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Evaluation of Social Media Platforms Using Best-Worst Method and Fuzzy VIKOR Methods: A Case Study of Travel Agency

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Abstract

A correct social media strategy is essential for travel agencies working in today's global market to reach customers. The travel industry is a service-oriented industry, and travel agencies can easily reach their customers on social media by transforming their marketing strategies at no extra costs. There are so many options that a travel agency can use to make itself more visible on social media. However, it is very difficult to choose the most suitable option. From this viewpoint, an analytical framework including BWM and fuzzy VIKOR is presented to find the best social media platforms in this study. First, the weights of nine criteria that were identified by the literature survey and expert interviews were obtained using BWM. Then, these weights were incorporated with fuzzy VIKOR for the ranking of social media platforms. During the implementation phase, the managers of a travel agency in Turkey were supported by the proposed framework for the organization. Results indicated that the cost criterion was the most important criterion (0.189), followed by the audience as the second rank (0.158). The results of the framework show that the proposed methodology is valid and can contribute to improving the decision-making process of enterprises and organizations.

Keywords

BWM, Fuzzy VIKOR, Social media marketing, Tourism industry.

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1. Introduction

The rapid development and change in communication technologies have made the Internet a natural part of daily life, especially in the last ten years. The Internet-based Innovations have influenced the daily life of individuals as well as organizational communication tools. Institutions are required to use these tools and platforms offered by new communication technologies in order to survive and to develop the ability to compete with other organizations (Boon-Long & Wongsurawat, 2015). Social media platforms are important in terms of bringing together large audiences from different divisions to promote products/services and enhance communication between individuals (Kelly, Kerr, & Drennan, 2010).

Institutions have achieved various issues such as marketing, sales, brand image, and customer relations on social networks that are an inevitable return of today's world. With the social media marketing approach, the direction of brand investments has also changed. Even the global brands allocate 90% of their annual expenditures to advertising budgets. Companies have increased investments in advertisements on social media. US companies spent $5.1 billion on social media advertising in 2013, expecting to introduce their products and services (Zhu & Chen, 2015).

Furthermore, social media gives equal opportunities to all of the institutions. Almost every organization, from giants such as Starbucks to local and small companies, has begun to be active in social media and more often share content about the products/services they offer. 368 (74%) of the companies that are listed as the Global 500 actively use their Facebook page (Barnes, Lescault, & Holmes, 2015).

The travel and tourism industry continues to grow steadily despite fluctuations in the global economy. According to a report published by the World Travel and Tourism Council (WTTC), 10.4% of global GDP and 319 million jobs, or 10% of total employment in 2018 in 2018, were generated by the industry (WTTC, 2019). Moreover, industry contribution to GDP is expected to increase by approximately 50% in the next decade. Therefore, decision-makers will need to pay more attention to travel and tourism competitiveness to go abreast this growing market.

Some countries such as Ethiopia, Egypt, and Turkey led the world in Travel and Tourism GDP growth in 2018. After a tough year in

2016, tourism industry experienced a strong recovery in Turkey, and Turkey's tourism industry has got stronger in recent years. Turkey welcomed 45 million foreign visitors in 2019, 14.1 percent up on a year-over-year basis, according to the Culture and Tourism Ministry data. The country's annual tourism revenue rose 17 percent to hit $34.5 billion (Turizm İstatistikleri, 2019).

Today, the Internet and social media are two of the most important communication channels determining the customer's brand awareness. Therefore, these channels are the leading sources used by potential tourists today and have become one of the main sources of online travel information (Dedeoğlu, 2020; Kang, 2018).

Considering the position of social media in the organizational communication tools, the importance of ranking the social media platforms has increased in the eyes of the managers in organizations. On the other hand, parallel to the rapid increase in the number of travel agencies, competition among agencies has increased rapidly. From the potential destinations to the selection of hotels, travelers' purchasing decisions affect tourism marketing from the beginning to the end. More and more people are turning to social networks to get support when planning their upcoming trip. This situation leads agents into an intense client grabbing race. At this point, it is seen that the businesses take part in the social media platforms for creating awareness for travel agencies, attracting potential customers, or communicating directly with their current customers and getting quick feedbacks.

To address this gap, this article aims to develop a methodology by answering the question of how a social media platform selection process should be executed for a travel agency. The objectives of this study are as follows: (1) To establish a methodology to select a social media platform for a travel agency; (2) To define the criteria for the selection of the social media platform; (3) To take advantage of fuzzy linguistic expressions for ranking. In addition, a sensitivity analysis is conducted to get an idea of how the changes in the weight of the criteria might affect the results. In this context, the article is organized as follows.

In the second section, a review of the literature related to social media selection, BWM, and VIKOR methods is presented. In the third section, the explanations of the BWM and fuzzy VIKOR methods are given. In the fourth section, the application of the methodology for a

travel agency is considered. In the last part of the study, suggestions are made about the results and future studies.

2. Literature Review

Social media creates interactive environments in which people and communities share, discuss, and modify with user-generated content. Social media provides the perfect place to find the audience of the companies and turn them into new sales opportunities. This section includes studies on social media selection, social media marketing, and decision-making studies using BWM and VIKOR methods.

