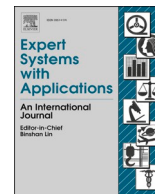




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Recovery solutions for ecotourism centers during the Covid-19 pandemic: Utilizing Fuzzy DEMATEL and Fuzzy VIKOR methods

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ABSTRACT

Obviously, the Covid-19 pandemic has huge impact on most businesses and has caused serious and countless problems for them. Therefore, providing solutions for affected businesses to recover and improve their activities during pandemic times is inevitable. In this regard, ecotourism centers are one of the businesses that went through this problem and have faced significant dilemmas in their activities. Also, reportedly, there is no related research focusing on the recovery approaches to address these obstacles relating to these kinds of businesses during the pandemic. Therefore, all of these exhorted us to do the current research. In this paper, some practical and useful action plans for ecotourism centers are firstly developed to help these businesses. To obtain the action plans, some brainstorming sessions were held consisting of tourism experts, university professors, managers, owners, and some personnel of eco-tourism centers. In order to prioritize the defined action plans, four criteria are considered. Firstly, we compute the weights of the considered criteria by the Fuzzy DEMATEL and then they are prioritized using the Fuzzy VIKOR. The findings of the current study divulge that the AP2 “Standardization of the centers” and AP3 “Estimating demand number and increasing the capacity” and AP7 “Identifying other natural tourist attractions of the region” have the highest and lowest priority to be implemented.

1. Introduction

These days, the world is facing one of the major challenges during the last century called the Covid-19, or namely the SARS-CoV-2 pandemic (Kargar et al., 2020; Ivanov, 2020a, 2020b; Ivanov and Dolgui, 2020). The Covid-19 pandemic, originated from Wuhan, China, rapidly spread all over the world and it had a strong impact on various aspects of life, especially the economic aspect (Alamoodi et al., 2020; Chandra et al., 2020).

The worldwide spread of this pandemic disease causes many challenges for all businesses and industries. One of these businesses, which is mostly affected by this pandemic, is the tourism business or namely the tourism industry (Ugur and Akbiyik, 2020). Reportedly, one of the most diverse, growing, and largest industries is the tourism industry in the world, and it is also considered as the most important source of income and job opportunities for many countries (Scheyvens and Hughes, 2019; Esmaili et al., 2020; Abbasi-Moud et al., 2020). This industry is important from two perspectives. The first is social and cultural

perspectives (Slabbert et al., 2020). This means that tourists will be familiar with the cultures, races, ethnicities, customs, and tourism attractions of the host country (Zaei and Zaei, 2013). The second point of view is the economic aspect in which the tourists are considered a source of income and currency for the host country (Eyuboglu and Eyuboglu, 2020). Therefore, due to its economic, social, and cultural effects, most of the countries have taken into account this industry. Besides, according to the statistics of the World Travel & Tourism Council (WTTC), travel and tourism had become one of the largest business sectors before the outbreak of the Covid-19 pandemic. Fig. 1 illustrates the GDP growth related to different economic sectors all over the world in 2019. According to this figure, the third-largest economic sector, after Information and Communication Technology (ICT) sector and financial services sector in terms of GDP growth in 2019, is the travel and tourism sector. As shown, the travel and tourism sector with other related industries together accounted for about 10.3% of GDP and 10.4% of total employment in the world (supporting one in 10 jobs (330 million) worldwide) in 2019. Also, the direct share of travel and tourism sector in

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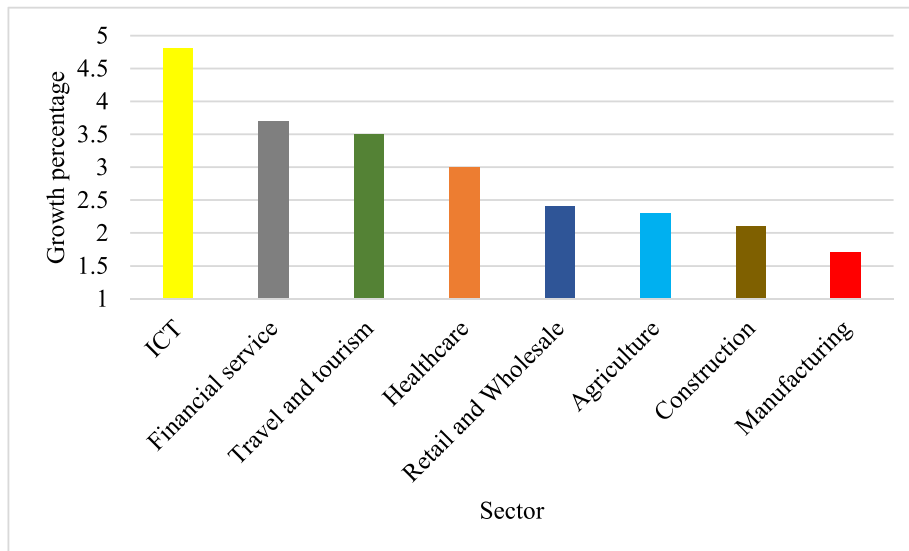


Fig. 1. Graph of GDP growth related to different economic sectors in the world in 2019.

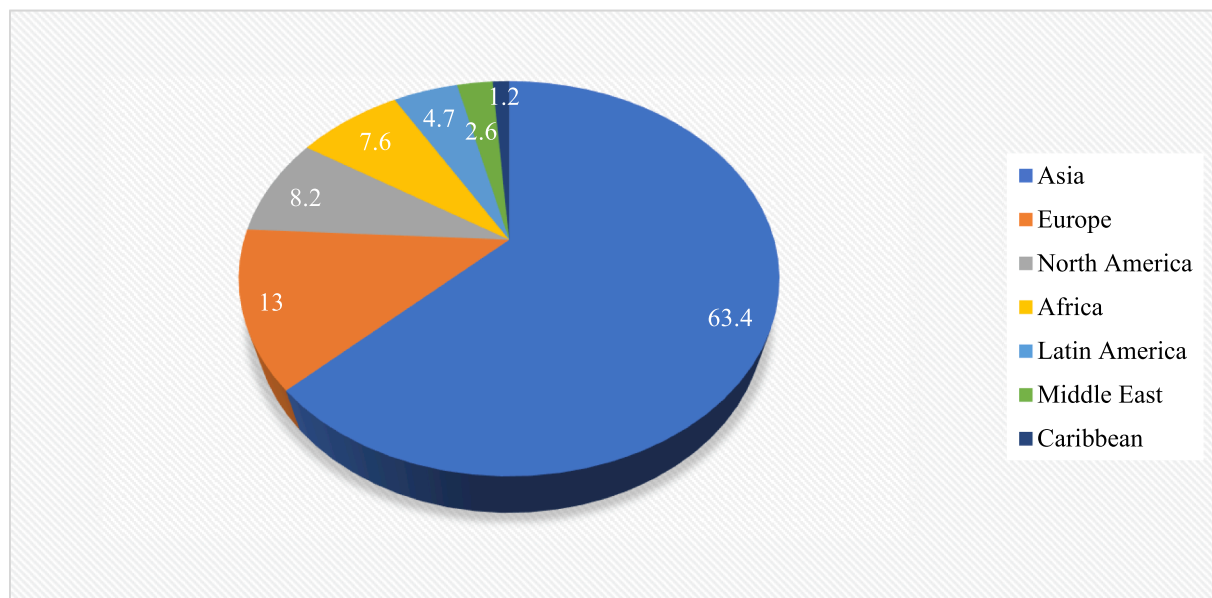


Fig. 2. Lost-job numbers in the travel and tourism industry in different regions of the world.

terms of GDP amount is 3.2% and its direct employment share was 3.8% of world employment in 2019 (World Travel & Tourism Council Organization (WTTC), 2020). All the mentioned facts clear the importance of the tourism industry and its related businesses in today’s economy.

As aforementioned, the tourism industry was seriously damaged by the outbreak. Also, the statistics presented in Fig. 2 confirm this fact. This figure shows the number of jobs that have been lost in the travel and tourism areas in 2020. According to Fig. 2, Asia has lost more jobs in the tourism industry than other sections of the world. Also, approximately 100 million jobs in the tourism industry were lost during the pandemic (WTTC, 2020). It can be evolved from this figure that the pandemic has a meaningful impact on the businesses related to the tourism industry.

One of the thriving and active businesses in the tourism industry is Ecotourism Centers (ECs) (Hosseini and Paydar, 2021b). They are usually established in regions that have the potentiality to do ecotourism activities and provide some services to tourists who are interested in nature-based tourism. Monetization and developing local communities

are the main goals of establishing ECs (Hosseini and Paydar, 2021a). Due to the pandemic, ECs, like many other businesses, have faced serious challenges and the coronavirus has great impacts on the activities of these centers (Donthu and Gustafsson, 2020; Bartik et al., 2020). Hence, the activities of ECs have been decreased and sometimes they were completely closed with no activities. So, with this condition, there is a serious need for recovery solutions to improve and develop the current situations of ECs at this time (Gentile et al., 2020; Nikolopoulos et al., 2021).

