

Multi-criteria ranking of available forms of promotional activities: a case analysis

Вишекритеријумско рангирање расположивих облика промотивних активности: анализа случаја

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Abstract: This paper presents an analysis of the case of multicriteria choice of promotion form for a product group, in one large retail chain. The following forms of promotion were available: commercial propaganda, personal selling, sales promotion, publicity, public relations and direct marketing. The selection was made on the basis of five criteria: the effects of a given form of promotion, the costs of a given form of promotion, the compliance of a given form of promotion with consumer preferences, the appropriateness of a given form of promotion in relation to the promotion of competition and the engagement of human resources for a given form of promotion. The problem of multicriteria analysis was solved with the VIKOR method. The initial decision table and criteria weights were determined using the expert method, in which the opinions of ten experts from the observed company were taken. In this way, subjectivity in these initial procedures is reduced. The final conclusion is that in the promotion of the analyzed product group, publicity should be used to the fullest extent possible, economic propaganda should be applied in accordance with financial possibilities, and most attention and energy should be directed towards sales promotion activities.

Keywords: Promotion forms, Multi-criteria analysis, Expert method, VIKOR method, Case analysis.

JEL classification: M37, C81.

Сажетак: У овом раду приказана је анализа случаја вишекритеријумског избора облика промоције за групу производа, у једном великом трговинском ланцу. На располагању су били следећи облици промоције: привредна пропаганда, лична продаја, унапређење продаје, публицитет, односи с јавношћу и директни маркетинг. Избор је вршен на бази пет критеријума: ефекти датог облика промоције, трошкови датог облика промоције, усаглашеност датог облика промоције са преференцијама потрошача, примереност датог облика промоције, у односу на промотивно деловање конкуренције и ангажованост

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људских ресурса за дати облик промоције. Постављени проблем вишекритеријумске анализе решаван је помоћу методе ВИКОР. Почетна табела одлучивања и тежине критеријума одређени су помоћу експертне методе у којој су узета мишљења десет експерата из посматраног предузећа. На овај начин, смањена је субјективност у овим почетним поступцима. Коначни закључак гласи: у промоцији анализираних група производа, публицитет треба максимално користити уколико постоји, привредну пропаганду треба примењивати у складу са финансијским могућностима, а највише пажње и енергије треба усмерити ка активностима унапређења продаје.

Кључне речи: Облици промоције, вишекритеријумска анализа, експертна метода, метода ВИКОР, анализа случаја.

JEL класификација: M37, C81.

Introduction

In today's business environment, businesses need to be more flexible and have to adapt their structures and brands faster to changing social, market and technological trends while maintaining the true nature of their company. Authenticity is the biggest capital in a situation of increasing transparency of information on the web (Kotler, Kartajaya, & Setiawan, 2017). In the sphere of marketing, innovative marketing plays a particular role and importance (Son, Sadachar, Manchiraju, Fiore, & Niehm, 2012; Prahalad & Ramaswamy, 2004; Muangkhrot & Ussahawanitchakit, 2015). The key effects of innovative marketing are: increasing labor productivity, the emergence of new business models, the creation of "new" jobs, new communication systems, higher protection at work, higher competitiveness, promotion of PR and brand (Schlechtendahl, Keinert, Kretschmer, Lechler, & Verl, 2015; Hall & Trivin, 2018; Müller & Däschle, 2018; Wollschlaeger, Sauter, & Jasperneite, 2017).

However, regardless of current marketing trends, some basic dilemmas and activities in practical terms always remain. One such activity is the implementation of appropriate forms of promotion for a particular product/service or product/service group. Prior to the implementation of particular forms of promotion, it is necessary to define and consider them, and this practically means making a decision on the choice of promotion forms, which are best suited to the case.

In this paper, the problem of multicriteria analysis of available forms of promotion is solved, for the purpose of ranking and defining the most favorable actions for promotion of a certain group of products, in one domestic company. Here, because of the confidentiality of the data, it is not stated which company it is, but it can be said that it is a large retail chain. What is important is the presentation of possibilities for solving this specific, as well as other similar problems in the process of selecting and defining promotional activities in business organizations.

At the beginning, the available actions were defined, namely the following forms of promotion: 1. Commercial propaganda, 2. Personal sales, 3. Sales promotion, 4. Publicity, 5. Public relations, 6. Direct marketing (Đorđević & Čočkaló, 2004; Nikolić, 2012b). Then, the criteria based on which choices are made are defined: (1) Effects of a given form of promotion, (2) Costs of a given form of promotion, (3)

Consistency of a given form of promotion with consumer preferences, (4) Suitability of a given form of promotion, in relation to the promotional activities of competitors and (5) Human resources engagement for a given form of promotion. When defining the criteria, experts from the observed company (employed in marketing function) were consulted. They have knowledge and experience in marketing, promotional activities and public relations.

The first part of solving this practical problem is to apply the expert method. Ten experts from the observed company expressed their opinion on the decision problem. Specifically, the experts gave ratings of each available action against each criterion, and also provided their own assessment of the weights of the criteria in the model. When defining attributes in the initial decision matrix, the experts took into account some general principles of ranking of particular forms of promotion (Kotler & Armstrong, 1996; Milisavljević, 2001; Đorđević & Čočkalović, 2004), as well as their experience and the specifics of the case.