Keegan and Rowley (2017) conducted a semi-structured interview with 18 experts working for social media marketing agencies and proposed a six-step framework for social media campaign evaluation. Capatina, Micu, Micu, Bouzaabia, and Bouzaabia (2018) applied qualitative comparative analysis with fuzzy sets for Facebook and addressed the ranking number of fans of 20 accommodation brands. John, Larke, and Kilgour (2018) addressed content analysis on 41 international hospitals in Thailand through focusing on monitoring and evaluating social media use in the marketing of health tourism services. Boon-Long and Wongsurawat (2015) developed a measurement tool to test the impact of consumer reviews on consumer buying decisions on a social media community site. Cox and McLeod (2014) implemented some interviews to identify, analyze, and interpret the experiences of school supervisors using multiple social media tools. Blogs, twitter, social networking sites, podcasts, and online videos were found as effective tools of communication. Ángeles Oviedo-García, Muñoz-Expósito, Castellanos-Verdugo, and Sancho-Mejías (2014) recommended a measurement to assess customer commitment on Facebook. Clark, Black, and Judson (2017) showed why consumers are integrated into a brand community for social media sites by a survey on business students. Menon and Sigurdsson (2016) investigated the effects of online consumers on decision making and the most important features of a fashion company using Facebook. Conjoint analysis results showed that price is the most important factor for consumers in the online shopping environment, followed by warranty, shipping, gallery pictures, order, and size. Galan, Lawley, and Clements (2015) investigated how and why graduate students use social media for educational decision-

making processes and found that students use blogs as well as Facebook and YouTube for searching studies.. Nagle and Pope (2013) carried out a study to improve the selection process and overcome the lack of value understanding in social media. Tavana, Momeni, Rezaeiniya, Mirhedayatian, and Rezaeiniya (2013) proposed an analytical framework for the selection of the social media platform, including the ANP and COPRAS-G methods, and implemented it for one of the largest airlines in the Middle East.

The BWM method proposed by Rezaei (2015) has been used frequently in recent years to obtain the weight of the criteria. Compared to the AHP method, more consistent results can be obtained with BWM that requires fewer data and less pairwise comparison. A linear mathematical model showing how to determine the weights of different criteria in the case of multi-optimality was extended by Rezaei (2016). Researchers have explored the solution of various decision-making problems using the BWM method. Table 1 presents a detailed review of the decision problems addressed by BWM. According to Table 1, there are few case studies in the tourism industry; the studies mainly focus on other industries. Although some Multi-Criteria Decision Making (MCDM) methods have been already applied to different sectors such as furniture, electronic, and food in the literature - to the best knowledge of the authors - a MCDM method for social media platform selection is still in need of further research.

Table 1. A summary of some previous studies on the BWM method

Researcher	Discussed issue	Used Methods	Application
Tian, Wang, Wang, & Zhang (2018)	Evaluation of smart bike-sharing programs	Fuzzy BWM, fuzzy maximizing deviation method, and fuzzy MULTIMOORA	Five smart bike-sharing programs in Changsha
Rezaei, Nispeling, Sarkis, & Tavasszy (2016)	Supplier selection	BWM	A case study in the edible oils industry
Shojaei, Seyed Haeri, & Mohammadi (2018)	Airport's performance evaluation	Taguchi Loss Function, BWM and VIKOR	21 airports in Iran
Torabi, Giahi, & Sahebjamnia (2016)	Risk assessment	BWM	A real service organization in Tehran
Tian, Wang, & Zhang (2018)	Risk priority	fuzzy BWM, relative entropy, and VIKOR	Grinding wheel system of the CNC machine

Table 1. A summary of some previous studies on the BWM method

Researcher	Discussed issue	Used Methods	Application
Abohashem Abadi, Ghasemian Sahebi, Arab, Alavi, & Karachi (2017)	Development strategies for medical tourism	SWOT and BWM	Yazd province of Iran
Gupta (2018)	Green Human Resource Management practices	BWM and fuzzy TOPSIS	Five manufacturing organizations
Cheraghalipour, Paydar, & Hajiaghaei-Keshteli (2018)	Supplier selection	BWM and VIKOR	An agricultural company in Iran
Salimi & Rezaei (2018)	Measuring research and development performance	BWM	A survey among the managers in Netherland
Wan Ahmad, Rezaei, Sadaghiani, & Tavasszy (2017)	Identification of external forces to sustainable supply chain management practices	BWM	Academic experts survey
Omrani, Alizadeh, & Emrouznejad (2018)	Selection of optimal combination of power plants	Taguchi neural network, fuzzy BWM, and TOPSIS	A case study in Iran
Yadav, Mangla, Luthra, & Jakhar (2018)	Development of adoption of offshore outsourcing.	BWM and ELECTRE	12 automotive business organizations
Bonyani & Alimohammadlou (2018)	Proposing a model to evaluate and sort foreign companies	BWM, ELECTRE III, and PROMETHEE II	20 petrochemical contractors
Stević, Pamučar, Zavadskas, Ćirović, & Prentkovskis (2017)	Evaluating the elements of internal transport	Rough SAW and BWM	A manufacturing company
Kheybari, Kazemi, & Rezaei (2019)	Bioethanol facility location selection problem	BWM	Iran
Cheraghalipour & Farsad (2018)	Sustainable supplier selection and order allocation problem	BWM and revised multi-choice goal programming	A firm from automotive industry in Iran
Akbarian-Saravi, Mobini, & Rabbani (2020)	Sustainable bioethanol supply chain	Artificial Neural Network, BWM and multi-objective mixed-integer linear programming model	Province in Iran
Rahimi, Hafezalkotob, Monavari, Hafezalkotob, & Rahimi (2020)	Landfill site selection problem	Geographic ınformation system, BWM and MULTIMOORA	The city of Mahallat in Iran
Yazdi, Komijan, Wanke, & Sardar (2020)	Oil project selection	BWM and WASPAS	A case study in Iran
Kumar, Aswin, & Gupta (2020)	Implementation of green practices in Indian airports	BWM and VIKOR	Five Indian airports

The VIKOR method proposed by Opricovic (1998) is an effective tool for finding a solution between a number of conflicting criteria. A summary list of studies performed with the VIKOR method is shown in Table 2.