Recovery solutions during the pandemic, not only can survive these centers again but also can move towards the prosperity and development of ECs during this disease and also after it. Hence, this manifests the importance of recovery solutions for ECs at coronavirus time. Therefore, our main reason and motivation to conduct this study was the terrible and shocking conditions created by the Covid-19 pandemic for ECs. This pandemic has caused dreadful conditions for them and finally pushed them to be closed for a long time. That is why we tried to find

useful and practical solutions for them to deal with this awfully bad situation. Few related works have been reported about recovery tourism during this pandemic disease and none of them focused on ECs. Besides, two well-known Multi-Criteria Decision Making (MCDM) tools including Fuzzy DEMATEL and Fuzzy VIKOR methods are utilized in this work. Firstly, we apply the Fuzzy DEMATEL method to calculate the weights of considered criteria, and then we prioritize the proposed action plans using the Fuzzy VIKOR method.

The related works are reviewed in Section 2. Section 3 details the materials and methods. The steps and results are explained in Section 4. Sections 5 and 6 deals with the discussion and conclusion, respectively.

2. Literature review

Some papers related to our work are reviewed in this section. These works are divided into two categories. In the first category, the papers are reviewed, which have studied the tourism industry under the effect of the pandemic and have provided a solution for its development and improvement. In the second one, the research pertains to the ecotourism field that applied one or more MCDM methods are investigated.

2.1. Tourism recovery and Covid-19

To date, the number of works that have examined the effects of the pandemic on the tourism industry and related parts are low. Here, the papers which have provided recovery solutions to survive the tourism industry during the Covid-19 disease or after it are reviewed and summarized to find the research gap and show the main differences and novelty of our paper in this research area.

Fong et al., (2020) presented a perspective for the recovery of tourism in china during the pandemic. They cited the government and its actions as an important factor in improving the tourism situation. The results of an online survey in their research showed that the government's rapid performance to deal with this disease accelerates the improvement of tourism conditions. They also emphasized that the government should consider some effective and useful measures to combat the coronavirus and prioritize them and finally implement them according to their priorities. Buckley and Westaway, (2020) examined the role of women in outdoor tourism and recreation. They also provided a conceptual paradigm to improve this type of tourism. Their theoretical framework expresses that outdoor tourism and recreation cause mental health advantages. Their proposed framework also revealed that the mental health advantages of tourism affect society from social and economic perspectives.

Like most of the researchers in this area, Yeh, (2020) studied the effects of the Covid-19 pandemic on tourism and also provided effective approaches to recovery tourism during this disease. He analyzed the Tourism Crisis and Disaster Management (TCDM) amid this disease applying a qualitative approach during the current crisis. The findings of her study claimed that open communication and the sponsored loans of the government are essential factors to improve tourism during the coronavirus disease. Shao et al., (2020) emphasized that having effective and pragmatic policies is necessary and crucial in improving tourism after the pandemic. They provided 140 useful policies that help the improvement of tourism in china. They also considered four of these policies as core policies. Moreover, they provided beneficial suggestions for governments to improve and develop tourism conditions in their countries.

Lapointe, (2020) declared that the Covid-19 pandemic causes changes in the orientations of tourism sectors. He examined the tourism condition during this widespread disease in Quebec, Canada. This study specifically focused on the future of tourism future after coronavirus. This research also stated that sanitary safety is so effective to develop tourism. Pinos Navarrete and Shaw, (2020) introduced Spa tourism as a helpful strategy to improve and develop tourism during and after the pandemic. Spa tourism is a form of wellness tourism and also is the

Table 1
Summary of the reviewed papers in Section 2.1.

Authors	Research field	Research area	Proposed solution
Fong et al., (2020)	Tourism industry	China	Government performance
Buckley and Westaway, (2020)	Outdoor tourism and recreation	–	Presenting a conceptual framework
Yeh, (2020)	Tourism industry	–	Open communication and the sponsored loans of government
Shao et al., (2020)	Tourism industry	China	The sponsored loans of the government
Lapointe, (2020)	Tourism industry	Canada	Sanitary safety
Pinos Navarrete and Shaw, (2020)	Tourism industry	Spain	Developing Spa tourism
Samarathunga and Gamage, (2020)	Tourism industry	Sri Lanka	Alternative tourism
Sheller, (2020)	Tourism industry	Caribbean	Mobility justice
Altuntas and Gok, (2020)	Domestic tourism	Turkey	Presenting a proper quarantine solution

oldest and fast-growing type of tourism. A spa is a place where mineral water or spring water is used for therapeutic bathing. This study investigated Spa tourism in Spain and presented the opportunities which are created by it to develop tourism during and after coronavirus.

Samarathunga and Gamage, (2020) introduced alternative tourism instead of mass tourism as a helpful remedy to develop tourism during coronavirus disease. Mass tourism is based on mass movement of people. Therefore, this type of tourism can cause serious health risks during coronavirus. Alternative tourism focused on wellness tourism, agrotourism, and ecotourism. They also examined the alternative tourism in Sri Lanka during coronavirus and concluded the findings. Sheller, (2020) examined the tourism of the Caribbean to reform it during and after coronavirus. She explained that it is possible to reconstruct and recovery tourism in the Caribbean through mobility justice. Mobility justice is a concept that focuses on taking actions to move through wider infrastructures in every field and the paper was used for tourism. She also considered climate resilience and sustainability of tourism in her research.

Altuntas and Gok (2020) studied the effect of the coronavirus on domestic tourism and quarantine decisions. They presented a useful approach for decisions about quarantine and used the DEMATEL method in their work to provide the right solution for quarantine decisions. The findings of their research declare that the proposed solutions for quarantine decisions can be used to make the hospitality industry ready to deal with this pandemic disease and other types of pandemic disease.

General information about the papers reviewed in Section 2.1 is shown in Table 1. This table includes the names of the authors, the research field, the research area, and the solutions each paper provided to improve or develop the situations of the tourism industry during or after the Coronavirus.

2.2. Applying MCDM methods in ecotourism

Some studies that have been done in the ecotourism field and also used one or more MCDM methods are examined and reviewed in this section.

Mansour et al., (2020) declared that Oman has numerous potential regions like Masirah Islands for doing ecotourism activities. Hence, their study aims to develop ecotourism in the region. To reach their goal, they used Geographic Information Systems (GIS) and the AHP method. They also claimed that finding of their research is helpful and useful for Government and tourism planners to develop ecotourism. Motlagh et al., (2020) studied the negative and positive effects of developing

Table 2
Summary of the reviewed papers in Section 2.2.

Authors	Research area	Methodology	Brief explanation
Mansour et al., (2020)	Masirah Islands, Oman	GIS and AHP	Developing ecotourism in the region
Motlagh et al., (2020)	Developing countries and Iran	BOCR model and ANP	Developing ecotourism in forest area
Balist et al., (2019)	Marivan city, Iran	Fuzzy logic, FAHP, and TOPSIS	Developing ecotourism in the region
Tseng et al., (2019)	Thailand	Fuzzy set theory and DEMATEL	Developing ecotourism
Lin and Kuo, (2019)	-	DEMATEL, ANP and VIKOR	presenting a service position model for PT service providers
Olaniyi et al., (2018)	Benin	GIS and AHP	Developing sustainable ecotourism
Pourebrahim and Amoushahi, (2017)	Mahallat city, Iran	ANP and DEMATEL	Developing ecotourism in the region
Arsić et al., (2017)	NPDJ, Serbia	FANP	Developing sustainable ecotourism
Wong and Fung, (2016)	Lantau Island, Hong Kong	GIS, EW, and AHP	providing a useful zoning plan to develop ecotourism

ecotourism in forest areas. They chose Iran as a case study in their research. The main target of their study was to answer the question “is the patterns which are used to develop ecotourism in developed countries also practical and appropriate in Iran?” to do their research, they used Benefits, Opportunities, Costs and Risks (BOCR) model and Analytic Network Process (ANP) method.

Balist et al., (2019) developed ecotourism in Marivan, Iran. They claimed that although Marivan has a lot of ecotourism potential, it is not in its right position. They considered 15 criteria that influenced the development of ecotourism in the region. Also, they used fuzzy logic, the Fuzzy Analytic Hierarchy Process (FAHP) method, Technique of Order Preference Similarity to the Ideal Solution (TOPSIS) method in their work to improve ecotourism in the region. Tseng et al., (2019) examined and developed ecotourism in Thailand. They supposed five ecotourism attributes and 21 criteria to develop ecotourism. They also used fuzzy set theory and Decision-Making Trial and Evaluation Laboratory (DEMATEL) method in their study. The result of their study denotes that community participation is the most effective attribute to develop ecotourism in Thailand. Package tour (PT) service providers always face serious challenges when they want to offer different type of PTs.

