	6/16	6/33	7
Lower limit Rough	5/5	3/66	5/33	6	2/75	2/66	5/62	5/22	5/25	6/3
Expert 7 Score	6	4	5	7	4	5	5	4	6	6
Upper limit Rough	6	4/71	6/25	7	5/33	5/33	6/11	5/4	6/33	6/44
Lower limit Rough	5/5	3/66	4	6/7	3	4	4/5	4	5/25	5/83
Expert 8 Score	3	3	3	7	5	5	6	6	6	6
Upper limit Rough	5/5	4/3	5/9	7	5/6	5/33	6/25	6/16	6/33	6/44
Lower limit Rough	3	3	3	6/7	3/75	4	5/62	5/22	5/25	5/83
Expert 9 Score	6	5	6	7	5	6	7	6	7	7
Upper limit Rough	6	5/66	6/42	7	5/6	6	7	6/16	7	7
Lower limit Rough	5/5	4	5/33	6/7	3/75	4/4	5/9	5/22	5/6	6/3
Expert 10 Score	6	4	6	6	3	6	6	6	5	6
Upper limit Rough	6	4/71	6/42	6/7	4/55	6	6/25	5/46	5/88	6/44
Lower limit Rough	5/5	3/66	5/33	6	2/75	4/4	5/62	5/57	4/5	5/83
High relative score	5/90	5/05	6/52	6/91	5/36	5/22	6/35	5/93	6/26	6/65
Low relative score	5/01	3/66	5/13	6/49	3/29	3/51	5/40	4/81	4/87	5/93

Table (2) shows the priority of projects based on the high Rough relative score.

Table 2. Project priority

project	A	B	C	D	E	F	G	H	I	J
Project priority	6	9	4	1	10	8	3	7	5	2

Given the priority of project D and taking into account the opinions of experts, Method 4 can be the best investment method to do it. In the second priority, for project J, one of the methods 1 or 2 will be useful, and for the third priority, i.e. the project, one of the investment methods, 2 or 4, will be useful. For other projects, according to the nature of the project and legal restrictions and the need to observe the investment method and conditions of the investor and the needs and current situation of the organization, any of the investment methods can be used. Due to the fact that investment conditions are bilateral and negotiable and can vary with time and other conditions, no specific method is proposed for these projects. In dynamic and changing conditions, it is not possible to provide a fixed solution. Therefore, depending on the conditions, any of the existing methods can be studied or integrated methods can be used.

5. Concluding remarks

In this study, two questions were answered. What are the priorities of investment projects in the field of waste management organization with a rough set theory approach? And, what is the priority of the appropriate method of investing the priority projects of the waste management organization? In response to the first question, 10 projects were identified, which were weighted and prioritized using the theory of rough sets, and in response to the second question, appropriate investment methods were reviewed from among the six methods. The approaches used in this research can be applied not only to prioritization issues but also too many decision making issues. As it turned out, the highest weight is related to the construction project of the recycling specialty town, so the implementation of this project is proposed according to the investment opportunities and the existence of the investor, which can be used depending on the conditions of each method.

Rough theory provides us with more information on project prioritization than other approaches such as fuzzy theory. The Municipal Waste Management Organization can make the best decision for selecting its projects according to the results of this prioritization and the presented investment methods. Also, combining these results with the fuzzy clustering approach can provide them with the allocation of shared resources, in addition to prioritizing projects.

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