Table 2. A summary of some previous studies on the fuzzy VIKOR method

Researcher	Discussed issue	Used Methods	Application
Zhao, Zhao, & Guo (2017)	Evaluation of the benefits of eco-industrial parks	Entropy weight and fuzzy VIKOR	Six eco-industrial parks in China
Li & Zhao (2016)	Performance evaluation of eco-industrial thermal power plants	Fuzzy Analytic Hierarchy Process, Shannon entropy fuzzy GRA-VIKOR	Five eco-industrial thermal power plants in China
Y. Wu, Chen, Zeng, Xu, & Yang (2016)	Supplier selection	Fuzzy VIKOR	The nuclear power plant in China
Z. Wu, Ahmad, & Xu (2016)	CNC machine tool selection	Fuzzy VIKOR	An example from Pakistan
Perçin (2018)	Evaluation of the service quality performance	Fuzzy DEMATEL, ANP, and VIKOR	Five airlines in Turkey
Awasthi, Govindan, & Gold (2018)	global supplier selection	Fuzzy AHP and fuzzy VIKOR	An electronic goods manufacturing company
Razavi Toosi & Samani (2017)	Watershed management	Fuzzy DEMATEL, fuzzy ANP, and fuzzy VIKOR	Five watersheds in Iran
Ali, Razi, De Felice, Sabir, & Petrillo (2019)	Prevention of smog/air pollution	Fuzzy VIKOR	A case study in Pakistan
Dincer & Yüksel (2018)	Performance evaluation of banks	Fuzzy AHP, fuzzy ANP and fuzzy VIKOR	16 Turkish deposit banks
Suganthi (2018)	Sustainable development	Fuzzy AHP, VIKOR, and DEA	A questionnaire with experts
Barak & Dahooei (2018)	Evaluating airline safety efficiency	Fuzzy SAW, Fuzzy TOPSIS, Fuzzy VIKOR, ARAS-F, COPRAS-F, and Fuzzy MULTIMOORA	Iranian airlines
Haji Vahabzadeh, Asiaei, & Zailani (2015)	Analyzing the impact of reverse logistics activities	Fuzzy VIKOR	Survey on reverse logistics options
Beheshtinia & Omidi (2017)	Performance evaluation of banks	AHP, fuzzy TOPSIS and fuzzy VIKOR	Four banks in Iran
Toosi & Samani (2017)	Watershed management	Fuzzy DEMATEL, fuzzy ANP and fuzzy VIKOR	Five watersheds in Iran

In the literature review, no study could be found that has tried to identify and determine the evaluation factors for social media platform selection and to rank the social media platforms in the tourism sector. Studies related to social media have been carried out mainly using survey research with the aim of examining consumer-buying behavior. While MCDM methods are rarely used in the selection of social media platforms, there is no study where a BWM and fuzzy VIKOR integrated approach is used.

3. Methodology

Decision-making is part of peoples' daily lives. In this process, evaluating options for decision-makers can be a waste of time, especially if you need to consider several alternatives associated with their confusing criteria. With the inclusion of social media in marketing processes, the contrast of the content of purchasing processes and the impact of user comments have created a new factor for the decision-making process of new consumers. Therefore, businesses should decide which social media tools would be used and which existing communities would be involved in the creation of marketing activities.

The selection of the social media platform uses the MCDM method as mentioned above and should use this method during the evaluation phase. In this study, an integrated MCDM method based on the combination of BWM and VIKOR methods is used.

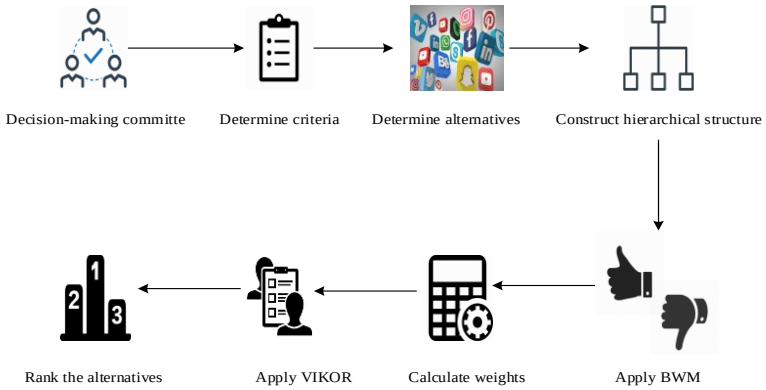

Fig. 1. The steps of the developed methodology

The procedure for ranking the existing platforms is presented in Figure 1. The proposed methodology uses an integrated MCDM approach in order to find the appropriate social media platform for a travel agency. In this method, the evaluation criteria are taken into consideration by literature review, and are narrowed down using experts' judgments. BWM is utilized to determine the priorities of the criteria, while fuzzy VIKOR is used to rank alternatives in terms of each criterion. The methodology is validated by its implementation within a travel agency in Turkey.

The developed methodology consists of three basic steps: the aim of the problem (as it is in every decision-making problem), the evaluation committee, criteria, and alternatives (Step 1); calculating the weights of the evaluation criteria determined by BWM (Step 2), and ranking the platforms (alternatives) using the VIKOR method (Step 3). The steps of the applied method are presented below:

3.1. BWM Method

The BWM consists of five steps that are presented below:

Step 1: A set of decision-making criteria are determined.