In this regard, Lin and Kuo, (2019) presented a service position model to solve this problem. They also used a hybrid MCDM method including DEMATEL, ANP, and Vlsekriterijumska Optimizacija I Kompromisno Resenje (VIKOR) methods to carry out their research. One of the important subjects in most research related to ecotourism is sustainability. Olaniyi et al., (2018) considered sustainability concept to improve ecotourism in two national parks in Benin. Sustainability contains economic, social, and environmental aspects. The AHP method and

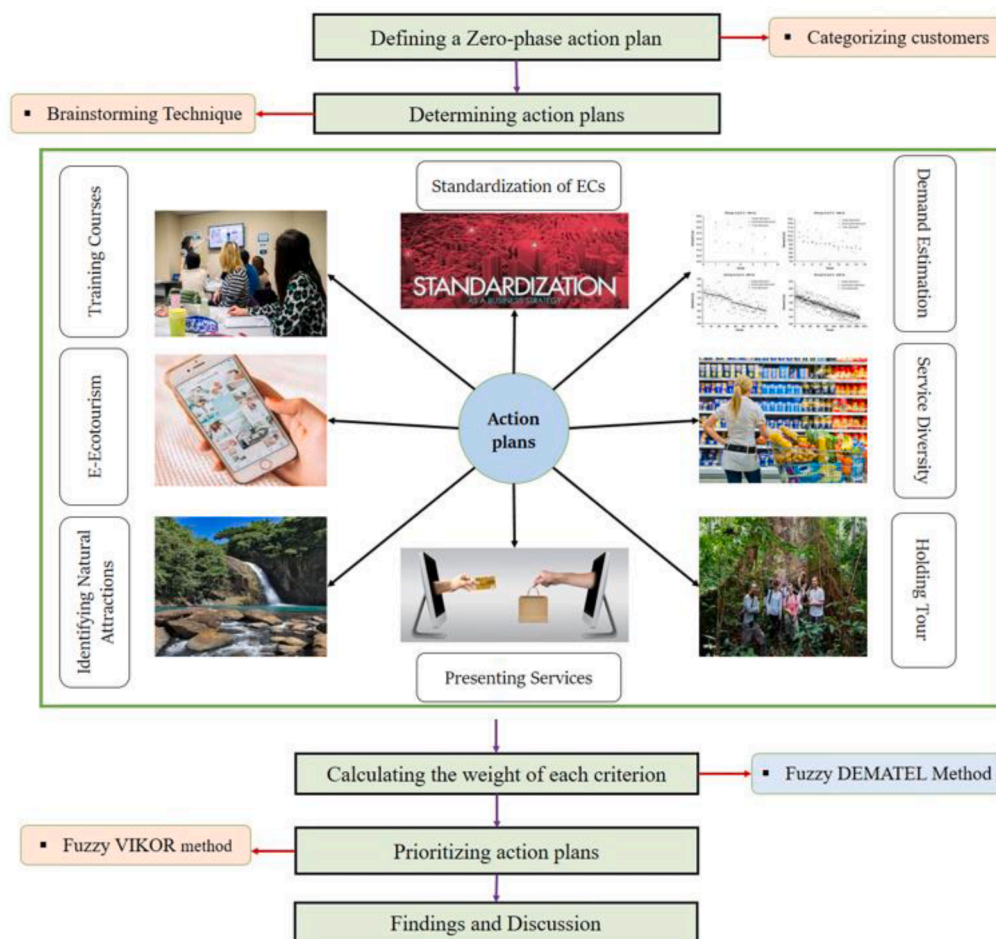


Fig. 3. The Research framework.

GIS were applied in their research to calculate the weights of criteria. Pourebrahim and Amoushahi, (2017) developed ecotourism in Mahallat city, Iran. To achieve their target, they considered some useful strategies. Then, ANP and DEMATEL methods were applied to prioritize these strategies. The result of their paper introduced natural and cultural attractions of the region as the most important factor to improve ecotourism in Mahallat city. Like many other related papers, Arsić et al., (2017) considered the sustainability issues to develop ecotourism in a park in Serbia. Firstly, the internal and external factors that have the most effects on ecotourism development in that park are determined. Then, they provided some strategies based on the identified factor. Finally, they applied the Fuzzy ANP method to prioritize the strategies. Wong and Fung, (2016) provided a useful zoning plan to develop ecotourism in Lantau Island, Hong Kong. Their aim in the proposed zoning plan was to satisfy visitors and also conserve natural resources. Also, a combined approach including MCDM methods consist of the equal-weighting (EW) and AHP method and GIS was used to conduct their research. Table 2 presents concise information about each reviewed papers. This information consists of information about the name of authors, the research area, approaches, methods, or tools used to conduct each research and also a brief description about each paper.

2.3. Research gap

In the first part of the literature review, some papers related to tourism and the coronavirus are examined. Even though some papers have been published about the tourism industry under the impact of the Covid-19 pandemic, but few of them presented effective and useful recovery solutions to improve and develop the tourism industry and related businesses during this disease. Therefore, the lack of research to provide solutions to improve the tourism industry and prosper the activities of its related businesses is strongly felt and needed.

The second part of the literature review also reveals that despite many works have been done in this field, it can be obviously found that most of them have developed the ecotourism concept in a region or a community, and just a few of them have focused on businesses related to the ecotourism industry.

As a result, based on the review, there has been no work reported to improve and develop conditions of ECs, particularly during Coronavirus disease. Hence, it motivated us to focus on this topic as our contribution in the research area. The most outstanding features of our work can be stated as follows:

- Providing recovery solutions to improve the situation of ECs during the Covid-19 pandemic for the first time.
- Considering real information and data (real case) to enhance the effectiveness of the research in the real world.
- Using common tools of MCDM approaches like Fuzzy DEMATEL and Fuzzy VIKOR method to do our research.
- Prioritizing the proposed action plans to make the decision process easy for owners and managers of ECs.
- Findings of the current research are not allocated just for the Covid-19, they also can be used during all other pandemic diseases and normal conditions.

3. Materials and methods

After doing some studies, interviews, and also conversations with tourism experts, managers, and owners of ECs and ecotourism activists, eight useful and applicable action plans are identified and proposed to develop and improve the conditions of ECs during coronavirus disease. Also, four criteria including time, cost, necessity, and effectiveness are considered to prioritize action plans.

Before prioritizing and implementing the action plans, an action plan called zero-phase action plan is presented. In other words, a zero-phase action plan means that ECs must take this action plan before

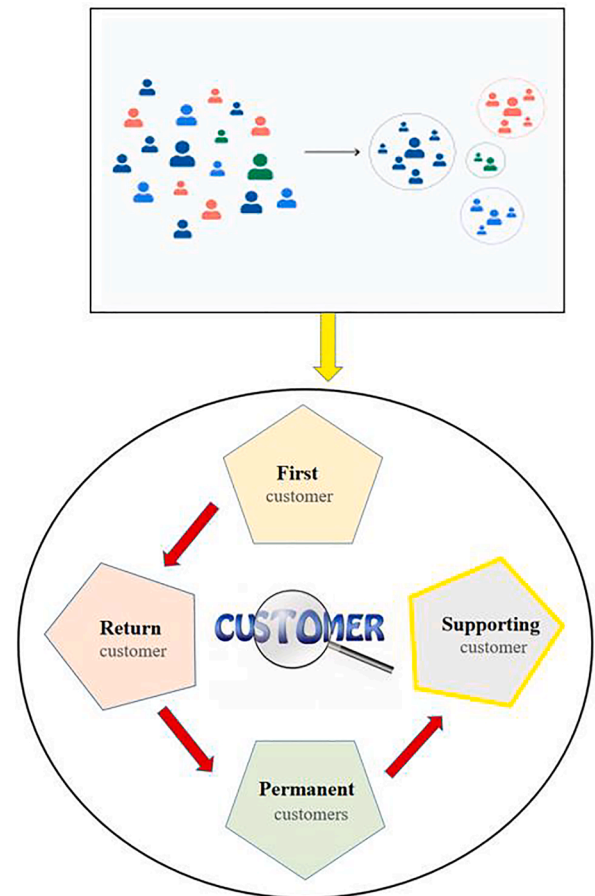


Fig. 4. Categorization of customers.

implementing any other action plan during coronavirus disease because this action plan affects all proposed action plans directly or indirectly. Fig. 3 shows the framework of the present research and it includes defining a zero-phase action plan, determining action plans and their prioritization and findings, results, and discussions.

3.1. Zero-phase action plan: categorizing customers

Customer recognition is one of the most important and crucial issues in many industries, especially manufacturing and service industries. To build a continuous and appropriate relationship with the customers, firstly, it is necessary to know them precisely and specify the type and quality of the relationship between each other. Then, a relationship with mutual interest must be built. Customer categorization is one of the fundamental steps in customer recognition. In this research, the brainstorming technique is used to categorize customers in phase zero.