The criteria $(C_1, C_2, \cdots, C_n)$ affecting decision-making are identified by expert opinions and literature review.

Step 2: The best (most important, most attractive) and the worst (least significant) decision criteria are determined by the decision maker.

Step 3: Determine the preference of the best criterion over all other ones. For the deterministic case, this is expressed using a scale between 1 and 9. The resulting vector is called the best-to-others vector, and would be:

$A_B = (a_{B1}, a_{B2}, \dots, a_{Bn})$

where; a_{Bj} indicates the preference of the best criterion b over criterion j and in this situation $a_{BB} = 1$.

Step 4: Determine the preference of all other criteria over the worst criteria in the same way using a scale of 1-9. The resulting others-to-worst vector is shown as

$A_W = (a_{W1}, a_{W2}, \dots, a_{Wn})^T$

where; a_{Wj} indicates the preference of the criterion j over the worst criterion w and in this situation $a_{WW} = 1$.

Step 5: Calculate the optimized weights of the criteria as $(w_1^*, w_2^*, \dots, w_n^*)$. To determine the optimal weights, the maximum absolute differences between $\left|\frac{w_B}{w_j} - a_{Bj}\right|$ and $\left|\frac{w_j}{w_W} - a_{Wj}\right|$ for all j is minimized. Considering the non-negativity and sum conditions of weights, the problem can be formulated as follows:

$$\begin{aligned} &\min max_j \left\{ \left| \frac{w_B}{w_j} - a_{Bj} \right|, \left| \frac{w_j}{w_W} - a_{Wj} \right| \right\} \\ &\sum_j w_j = 1 \\ &w_j \geq 0 \text{ for all } j \end{aligned} \tag{1}$$

Model (1) can be transformed into the following problem:

$$\begin{aligned} &min\ \xi \\ &\left| \frac{w_B}{w_j} - a_{Bj} \right| \leq \xi \\ &\left| \frac{w_j}{w_W} - a_{Wj} \right| \leq \xi \\ &\sum_j w_j = 1 \\ &w_j \geq 0 \text{ for all } j \end{aligned} \tag{2}$$

By solving the above (2), the weights and ξ can be obtained.

3.2. Fuzzy VIKOR Method

The VIKOR method used in MCDM focuses on the selection of the most suitable alternative by listing alternatives under contradictory criteria. The steps taken in the VIKOR method are summarized below (Opricovic & Tzeng, 2007).

Step 1: Let us consider a set of m alternatives, a set of n criteria, and a set of k decision makers. The fuzzy decision matrix $\widetilde{D} = [\tilde{x}_{ij}]$ is constructed as follows:

$$\tilde{D} = \begin{array}{c} \\ A_1 \\ A_2 \\ \vdots \\ A_m \end{array} \begin{array}{c} \begin{array}{cccc} C_1 & C_2 & \dots & C_n \end{array} \\ \begin{bmatrix} \tilde{x}_{11} & \tilde{x}_{12} & \dots & \tilde{x}_{1n} \\ \tilde{x}_{21} & \tilde{x}_{22} & \dots & \tilde{x}_{2n} \\ \vdots & \vdots & \dots & \vdots \\ \tilde{x}_{m1} & \tilde{x}_{m2} & \dots & \tilde{x}_{mn} \end{bmatrix} \end{array} \quad \begin{array}{l} i = 1, 2, \dots, m; \ j = 1, 2, \dots, n \\ \tilde{W}_j = \left[\tilde{w}_1, \tilde{w}_2, \dots, \tilde{w}_n \right] \end{array} \tag{3}$$

$$\tilde{x}_{ij}^k = \left(l_{ij}^k, \ m_{ij}^k, u_{ij}^k \right) \quad \tilde{W}_j = \left(\tilde{w}_1, \tilde{w}_2, \cdots, \tilde{w}_n \right)$$

where $\tilde{x}_{ij}^k$ represents the performance rating of alternative A_i with respect to criterion C_j evaluated by k^{th} expert. The aggregated fuzzy ratings ($\tilde{x}_{ij}$) of alternatives with respect to each criteria is obtained employing the below equation:

$$l_{ij} = \min_k \left(l_{ij}^k \right), \ m_{ij} = \frac{1}{K} \sum_{k=1}^{K} m_{ij}^k, u_{ij} = \max_k \left(u_{ij}^k \right) \tag{4}$$

Step 2: The fuzzy decision matrix is defuzzified to crisp values. This calculation is done using the following equation:

$$a = \frac{l + 4m + u}{6} \tag{5}$$

Step 3: Determine the best f_j^* and the worst f_j^- values of all criterion functions $j = 1, 2, .., n$. If the criterion j is a benefit:

$$f_j^* = \max_i x_{ij} \qquad f_j^- = \min_i x_{ij} \tag{6}$$

Step 4: Compute S_i and R_i values, $i = 1, 2, \dots, m$ by the relations,

$$S_i = \sum_{j=1}^{n} w_j \left(f_j^* - x_{ij} \right) / \left(f_j^* - f_j^- \right) \tag{7}$$

$$R_i = \max_j \left[w_j \left(f_j^* - x_{ij} \right) / \left(f_j^* - f_j^- \right) \right] \tag{8}$$

Step 5: Compute Q_i values by the relation,

$$Q_i = q\frac{\left(S_i - S^*\right)}{S^- - S^*} + (1-q)\frac{\left(R_i - R^*\right)}{R^- - R^*} \quad (9)$$

where $S^* = \overset{min}{i} S_i$; $S^- = \overset{max}{i} S_i$; $R^* = \overset{min}{i} R_i$; $R^- = \overset{max}{i} R_i$ ve q is introduced as a weight for the strategy of maximum group utility, whereas, $(1-q)$ is the weight of the individual regret.

Step 6: Rank the alternatives, sorting them by the values S, R, and Q in ascending order.

Step 7: Propose as a compromise solution the alternative ($A^{(1)}$) which is best ranked by the measure Q (minimum) if the two conditions are satisfied (Perçin, 2018).

4. Results of Real Case Application

Implementation of the proposed methodology is carried out using a travel agency that has been operating in Turkey since 2005. It is aimed to obtain a ranking of social media platforms for the company that has special agreements with many hotels, holiday villages, and airline companies producing many tour package options including domestic and international travel.

In the process of determining criteria and alternatives, which are the basic elements of the decision-making, various meetings were held with the managers of the company and the experts working in the communication unit. The criteria obtained from the literature review were reviewed with the experts and the following nine criteria were determined as a result of these meetings.

There are some options to consider, including the alternatives identified with the experts, namely Facebook (A1), Linkedin (A2), Instagram (A3), Twitter (A4), and Youtube (A5) from among the social media platforms. After determining the alternatives and the criteria, the hierarchical structure of the model was decided upon, as shown in Figure 2, in order to select the appropriate social media platform.

Table 3. A brief explanation of assessment criteria

Criteria	Description
Length (C1)	Because long and unnecessary shares affect readers negatively, They do not provide feedback to the brand or institution. Thus, the ideal length of the published content should be analyzed correctly.
Content (C2)	Any content to be shared on social media should be creative and original, attracting the attention of users.
Popularity (C3)	If companies cannot find new ways to interact with customers and continue their development on the right and popular social media platforms, they will not increase the number of users who are effective in social media marketing.
Analytics & reporting (C4)	Unlike traditional marketing methods, social media marketing offers measurable and reportable results.
Security (C5)	Social media security is more important than ever with the amount of information stored and shared online.
Cost (C6)	The social media platform chosen for the social media marketing campaign is one of the most important factors affecting advertising cost.
Audience (C7)	The delivery of the right things to the right person with the right platform is carried out more effectively in this way.
Easy to Use (C8)	Good social media marketing tools are not only easy to get used to, but also easy to learn and potentially spread in an organization.
Customer Service (C9)	Customer service should reply transmitted and received related messages and requests quickly.

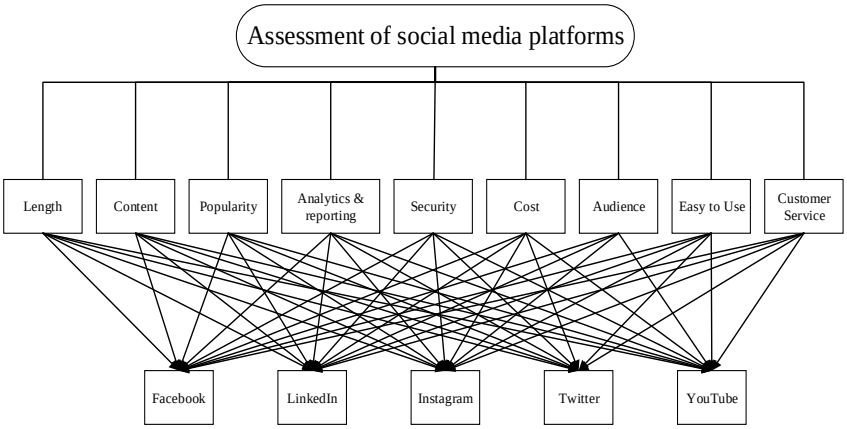

Fig. 2. Hierarchy of social media platform selection

4.1. Determination of Criteria Weights by BWM

The weights of criteria were obtained by the BWM method after the order was established. For this purpose, a questionnaire was prepared to identify the best and the worst criteria for BWM method. The created questionnaire was answered by 10 experts. Using a nine-point Likert scale (1: very low to 9: very high), each expert expressed the preference of his/her best criterion over all other criteria and the preference of all other criteria over the worst criterion. The experts' linguistic preferences are shown in Table 4.

Table 4. Comparative results obtained from the experts

		Criteria										Criteria								
Experts	**Best**	**C1**	**C2**	**C3**	**C4**	**C5**	**C6**	**C7**	**C8**	**C9**	**Worst**	**C1**	**C2**	**C3**	**C4**	**C5**	**C6**	**C7**	**C8**	**C9**
1	C6	7	7	5	6	3	1	5	8	7	C1	1	3	5	5	7	9	5	3	5
2	C5	3	4	5	7	1	4	2	9	3	C8	7	6	5	6	9	6	8	1	5
3	C3	2	2	1	3	3	4	3	3	3	C4	2	3	2	1	4	2	2	2	4
4	C6	5	5	3	7	3	1	7	7	6	C1	1	4	5	3	8	7	6	5	4
5	C5	5	8	3	3	1	3	4	6	5	C2	2	1	4	3	5	8	6	4	7
6	C7	9	6	5	7	4	4	1	5	6	C4	6	4	6	1	3	5	8	4	3
7	C6	9	7	6	4	8	1	3	9	5	C4	9	2	3	1	2	2	3	3	6
8	C5	2	4	2	2	1	2	3	3	6	C9	4	3	4	2	3	3	3	5	1
9	C3	2	5	4	3	6	1	2	7	7	C4	7	2	2	1	2	4	4	3	3
10	C6	6	3	2	8	5	1	4	9	5	C8	2	5	8	2	3	9	4	1	4