The brainstorming technique is a very useful, efficient, and widely used method in many organizations, businesses, and institutions to find the best possible and most beneficial solutions to solve a problem (Al-Samarraie and Hurmuzan, 2018). Brainstorming is one of the best-known techniques for generating ideas to creatively solve the problem and is done with the help of a group of people (Clark et al., 2019). Actually, different ideas are presented and examined to solve a problem and the best approaches are selected at the end. Another noteworthy point about this technique is that an idea which at first is thought to be very ridiculous and inefficient and silly can be nurtured, developed, completed, and turn into a very useful and effective one with the help of other people participating in the brainstorming session (Faure, 2004).

In this section, firstly, the customers (tourists visiting the centers) of the five centers mentioned in our case study were examined regarding

the historical data of the last three years. Different aspects which were considered to examine customers include their distance from the centers, being a domestic tourist or international one, the number of visits to the centers, and the duration of their presence in the centers. Then, some brainstorming sessions consisting of tourism experts, owners, managers, and some personnel of the centers were held. Various ideas and opinions were presented and reviewed, and finally, customers were classified into four different groups, shown in Fig. 4, include:

1) First time customers: Customers who have used services of their centers for the first time. 2) Return customers; this type of customer includes first-time customers that they should try to turn into return customers. 3) Permanent customers; those customers who use only the services of their center among the various existing ECs and also are called loyal customers. 4) Supporting customers; this group of customers includes permanent customers who not only prefer the services of the center to other centers but also encourage others to use services of the center.

This action plan has some benefits for ECs. They are detailed as follows:

- **Retain first time customers:** The first advantage of customer classification is retaining customers, especially first-time customers.
- **Convert all types of customers to supporting customers:** In fact, turning customers into supporting customers is an approach of advertising for the center without imposing any cost on the center.
- **Identify customer characteristics to respond appropriately to their requests:** By identifying the type of customers, the behavioral characteristics and the type and amount of their demands for each service can be identified. With this action, responding to customer demands will be done more effectively.

3.2. Action plans

An action plan is a tool of planning including the steps or tasks which are needed to achieve the goals. It's an extremely important part of the strategic planning process. Action plans are very effective when quick and accurate approaches are needed to overcome an undesirable situation (Pirlone and Spadaro, 2017). Hence, their usage is common in many organizations and businesses. An important step in creating effective action plans is setting the goal (Cramer, 2017). Also, in creating action plans, the existing requirements and limitations must be fully identified and considered (Cleveland, 2001; Pannell and Roberts, 2010). In this paper, eight applicable and effective action plans are determined for ECs to improve their performance and boost their productivity during the Covid-19 pandemic.

Before providing action plans, initial information was collected on the status of the ECs before and during the Covid-19 pandemic by face-to-face interviews with the managers and owners of these centers. They were asked some questions such as the types of services offered to tourists before the pandemic, the average number of tourists who visited their centers per day, the average of the income, the numbers of their personnel, and their conditions during the pandemic. After gaining the initial information, the conditions of ECs were studied carefully and deeply. Studies and investigations on the obtained information revealed the awful conditions of the centers, especially from psychological and economic aspects. Therefore, the conditions necessitate the provision of practical and efficient solutions for these centers to get rid of the current terrible situations. To provide the action plans, people were asked through an online poll on the Instagram page of the five ECs with a question entitled "What are your suggestions or solutions for the managers of tourist centers, especially ECs during the Covid-19 pandemic to improve the current situation?" Approximately 1000 people took part in the survey. First, all the answers were organized, which means that the answers that were not practical and useful were deleted, and the other answers were written down. Then, by utilizing the brainstorming technique and holding three online meetings, all the received answers

were analyzed and reviewed meticulously, and finally, eight action plans were selected. The session members have consisted of five local tourism experts, five tourism experts of Mazandaran Cultural Heritage, Handicraft and Tourism Organization, five managers and 10 personnel of the ECs, three university professors from the Faculty of Cultural Heritage, Handicrafts and Tourism of Mazandaran University, Babolsar, Iran. It is noteworthy to mention that the session members chose plans that are feasible in terms of the considered criteria and are also useful and beneficial for the ECs to improve and develop the current situation. The proposed action plans are described in the following.

AP1: Holding training courses: Given that one of the customers of ECs are international tourists, so to better and suitable communicate with them, the staff of ECs should be fluent in English. The time coincidence with the coronavirus is a good opportunity to improve the English language level of their staff. Besides, one of the important criteria for retaining and attracting customers is proper communication with tourists. Therefore, the management of ECs can hold online training courses for its staff focusing on suitable behavior with tourists. In addition to the mentioned advantages, these courses have another benefit that helps centers to be in touch with their staff.

AP2: Standardization of ECs: Increasing the desire of people to spend their leisure time in natural areas has increased the demand for ECs. This subject leads to the development of the concept of ecotourism in countries with ecotourism potential. However, if ECs suffer from poor oversight and lack of proper standards, they not only hinder the development of the concept of ecotourism but also this nascent and emerging concept will face serious challenges. One of the services presented by ECs is accommodation. These accommodation centers are often created in pristine natural environments and rural contexts. In their design, compliance with environmental standards, local architecture, and the natural appearance of the region is very important. With the formation of these accommodation centers, necessary actions for standardization must be taken to protect the rights of tourists. Therefore, in the coronavirus time and closure of ECs, there is an opportunity to implement this action plan.

AP3: Estimating demand number and increasing the capacity of ECs in proportion to them: One of the advantages of customer categorization is to estimate the number of customer demands for each type of service presenting by the ECs. Demand forecasting helps managers of ECs to increase the capacity of some services that respond to their demands may be encounter with shortage. One of the most important benefits of implementing this action plan is to increase customer satisfaction and retain them.

AP4: Diversify services and increase their quality: Considering the activity of an appropriate number of ECs in the country and also the increase in their number, familiarity with the methods of increasing sales and customer attraction is a necessity for success in any this business. One of the factors to attract and retain customers is to offer a variety of services with a suitable quality level. Therefore, the pandemic leads to a good opportunity to prepare necessary substrates for adding some new services to the portfolio of services presenting by ECs. Also, if there is a need, the quality of some services must be improved.

AP5: Holding special one-day family tours during the coronavirus: Under normal situations (before the outbreak), one of the services presenting by ECs was the tour service. With the outbreak of this pandemic and the increasing number of Covid-19 cases, most of the governments have decided to close crowded centers like tourist centers, which led to the cancellation of all tourist tours. By subsiding the wave of coronavirus and the reopening of ECs, one of the services that can be presented during this disease is one-day family tours that are held in a limited way and with full observance of health instructions for members of a family. The location where the tour is held must be suitable in terms of pollution and crowds. It should be noted that presenting this service (one-day tour) not only brings income for ECs, but also increases the happiness and cheerful spirit of family members.

AP6: Developing Electronic ecotourism (E-ecotourism):

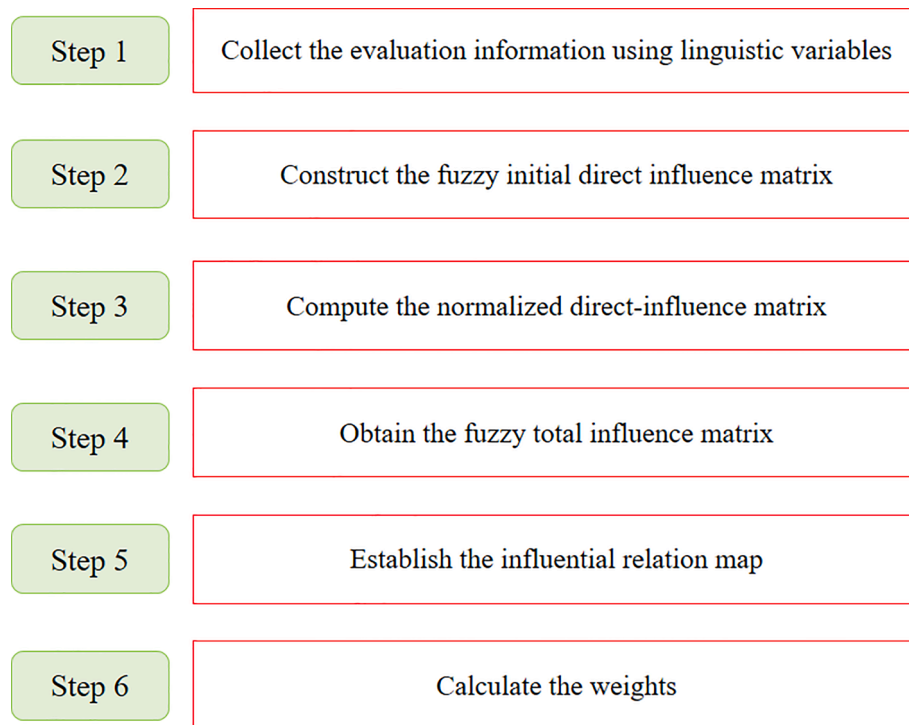


Fig. 5. Framework of steps of Fuzzy DEMATEL method.