After making a comparison of the preferences for all criteria, the results of the evaluation were modeled using Equations (1) and (2), and weights were calculated using the GAMS program. The results of the BWM solutions of 10 experts are given as follows:

Table 5. Criteria weights obtained with BWM

Experts	C1	C2	C3	C4	C5	C6	C7	C8	C9	ζ
1	0.035	0.066	0.093	0.077	0.155	0.356	0.093	0.058	0.066	0.109
2	0.117	0.088	0.070	0.050	0.272	0.088	0.176	0.022	0.117	0.079
3	0.146	0.146	0.195	0.049	0.098	0.073	0.098	0.098	0.098	0.098
4	0.034	0.090	0.150	0.064	0.150	0.309	0.064	0.064	0.075	0.140
5	0.078	0.029	0.129	0.129	0.266	0.129	0.097	0.065	0.078	0.123
6	0.051	0.077	0.092	0.034	0.115	0.115	0.348	0.092	0.077	0.111
7	0.052	0.078	0.094	0.030	0.117	0.117	0.340	0.094	0.078	0.129
8	0.134	0.067	0.134	0.134	0.185	0.134	0.089	0.089	0.034	0.082
9	0.185	0.074	0.093	0.044	0.062	0.251	0.185	0.053	0.053	0.120
10	0.061	0.123	0.184	0.046	0.074	0.317	0.092	0.029	0.074	0.052
Average	0.089	0.084	0.123	0.066	0.149	0.189	0.158	0.066	0.075	

In this study, the maximum consistency ratio is obtained as 0.123, so it can be concluded that the consistency results are acceptable (Rezaei, 2016). The final results are shown on the last line of Table 5 using arithmetic mean to reduce the criteria weights obtained according to expert opinions to a single value. The most important criterion is the cost (0.189), followed by the audience criterion with the weight ratio of 0.158. Although connecting with customers is less costly (Nagle & Pope, 2013), the cost criterion is still the most important criterion for the travel agency. Nagle and Pope (2013) point out that the primary sources of value creation on social media for non-profit projects stem from efficiency and innovation. Unlike non-profit organizations, the cost criterion for the tourism industry can lead to more damage for companies.

4.2. Ranking the Alternatives by Fuzzy VIKOR Method

Among the alternatives, the most preferred social media platform was selected using the fuzzy VIKOR method. Using the linguistic variables given in Table 6, expert opinions of ten decision-makers were used to evaluate alternatives according to the selected criteria. The ratings are given in Table 7. These evaluations were first converted to triangular fuzzy numbers, and then the aggregated fuzzy ratings ($\tilde{x}_{ij}$) of the alternatives with regard to each criteria could be computed according to Equation (4). Take fuzzy rating of A1 as an example with respect to criterion C1 as an example (the rating is (VG,G,G,G,F,F,G,G,G,VG)):

$$\tilde{x}_{11} = \left(l_{11}, m_{11}, u_{11}\right)$$

$$l_{11} = \min_k \left(l_{11}^k\right) = \min_k \left(7,5,5,5,3,3,5,5,5,7\right) = 3$$

$$m_{11} = \frac{1}{K}\sum_{k=1}^{K} m_{11}^k = \frac{1}{10}\left(9+7+7+7+5+5+7+7+7+9\right) = 7$$

$$u_{11} = \max_k \left(u_{11}^k\right) = \max_k \left(9,9,9,9,7,7,9,9,9,9\right) = 9$$

Therefore, $\tilde{x}_{11} = (3,7,9)$.

Similarly, the fuzzy ratings of the remaining alternatives could also be calculated, and the results are given in Table 8. For instance, the crisp value for $\tilde{x}_{11}$ is calculated using Equation (5).

$$a = \frac{3 + 4.7 + 9}{6} = 6.667$$

Similarly, other crisp ratings of alternatives in terms of criteria were calculated, and the results are given in Table 8.

Table 6. Linguistic ratings for alternatives

Linguistic variable	Corresponding triangular fuzzy number
Very Poor (VP)	(1, 1, 3)
Poor (P)	(1, 3, 5)
Fair (F)	(3, 5, 7)
Good (G)	(5, 7, 9)
Very good (VG)	(7, 9, 9)

Table 7. Evaluation of decision-makers for the alternatives

	Alternatives	Decision makers									
		DM1	DM2	DM3	DM4	DM5	DM6	DM7	DM8	DM9	DM10
C1	A1	VG	G	G	G	F	F	G	G	G	VG
	A2	F	G	G	F	P	F	F	G	VG	G
	A3	VG	VG	VG	G	G	G	VG	G	G	G
	A4	F	G	F	F	P	P	G	F	G	G
	A5	G	P	F	P	VP	VP	P	F	F	P
C2	A1	G	VG	VG	F	F	G	P	F	F	G
	A2	G	G	G	G	P	P	VG	F	F	F
	A3	G	VG	G	VG	VP	VG	P	G	P	F
	A4	P	VP	VP	G	F	P	P	G	P	F
	A5	F	G	G	F	G	F	F	VG	VG	VG
C3	A1	G	G	G	VP	VG	F	F	VP	G	VP
	A2	F	G	P	VG	P	G	VP	G	VP	VG
	A3	VG	G	G	VP	P	VG	P	VG	G	F
	A4	F	P	F	VG	P	VP	F	P	VP	F
	A5	F	VG	G	VP	G	VG	VG	VP	VP	F
C4	A1	F	F	G	VP	VP	P	VG	F	G	VP
	A2	VP	P	F	VG	P	VP	VG	P	VG	G
	A3	VP	G	P	F	F	F	F	G	G	P
	A4	VP	P	VP	P	F	VG	VG	VG	VP	G
	A5	G	VP	P	VG	F	F	F	VP	G	VP
C5	A1	F	F	F	F	VG	G	VG	VG	VG	G
	A2	F	P	P	G	P	VP	G	F	G	G
	A3	G	G	F	F	P	VG	G	P	F	P
	A4	P	F	P	VG	P	VP	G	G	P	P
	A5	F	P	F	P	F	P	F	P	VP	VG
C6	A1	P	P	VP	VP	P	G	VP	F	G	VG
	A2	P	P	P	VP	G	VP	VP	F	VG	G
	A3	G	G	F	VG	G	VG	G	G	F	VG
	A4	F	P	P	G	VG	VP	G	F	F	G
	A5	G	G	G	F	G	G	VG	VP	F	G