Electronic-tourism or E-tourism means the presence in the digital realm of information and communication, which allows you to view audio, video, and textual information from the surrounding physical world. This type of tourism is based on Information and Communication Technology (ICT). E-tourism is a tool that makes it possible for tourists to travel to a specific location or place in the shortest time and with the least facilities and costs and identify the tourist attractions and tourism capacities of the desired destination. An E-tourist typically expects access to the required services and information about the destination after entering a tourist site.

The information that should be presented to tourists on tourist sites includes the geographical and climatic situation of the region, the status of communication routes, the introduction of historical monuments, tourist attractions, and level of tourism facilities in the area. These days, when the coronavirus is rampant in the world and people are banned from traveling, it is the best option to spend the corona days, especially the holidays in the computer frame (E-tourism). Therefore, ECs can utilize the benefits of the existing opportunity and ease the development of E-ecotourism. This action introduces the center to the tourist and its services and the region in which the center is located. Furthermore, this action creates happy and cheerful moments for tourists in addition to attracting new customers and retaining old customers.

AP7: Identifying other pristine and natural areas in the region: One of the services that are always welcomed by tourists is a tour. The important point for tourists about tours is the locations where the tours are held (tour destination). In other words, if the tour destination has more special tourist attractions and natural outlook landscapes, and also be in an appropriate status, in the term of the service and health facilities, it will encourage more tourists to participate in the tours.

AP8: Presenting some services during the coronavirus with full observance of health instructions: Earning money and retaining customers are two of the major concerns for managers and owners of ECs during coronavirus disease. Before the outbreak of the Covid-19, ECs presented some services such as food, edible and non-edible souvenirs, tours, and accommodation centers. During the pandemic, ECs can present some services such as edible- souvenirs of the region such as local milk, yogurt and butter, local poultry, local pickles and jams, local rice,

and also accommodation centers in full compliance with health instructions. This action, in addition to earning money and preventing severe economic damage, helps to retain customers and gain their satisfaction. It is suggested that the delivery of customer orders be done by the staff of ECs because it maintains the relationship between ECs and customers, as well as awareness of their suggestions and criticisms.

3.3. Criteria

The decision criteria are important in each decision-making process to evaluate the alternatives to choose the best one. Therefore, in this paper, four criteria including time, cost, necessity, and effectiveness are determined to prioritize the proposed action plans. More details about each criterion are presented in the following.

C1: Time: In any planning program, the time criterion is very important and managers prefer to implement actions that require less time to be implemented.

C2: Cost: Cost is one of the most important criteria in prioritizing action plans. This criterion expresses the amount of budget required to implement each action. Given the inappropriate economic situation during coronavirus, this criterion is very important for ECs.

C3: Necessity: The criterion that is also important in planning is a necessity. Most of the time, the issue of importance and necessity is confused with each other but according to researchers and planners, they are completely different. Sometimes implementing an action plan is important but it is not necessary. It is also remarkable to note that there are plenty of potential important action plans in the planning and related process but there are a few special action plans that need to be done. To understand deeply, necessity can be defined as the significant impact of implementing an action plan on the development of ECs.

C4: Effectiveness: Effectiveness is a critical issue for managers in many organizations when planning to develop and improve existing conditions. Effectiveness means the usefulness of the action plans taken to achieve predetermined goals. In other words, in this paper, efficiency is the usefulness of implementing each action plan in terms of affecting the income of the center or its greater impact on attracting more customers.

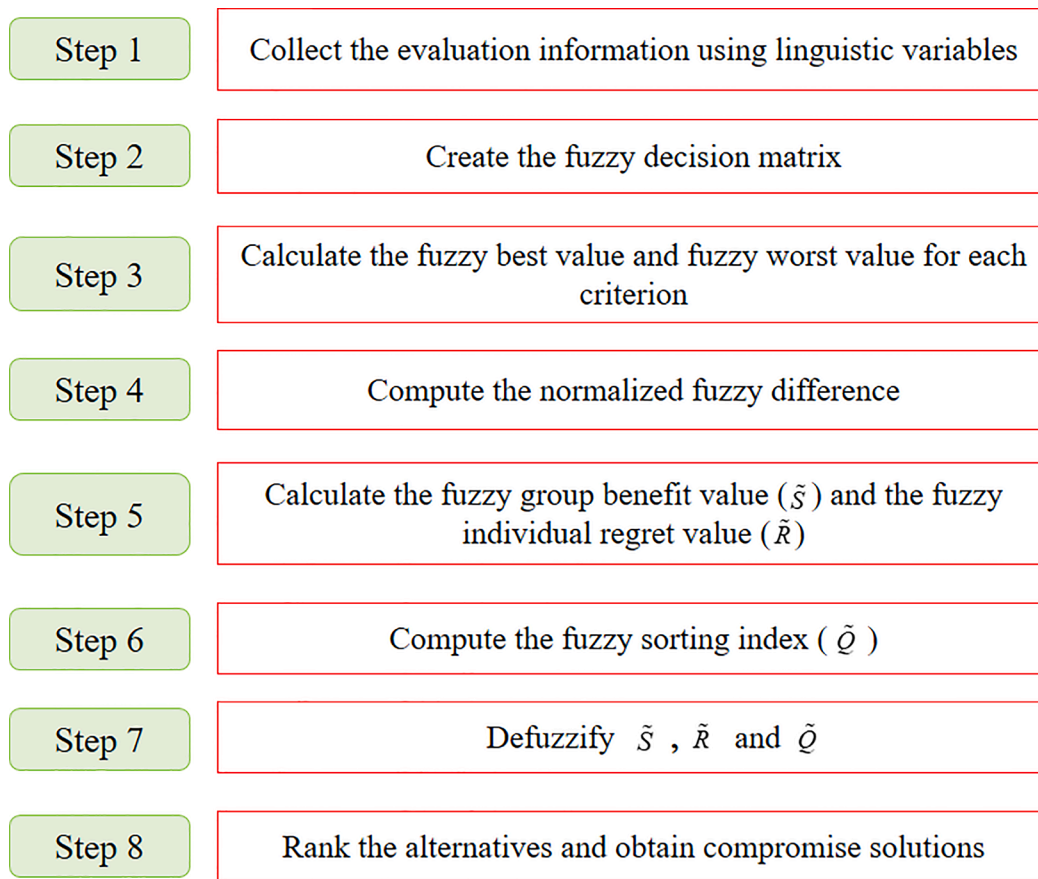


Fig. 6. Framework of steps of Fuzzy VIKOR method.

3.4. Fuzzy set theory

Zadeh (1975) firstly introduced the main idea of this theory. Based on fuzzy set theory, a membership degree must be assigned to each element in a fuzzy set. The membership degree of each element within a specific interval, which is mainly [0, 1]. Monotone, triangle, and trapezoidal are the most common types of fuzzy membership functions (Taha and Rostam, 2011). In most fuzzy environments, a Triangular Fuzzy Number (TFN) is used due to its simple calculation. Besides, TFN is extensively applied in most research to represent a fuzzy number (Patil and Kant, 2014). The membership degree function of a TFN $\tilde{A} = (A^l, A^m, A^u)$ is presented as follows (Suzan and Yavuzer, 2020):

$$\mu_{\tilde{A}}(x) = \begin{cases} (x - A^l) / (A^m - A^l) & \text{if } A^l \leq x < A^m \\ (A^u - x) / (A^u - A^m) & \text{if } A^m \leq x < A^u \\ 0 & \text{otherwise} \end{cases}$$

3.5. Fuzzy DEMATEL

The DEMATEL technique is a well-known and most widely method in decision-making approach that is utilized to solve complicated and intertwined and MCDM problems (Li and Tzeng, 2009). This technique is based on diagrams (directional graphs) which uses the judgment of experts to identify the factors in a system. Also, this method applies the principles of graph theory to extract causal relations between factors (Altuntas and Dereli, 2015). The DEMATEL method can also be used to help Decision-Makers (DMs) to find out the interdependence of factors through graphs or matrixes (Yazdi et al., 2020). No need to compare all

pairwise comparisons of variables in the DEMATEL method and thereby reducing the computational process is one of the special advantages of this method (Tadić et al., 2014). The DEMATEL method can help us for better understanding of the experts' opinions about the criteria and present a practical solution with the help of the visualization structure model (Chang et al., 2011).

To deal with vagueness, uncertainty and lack of information and called the Fuzzy DEMATEL method, it is common in research to utilize this method with fuzzy set theory as shown in Fig. 5 (Acuña-Carvajal et al., 2019). More details and information about the steps of this method can be reached in the paper of Li et al., (2020).

3.6. Fuzzy VIKOR

The VIKOR technique is a more frequently used method in MCDM for solving problems including various conflicting criteria. One of the reasons for the high usage of this method for ranking alternatives compared to other MCDM methods is the low and easy computational steps (Zimonjić et al., 2018). The VIKOR method introduces and uses compromise solutions to rank alternatives based on non-commensurable and conflicting criteria. Some authors have stated that using a compromise solution is the biggest advantage and strong point of this method compared to other methods (Opricovic and Tzeng, 2004; Shemshadi et al., 2011; Kim and Ahn, 2019). The VIKOR method is a compromise method that ranks alternatives based on non-commensurable and conflicting criteria (Opricovic and Tzeng, 2007). The compromise solution means that this method searches for a ranking order by compromising between expected and pessimistic solutions. We refer the readers also to Çali, and Balaman (2019) and Tian et al. (2018) for ore explanations.

The VIKOR method like other MCDM approaches can be combined

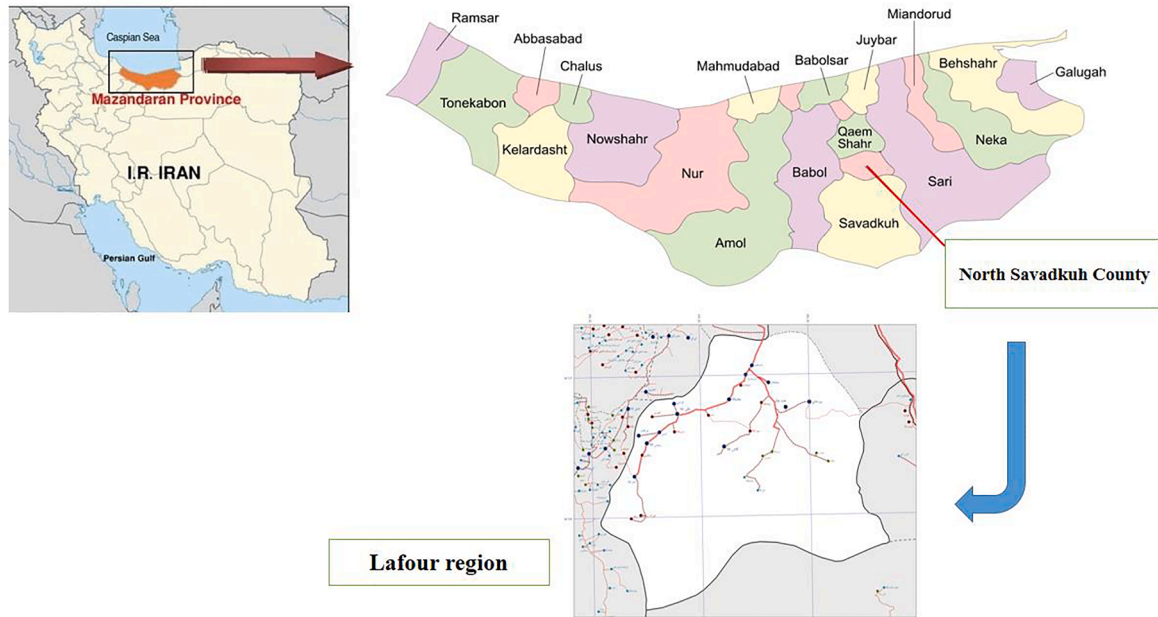


Fig. 7. Geographical map of the study.

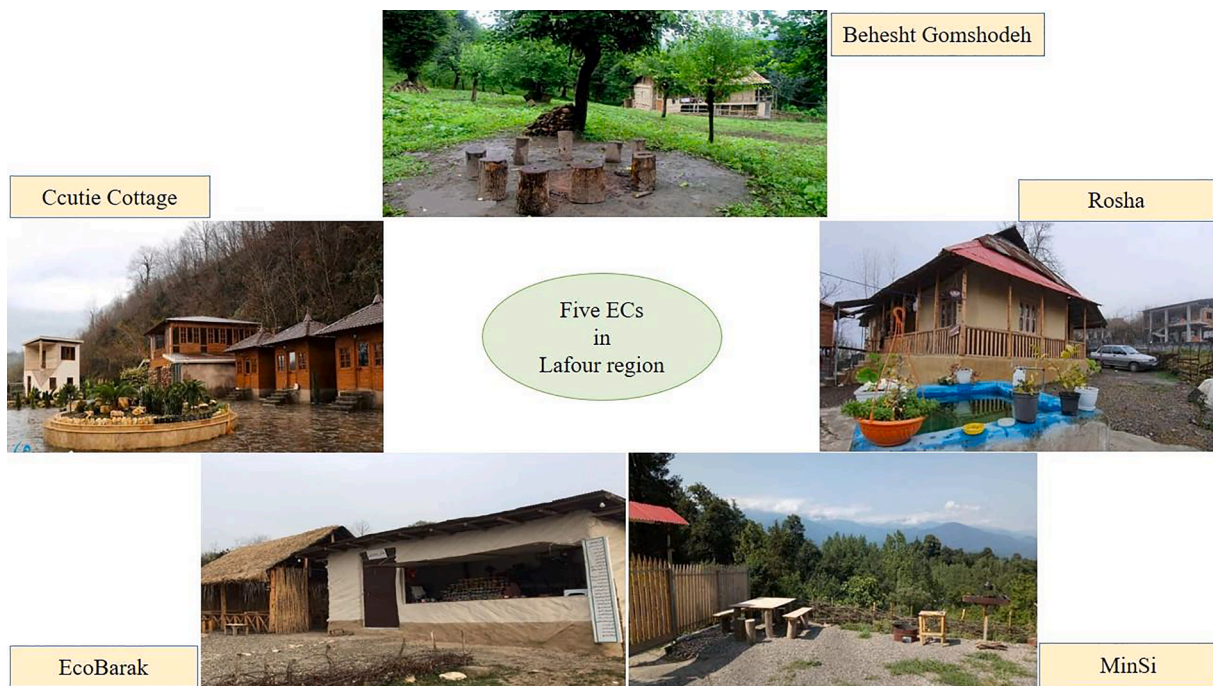


Fig. 8. Five ECs in the Lafour region.

with the fuzzy set theory (Joshi, 2020). In the present research, we use this method to prioritize the action plans. The steps of implementing the Fuzzy VIKOR method are represented in Fig. 6 and more explanations can be found in the research of Ikram et al., (2020).

4. Implementation and findings

4.1. Study region

Lafour or Lafur rural district is a region that is located in North Savadkuh County, Mazandaran Province, Iran. The Lafour region is a potential area for doing tourism activities particularly ecotourism

activities and an Attractive and favorite area for tourists interested in nature-based tourism. Also, due to not existing enough tourism centers in the Lafour region to meet the needs of tourists, the need of establishing service centers such as ECs in the region was felt more than ever. Therefore, all of these reasons encourage investors and ecotourism enthusiasts to establish ECs in this area.

There are five ECs in the Lafour region named: 1) Behesht Gomshodeh 2) Ccutie Cottage 3) MinSi 4) Rosha and 5) EcoBarak (Barak Sabz). With the outbreak of coronavirus disease, these ecotourism centers have faced serious challenges, and the managers and owners of these centers are vehemently looking for effective solutions to meet the existing serious challenges and improve their current awfully

Table 3
The fuzzy linguistic scales for evaluation in Fuzzy DEMATEL method (Chang et al., 2011).

Linguistic terms	Abbreviations	TFN
No Influence	NI	(0,0,0.25)
Very Low Influence	VL	(0,0.25,0.5)
Low Influence	L	(0.25,0.5,0.75)
High Influence	HI	(0.5,0.75,1)
Very High Influence	VH	(0.75,1,1)

Table 4
Evaluation information matrix of criteria according to managers of each EC.

Decision-makers	Criteria	C1	C2	C3	C4
EC1	C1	NI	HI	HI	L
	C2	VH	NI	L	HI
	C3	VL	HI	NI	HI
	C4	L	VL	VH	NI
EC2	C1	NI	HI	L	L
	C2	HI	NI	VL	HI
	C3	L	L	NI	L
	C4	VL	NI	L	NI
EC3	C1	NI	VH	HI	L
	C2	HI	NI	NI	VH
	C3	NI	VL	NI	VH
	C4	NI	L	HI	NI
EC4	C1	NI	VH	VH	VL
	C2	L	NI	VL	HI
	C3	VL	L	NI	L
	C4	L	VL	HI	NI
EC5	C1	NI	VH	HI	L
	C2	VH	NI	VL	HI
	C3	HI	HI	NI	HI
	C4	VL	VL	HI	NI

Table 5
The FIDI matrix of four criteria.

Criteria	C1	C2	C3	C4
C1	(0,0,0.25)	(0.65,0.9,1)	(0.5,0.75,0.95)	(0.2,0.45,0.7)
C2	(0.55,0.8,0.95)	(0,0,0.25)	(0,0.2,0.45)	(0.55,0.8,1)
C3	(0.15,0.35,0.6)	(0.3,0.55,0.8)	(0,0,0.25)	(0.45,0.8,0.95)
C4	(0.1,0.3,0.45)	(0.05,0.25,0.4)	(0.5,0.75,0.95)	(0,0,0.25)

Table 6
The FNDI matrix.