Table 7. Evaluation of decision-makers for the alternatives (Continiud)

	Alternatives	Decision makers									
		DM1	DM2	DM3	DM4	DM5	DM6	DM7	DM8	DM9	DM10
	A1	F	F	P	VP	G	G	G	F	G	G
	A2	F	P	F	F	VP	P	P	VG	G	G
C7	A3	G	F	VG	F	F	VG	P	VG	VG	P
	A4	G	F	F	F	F	F	P	F	G	F
	A5	P	G	F	P	G	P	VG	VP	P	VP
	A1	VG	F	VG	VG	VP	VP	VP	G	F	P
	A2	G	F	G	P	F	G	VG	VP	VG	G
C8	A3	G	F	VG	F	P	P	VG	F	VP	VP
	A4	P	VG	G	VP	VP	VG	F	VP	VG	VP
	A5	F	P	G	P	VG	F	VP	P	P	G
	A1	F	G	G	F	G	VG	G	G	F	G
	A2	P	VP	P	VG	P	P	P	VP	VG	VG
C9	A3	F	F	G	VP	VP	F	F	P	G	G
	A4	F	G	P	G	VP	G	G	G	VP	G
	A5	P	F	G	VG	F	VG	G	VG	F	VP

Table 8. Aggregated evaluations for the alternatives

	Aggregated fuzzy ratings					Crisp ratings				
	A1	A2	A3	A4	A5	A1	A2	A3	A4	A5
C1	(3,7,9)	(1,6,9)	(5,7.8,9)	(1,5.4,9)	(1,3.6,9)	6.667	5.667	7.533	5.267	4.067
C2	(1,6.2,9)	(1,5.8,9)	(1,6,9)	(1,3.8,9)	(3,6.8,9)	5.800	5.533	5.667	4.200	6.533
C3	(1,5,9)	(1,5.2,9)	(1,6,9)	(1,4,9)	(1,5.4,9)	5.000	5.133	5.667	4.333	5.267
C4	(1,4.4,9)	(1,5,9)	(1,4.8,9)	(1,4.8,9)	(1,4.4,9)	4.600	5.000	4.867	4.867	4.600
C5	(3,7,9)	(1,4.8,9)	(1,5.4,9)	(1,4.4,9)	(1,4.2,9)	6.667	4.867	5.267	4.600	4.467
C6	(1,4,9)	(1,4,9)	(3,7.2,9)	(1,5.2,9)	(1,6.2,9)	4.333	4.333	6.800	5.133	5.800
C7	(1,5.4,9)	(1,4.8,9)	(1,6.4,9)	(1,5.2,9)	(1,4.2,9)	5.267	4.867	5.933	5.133	4.467
C8	(1,5,9)	(1,6,9)	(1,4.8,9)	(1,4.6,9)	(1,4.6,9)	5.000	5.667	4.867	4.733	4.733
C9	(3,6.6,9)	(1,4.4,9)	(1,4.6,9)	(1,5.2,9)	(1,6,9)	6.400	4.600	4.733	5.133	5.667

Based on the values given in Table 8, Equation (6) is used to give in the best (f_j^*) and the worst (f_j^-) values for each criterion, while S_i and $R_i$values for the five social media platforms are calculated with the help of equations (7) and (8). Then, Q_i values are determined using Equation (9). Note that $q = 0.5$. S, R, and Q values are sorted in ascending order and three ranking lists have been created for social media platforms. The results of ranking of social media platforms by evaluations are shown in Table 9.

Table 9. Ranking the results of social media platforms with the VIKOR method

	Q		S		R	
Alternatives	**Value**	**Rank**	**Value**	**Rank**	**Value**	**Rank**
A1	0.716	2	0.484	2	0.189	4
A2	0.870	5	0.634	3	0.189	4
A3	0.000	1	0.274	1	0.095	1
A4	0.741	3	0.761	5	0.140	2
A5	0.747	4	0.673	4	0.158	3

Based on the obtained Q values, the order of alternatives is determined as $A3 > A1 > A4 > A5 > A2$. The most suitable alternative platform for social media expenditures is found to be A3 (Instagram). The alternative A3 fulfills the requirements of both condition 1 and condition 2; $Q(A3) - Q(A1) > {}^{1}/_{(5-1)}$ A3 is also best ranked by S ve R values.

4.3. Sensitivity Analysis

In this study, sensitivity analysis was applied to show how the ranking of social media platforms changed when the weights of the criteria were altered. In order to carry out this process, the value in a criterion was varied from as low as 0 to as high as 1 with a 0.5 increment, and the value of the other criteria was evenly distributed. A total of 27 experimental sets were established to evaluate the impact of weights on the ranking alternatives. Figure 3 presents the sensitivity analysis results for 27 experimental sets. In addition, the order of the alternatives was examined by changing the q values from 0.1 to 1 with 0.1 steps, and the results in Figure 4 are obtained.

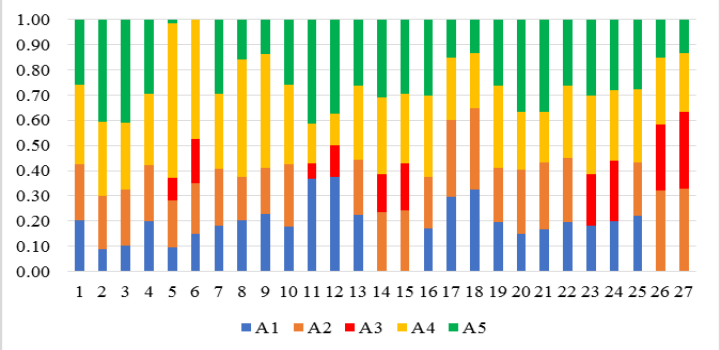

Fig. 3. The results of the sensitivity analysis

Considering the sensitivity analysis results, A3 is the first rank in 17 of the 27 test sets. The A3 (Instagram) alternative is not much affected by the changes in weights and A3 is the most appropriate alternative for advertising expenses. However, when the weight of the criteria C2, C4, C5, C8, and C9 is increased, the first rank changes. The A3 alternative gives the first rank to other alternatives. The first rank changes as a result of the changes in the weight of the criteria and the high scores taken by the alternatives under the relevant criteria. For example, if the weight of the C2 criteria increases, A5 alternative gets the first rank. Accordingly, decision-makers will be able to change their investment preferences according to the importance of weights. The results obtained show that ranking between alternatives is very sensitive to changes in weight of evaluation criteria.

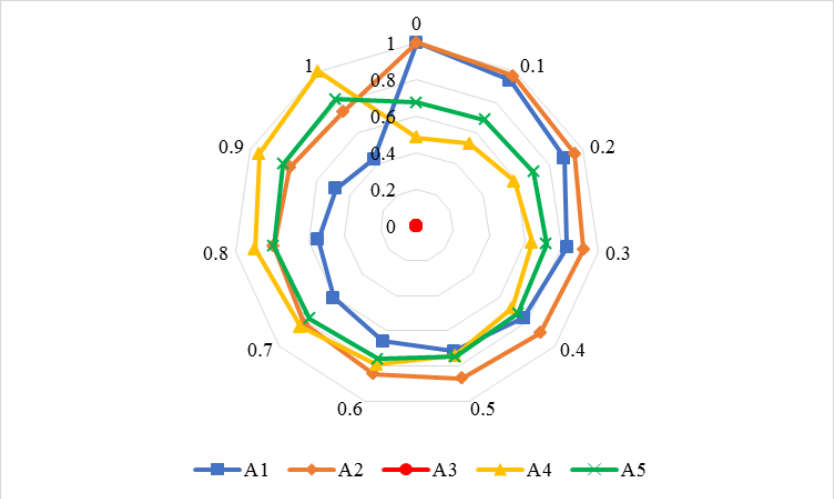

Fig. 4. Effect of changing maximum group utility on the ranking

When the maximum group benefit is changed from 0 to 1, the rankings of alternatives for social media platforms are generally obtained as $A3 > A1 > A4 > A5 > A2$.

5. Conclusions

The importance of social media has increased rapidly and so, the Internet and social networks are settled on the center of daily life. In

order to be successful in terms of today's businesses concepts such as communication technologies, socialization, customer satisfaction, customer relationship management, etc. the use of social media has become inevitable. As a result of the intensive use of new communication technologies and platforms by the target groups, which are the focal point of the communication activities carried out by the institutions, the actors of corporate communications have also taken a favorable position according to this change.

Social media platforms can be used as one of the most important channels of participation to improve relationships with customers (Kim & Park, 2017). Companies are not the only ones that understand the power of social media. Governments and public institutions cannot ignore the use of social media tools (Cox & McLeod, 2014). Thus, the impact of social media on purchasing decisions is not overlooked in the tourism sector as in many other sectors. In the light of this information, the most appropriate social media platform for investment should be redesigned according to the viewpoint of experts under contradictory criteria. The proposed methodology in this case study provides evidence to support the features of Keegan and Rowley's (2017) frameworks. The methodology is used to determine the importance of the criteria that will affect the selection of social media platforms and to establish a ranking among the determined platforms. The first stage of the proposed methodology is to define the criteria affecting the selection of social media platforms and to narrow them down according to the expert opinion and literature. Then, the weight of the evaluation criteria determined by the BWM method followed by the VIKOR method is applied to obtain a ranking of the alternatives. This method is applied to a real-world problem for a travel agency. The A3 alternative (Instagram) is obtained as the best alternative for the selection of social media platforms based on the specified criteria. The rankings of social media platforms may differ from previous studies. For example, Clark, Black, and Judson (2017) found that the most visited frequently four platforms are Twitter, Instagram, Facebook, and Pinterest. According to Tavana et al. (2013), the content criterion was found the most important criterion in the evaluation of social media platforms, and Facebook was selected as the most suitable social media platform. Galan, Lawley, and

Clements (2015) identified Facebook and YouTube as the predominant social media platforms for postgraduate international students. According to Stelzner (2013), the ranking of the social media platforms for marketers in descending order was determined as Facebook and LinkedIn.

This study shows the main factors related to the application of MCDM methods in the selection of social media platform. Accordingly, the results may be a starting point for other theoretical and empirical studies. As another research perspective, the various applications of social media marketing in decision-making can be addressed using the proposed solution methodology.

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