Criteria	C1	C2	C3	C4
C1	(0,0,0.093)	(0.242,0.336,0.373)	(0.186,0.28,0.355)	(0.074,0.168,0.261)
C2	(0.205,0.299,0.355)	(0,0,0.093)	(0,0.074,0.186)	(0.205,0.299,0.373)
C3	(0.056,0.130,0.224)	(0.112,0.205,0.299)	(0,0,0.093)	(0.168,0.299,0.355)
C4	(0.037,0.112,0.168)	(0.018,0.093,0.149)	(0.186,0.280,0.355)	(0,0,0.093)

Table 7
The FTI matrix of four criteria.

Criteria	C1	C2	C3	C4
C1	(0.017, -1.19, -1.24)	(1.017, -0.09, -0.09)	(-0.72,0.69,0.79)	(-0.14,0.74,0.80)
C2	(1.01, -0.19, -0.24)	(0.01-1.09, -1.09)	(-0.72,0.69,0.79)	(-0.14,0.74,0.80)
C3	(1.01, -0.19, -0.24)	(1.01, -0.09, -0.09)	(-1.72, -0.30, -0.20)	(-0.14,0.74,0.80)
C4	(1.01, -0.19, -0.24)	(1.01, -0.09, -0.09)	(-0.72,0.69,0.79)	(-1.14, -0.25, -0.0.19)

conditions. Therefore, this vital issue has persuaded us to do this research for providing useful and helpful recovery solutions for them during this pandemic disease. Fig. 7 displays the geographical map of the research area. An overview of the five ECs in the Lafour region is shown in Fig. 8.

4.2. Fuzzy DEMATEL: Calculating the weight of each criterion

To prioritize the proposed action plan, four criteria including time, cost, necessity, and effectiveness are considered. We obtain the weights of the considered four criteria using the Fuzzy DEMATEL method. The initial data for calculating the weights are collected according to managers of five different ECs and are shown in Table 4. For more information, the linguistic terms are displayed in Table 3 that are used to determine all values presented in Table 4. Table 5 denotes the Fuzzy Initial Direct-Influence (FIDI) matrix of four criteria. This matrix is the initially required matrix to start the implementation process of the Fuzzy DEMATEL method. Table 6 represents the Fuzzy Normalized Direct-Influence (FNDI) matrix of four criteria. Then, the Fuzzy Total Influence (FTI) matrix of each criterion is shown in Table 7. Table 8 indicates the obtained weight of each criterion. To gain the weight of i th criterion W_i , Eq. (2) is used (Baykasoğlu et al., 2013):

$$W_i = \frac{\left[\left((\tilde{D}_i + \tilde{R}_i)^{def} \right)^2 + \left((\tilde{D}_i - \tilde{R}_i)^{def} \right)^2 \right]^{1/2}}{\sum_{i=1}^n \left[\left((\tilde{D}_i + \tilde{R}_i)^{def} \right)^2 + \left((\tilde{D}_i - \tilde{R}_i)^{def} \right)^2 \right]^{1/2}} \tag{2}$$

The fourth and fifth columns of Table 8 demonstrate the defuzzification values of $(\tilde{D} + \tilde{R})$ and $(\tilde{D} - \tilde{R})$, respectively. In this research, Graded Mean Integration Representation (GMIR) technique is used to defuzzify these values. The formulation of the GMIR technique is presented in Eq. (3).

Assume that $\tilde{A} = (A^l, A^m, A^u)$ is a fuzzy number and the \tilde{A}^{def} is the defuzzification value of \tilde{A} (Zhao and Guo, 2015).

$$\tilde{A}^{def} = \frac{A^l + 4 \times A^m + A^u}{6} \tag{3}$$

Table 8
Weight calculation.

Criteria	\tilde{D}	\tilde{R}	$(\tilde{D} + \tilde{R})^{def}$	$(\tilde{D} - \tilde{R})^{def}$	W
C1	(0.16,0.14,0.25)	(3.07, -1.79, -1.99)	-0.85	1.17	0.25
C2	(0.16,0.14,0.25)	(3.07, -1.38, -1.38)	-0.47	0.8	0.16
C3	(0.16,0.14,0.25)	(-3.90,1.78,2.17)	1.06	-0.73	0.23
C4	(0.16,0.14,0.25)	(-1.58,1.98,2.22)	1.63	-1.26	0.36

Table 9
The fuzzy linguistic scales for evaluation in Fuzzy VIKOR method (Li et al., 2020).

Linguistic terms	Abbreviations	TFN
Very Poor	VP	(0,0,0.17)
Poor	P	(0,0.17,0.33)
Medium Poor	MP	(0.17,0.33,0.5)
Fair	F	(0.33,0.5,0.67)
Medium Good	MG	(0.5,0.67,0.83)
Good	G	(0.67,0.83,1)
Very Good	VG	(0.83,1,1)

Table 10
Evaluation ratings of alternatives according to managers on each EC.

Decision-makers	Alternatives	Criteria			
		C1	C2	C3	C4
EC1	AP1	VG	G	VG	F
	AP2	VP	VP	VG	MG
	AP3	G	VG	VG	G
	AP4	F	MP	F	VG
	AP5	VG	VG	VG	G
	AP6	P	P	G	MG
	AP7	MG	F	MP	P
	AP8	MG	MP	VG	VG
EC2	AP1	VG	VG	VG	F
	AP2	P	VP	G	G
	AP3	G	VG	VG	VG
	AP4	MP	F	F	G
	AP5	VG	VG	VG	VG
	AP6	MP	P	MP	G
	AP7	G	F	F	P
	AP8	G	MP	VG	VG
EC3	AP1	G	G	VG	G
	AP2	P	VP	G	MG
	AP3	VG	VG	VG	VG
	AP4	F	MP	MP	VG
	AP5	VG	G	G	G
	AP6	MP	P	G	G
	AP7	MG	MG	F	P
	AP8	MG	P	VG	VG
EC4	AP1	VG	G	VG	G
	AP2	MP	MP	F	VG
	AP3	G	VG	F	F
	AP4	G	F	G	VG
	AP5	G	G	VG	VG
	AP6	F	P	VG	G
	AP7	G	G	P	P
	AP8	VG	G	VG	VG
EC5	AP1	G	F	G	G
	AP2	F	P	VG	VG
	AP3	G	G	MP	F
	AP4	MG	MG	G	VG
	AP5	G	G	F	VG
	AP6	MG	P	MG	G
	AP7	G	G	MG	F
	AP8	G	MG	VG	VG

4.3. Fuzzy VIKOR: Prioritizing action plans

After calculating the weight of each criterion in the previous section, the Fuzzy VIKOR method is applied to prioritize the identified action plans in this section. To implement the Fuzzy VIKOR method, the decision matrix is needed. To reach this matrix, first, the evaluation rating matrix is provided based on the managers of five ECs through a structural questionnaire (Table 10) and using the linguistic terms are presented in Table 9. After obtaining the evaluation rating matrix, this matrix turned to the fuzzy decision matrix shown in Table 11. Table 12 presents Fuzzy Best (FB) and Fuzzy Worst (FW) values of each criterion. The values of \tilde{S} , \tilde{R} and \tilde{Q} are available in Table 13. Table 13 illustrates the final ranking of each action plan. The best alternative is the one that has the smallest amount of \tilde{Q} , but subject to two conditions (Opricovic and Tzeng, 2004):

- 1) If alternatives a and b are ranked in first and second places among m alternatives, Eq. (4) must be true:

$$Q(b) - Q(a) \geq \frac{1}{m - 1} \tag{4}$$

- 2) The alternative that has the first rank (alternative a) must be in the first place in terms of at least one of the S and R values: The best alternative has the smallest amount of S and R.

If one of the above two conditions is not met, a set of compromise solutions is presented. If only the second condition is not met, alternatives a and b are introduced as the compromise solutions.

If the first condition is not met, then n first alternatives (n alternatives with better rank) are introduced as a compromise solution. The value of n is calculated from Eq. (5).

$$Q(n) - Q(a) < \frac{1}{m - 1} \tag{5}$$

Fig. 9 represents the S, R and Q values for each action plan simultaneously. According to this figure, AP7 and AP2 have the highest and lowest amounts for all three values, respectively.

Conditions one and two checked for all action plans. The final results obtaining from surveying conditions one and two for all action plans are presented in Table 14. According to Table 14, Compromise solutions mean that the priorities of implementing the action plans which are placed in the same group are approximately equal (see Table 15).

5. Discussion

According to the results, AP2 gained the first rank to be implemented. AP2 mentions the standardization of ECs. This action plan is very suitable and effective in terms of necessity and effectiveness criteria. Besides, most managers of ECs had consensus on implementing this action plan during the Covid-19 pandemic.

The next rank belongs to AP6. AP6 emphasizes developing Ecotourism during this pandemic time. Utilizing this action plan can help the ECs better than others to plans to move toward better conditions. Also, it should be noted that the biggest change to implement this action plan is a lack of necessary and suitable platforms in the country.

AP4 and AP8 are introduced as a first compromise solution. That

Table 11
The fuzzy decision matrix.

Alternative	Criteria			
	C1	C2	C3	C4
AP1	(0.766,0.932,1)	(0.634,0.798,0.934)	(0.798,0.966,1)	(0.534,0.698,0.868)
AP2	(0.1,0.244,0.4)	(0.034,0.1,0.268)	(0.666,0.832,0.966)	(0.666,0.834,0.932)
AP3	(0.702,0.864,1)	(0.798,0.966,1)	(0.598,0.766,0.834)	(0.598,0.766,0.868)
AP4	(0.4,0.566,0.734)	(0.368,0.466,0.634)	(0.434,0.598,0.768)	(0.798,0.966,1)
AP5	(0.766,0.932,1)	(0.734,0.898,1)	(0.698,0.866,0.934)	(0.766,0.932,1)
AP6	(0.244,0.4,0.566)	(0,0,0.17)	(0.568,0.664,0.866)	(0.636,0.798,0.966)
AP7	(0.602,0.766,0.932)	(0.5,0.666,0.834)	(0.266,0.434,0.6)	(0.066,0.236,0.398)
AP8	(0.634,0.8,0.932)	(0.302,0.466,0.632)	(0.764,0.934,0.966)	(0.83,1,1)

Table 12
FB and FV values for each criterion.

Criteria	FB value	FW value
C1	(0.1,0.244,0.4)	(0.766,0.932,1)
C2	(0,0,0.17)	(0.798,0.966,1)
C3	(0.798,0.966,1)	(0.266,0.434,0.6)
C4	(0.83,1,1)	(0.066,0.236,0.398)

Table 13
Results of \tilde{S} , \tilde{R} and \tilde{Q}

Alternative	\tilde{S}	\tilde{R}	\tilde{Q}
AP1	(0.421,0.462,0.365)	(0.186,0.191,0.166)	(0.663,0.702,0.711)
AP2	(0.109,0.124,0.052)	(0.061,0.061,0.025)	(0,0,0)
AP3	(0.474,0.515,0.432)	(0.166,0.187,0.166)	(0.653,0.74,0.774)
AP4	(0.284,0.311,0.265)	(0.119,0.122,0.1)	(0.226,0.256,0.442)
AP5	(0.382,0.424,0.347)	(0.186,0.191,0.166)	(0.626,0.666,0.694)
AP6	(0.187,0.218,0.1)	(0.075,0.1,0.04)	(0.114,0.203,0.089)
AP7	(0.703,0.743,0.64)	(0.291,0.29,0.23)	(1,1,1)
AP8	(0.216,0.256,0.247)	(0.148,0.156,0.148)	(0.464,0.404,0.546)

means the priorities of them for Managers of ECs are almost the same. AP4 refers to diversifying the services that are presented by ECs with an appropriate and acceptable quality level. Nowadays, to succeed in business and surpass competitors in a competitive environment, it is necessary to identify and apply appropriate action plans. One of these action plans is named service and product diversity. ECs can use this action plan not only in the current critical situation but also at other

times. This action plan also makes businesses able to get more customers. The services and products diversity strategy modifies revenue flow and significantly increases sales. Obviously, it is very important to consider that the variety of services and products without an acceptable quality level is not very efficient.

ECs can provide some services to customers to improve the economic situation and prevent the decline of the center during this time. Presenting these services not only improves the economic situation but also leads to continuous communication with customers and retain them. So, the implementation of AP8 during this disease is very useful and efficient

AP5 states that the ECs should hold one-day tours for members of a family in full compliance with health tips and instructions. An important note that the managers should take into account is that most people in the survey agreed to hold this type of tour. Therefore, it shows the high

Table 14
The final results of implementing the VIKOR method.

Alternative	S	R	Q	Prioritization		
				S	R	Q
AP1	0.439	0.186	0.697	6	6	6
AP2	0.11	0.055	0	1	1	1
AP3	0.494	0.18	0.731	7	7	7
AP4	0.299	0.118	0.363	3	3	3
AP5	0.403	0.186	0.664	5	5	5
AP6	0.193	0.086	0.169	2	2	2
AP7	0.719	0.281	1	8	8	8
AP8	0.248	0.153	0.438	4	4	4

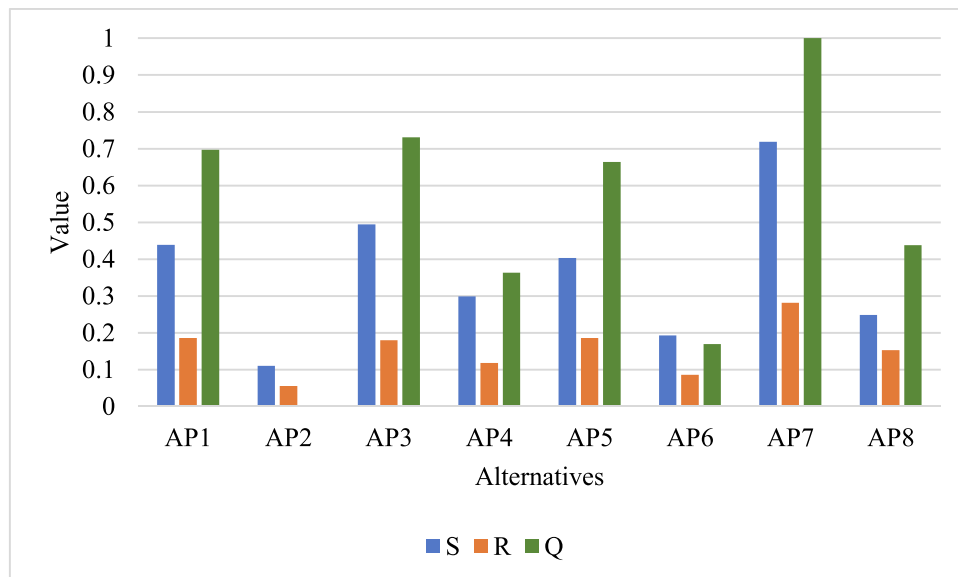


Fig. 9. The chart of S, R and Q for each alternative.

Table 15
Different group of compromise solution

Compromise solutions	Action plans
Group 1	AP2
Group 2	AP6
Group 3	AP4 and AP8
Group 4	AP1 and AP5
Group 5	AP3 and AP7

necessity to implement this action plan.

In AP1, ECs are recommended to increase customer satisfaction and retain them by holding training courses. The tourism industry is an international industry and the customers of this industry, in addition to domestic customers, are also people from other countries. Since English is an international language, ECS needs to have some well English-speaking staff to communicate properly with this group of customers. Therefore, the English training course emphasized in AP1.

Demand forecasting is an important step for planning in production and service units. By predicting the amount of demand, it is possible to determine the right amount for capacity and avoid an important challenge such as a lack of response to customer demand. As a result, demand forecasting leads to retain customers, gain more market share and finally increase the revenue of an organization. Therefore, AP3 emphasizes demand forecasting and increasing capacity when needed in ECs.

Implementations AP7 has the lowest priorities like AP3 than other action plans. AP7 emphasizes identifying other natural attractions existing in the region that the center is located there. The reason for the lower priority for these action plans is clear. AP7 is not in a good situation in terms of effectiveness and necessity compared to other action plans. For more explanation, its implementation does not have a significant impact on revenue and economic situation, and customer retention which are the main goals of ECs at this time (during Corona time). But its implementation has positive and beneficial effects in the long run for ECs.

6. Conclusions

The Covid-19 pandemic causes many businesses to be severely damaged. One of these businesses is ECs. Managers and owners of ECs attempt to find helpful and effective recovery solutions to move toward better situations during this pandemic. This issue motivated us to study and investigate existing circumstances and situations in this paper and present some suitable action plans as a recovery solution for ECs.

The proposed action plans were determined with the help of tourism experts and face to face interviews with managers of ECs and a poll with people. To prioritize the proposed action plans, four criteria include time, cost, necessity, and effectiveness are considered. Firstly, the weights of each criterion were obtained using the Fuzzy DEMATEL method. Then, they are prioritized by applying the Fuzzy VIKOR method. The obtained results state that AP2 is the optimal solution to be implemented first. AP2 emphasizes performing measures related to standardization. AP6 is the next priority which focuses on developing E-Ecotourism. AP3 and AP7 belong to the last group of compromise solutions and gain the last priorities to be implemented.

It is claimed that the findings of our research not only can help the ECs to proceed through a better situation at this pandemic time but also are useful for other businesses that are close to the ECs. Also, it should be mentioned that the results of this study are not limited to this type of pandemic and they are applicable during other pandemic or especial times. Besides, according to the findings of this study, there are plenty of useful implications for future studies and practices. Further research could also be conducted to determine the capability, efficiency, and effectiveness of the proposed plans in other places.

CRedit authorship contribution statement

Seyyed Mehdi Hosseini: Conceptualization, Data curation, Investigation, Software, Validation, Writing – original draft, Resources. **Mohammad Mahdi Paydar:** Supervision, Methodology, Project administration, Writing – original draft, Formal analysis. **Mostafa Hajiaghahi-Keshteli:** Supervision, Methodology, Visualization, Writing – review & editing.

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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