Then, the average values of each stock according to each criterion were determined as well as the average values of the criterion weights. This approach can also be understood as group decision making in parallel form (Dufner, Hiltz, Johnson, & Czech, 1995; according to Čupić, Tummala, & Suknović, 2001). This form of group decision-making involves the quantitative determination of the result of individual opinions, which can be done at the end of application of the method (each group member performs the procedure until the end, and then finds the resultant of these final solutions) or partially, after individual steps in the applied method (each group member do a certain phase of the method, and then find the resultant, which goes with the further calculation) (Nikolić, 2012a). The second case was used in this paper: the experts expressed opinions at the beginning, the result of these opinions (average values) was immediately found, and the further calculation was continued with the initial values thus obtained, without additional subjectivity until the end of the procedure.

The problem of multicriteria analysis was solved using the VIKOR method (Opricović, 1986; Opricović & Tzeng, 2004). This method was chosen to solve a given case, for two reasons. First, the VIKOR method can very well take advantage of the fact that the values in the initial decision table are obtained by the expert method: it enables accurate and objective calculation with the average values thus obtained. In essence, in the VIKOR method, subjectivity exists when forming an initial decision matrix, as well as when assigning weights to criteria. These two phases are made more objective precisely by the expert method, and the further procedure contains no subjectivity. Second, the VIKOR method, as a solution, provides a set of compromise solutions. This is appropriate in this case, because it is not necessary to choose only one form of promotion: applying one form of promotion does not exclude the possibility of using other forms of promotion. It is possible that the solution involves

several actions in the set of compromise solutions, which can be a significant guideline for reaching a final decision.

1. Multicriteria analysis

1.1. Introduction to multicriteria analysis

The complexity and complexity of business decision-making often requires a multi-criteria model, that is, a multi-criteria base, as a prerequisite for objective selection and choice of alternative solutions (Radojičić & Žižović, 1998). It is clear that the area in which strategic and other decisions are made in an enterprise generally requires the application of multicriteria decision-making methods (Nikolić, 2012a). Multi-criteria decision-making (MCDM) refers to decision-making situations when there are a number of, most often conflicting, criteria (Čupić, Tummala & Suknović, 2001). Ranking alternatives by multiple criteria at the same time contributes to the reality of dealing with such situations.

Multicriteria analysis has been used successfully in various fields of human activity. This is evidenced by numerous references related to the diverse application of multicriteria analysis, for example: evaluating the economic performance of fishing systems (Romeo & Marciànò, 2019), evaluating a portfolio of projects in state-owned energy companies (Hernandez-Perdomo, Mun, & Rocco, 2017), assessment of likely future scenarios under different drivers of land use change (Martínez-Sastre, Ravera, González, López Santiago, Bidegain, & Munda, 2017), testing the differences between Integrated Pest Management (IPM) strategies in pome fruit across Europe (Caffi, Helsen, Rossi, Holb, Strassemeyer, Buurma, Capowiez, Simon, & Alaphilippe, 2017), identifying the highest and best use for historic buildings (Ribera, Nesticò, Cucco, & Maselli, 2020), evaluating the sustainability of conservation agriculture (Craheix, Angevin, Doré, & de Tourdonnet, 2016), analysis of barriers to the adoption of autonomous vehicles (Raj, Kumar, & Bansal, 2020). It can be noted that the references are more recent, which indicates that multicriteria analysis does not in the least lose its relevance, application and importance.

1.2. The VIKOR method

The VIKOR (Multiple Criteria Ranking) method is a very commonly used multi-criterion ranking method, suitable for solving various decision problems. In writing this point, reference has been significantly used (Nikolić, 2012a). The VIKOR method was developed based on elements from compromise programming. The method starts from the “boundary” forms of the L_p metric (Opricović, 1986). Looking for the solution closest to the ideal. The following metric is used as a measure of the distance from the ideal point:

$$L_p(F^*, F) = \left\{ \sum_{j=1}^n [f_j^* - f_j(x)]^p \right\}^{\frac{1}{p}}, \quad 1 \leq p \leq \infty$$

This metric represents the distance between the ideal point F^* and the point $F(x)$ in the space of criterion functions (Opricović, 1986). Minimizing this metric determines the compromise solution. The following tags are used in the VIKOR method:

- m - number of actions,
- i - the ordinal number of the action, $i = 1, 2, \dots, m$,
- n - number of criteria,
- j - ordinal number of criteria, $j = 1, 2, \dots, n$,
- f_{ij} - the value that the i th action realizes for the j th criterion function,
- w_j - weight of the j th criterion function,
- v - the weight of the strategies to satisfy most criteria,
- Q_i - a measure for multi-criteria ranking of the i^{th} action.

For each action there is a value of Q_i , and then an action is selected at which this value is the smallest (the least distance from the “ideal” point). The measure for multicriteria ranking of the i th action (Q_i) is calculated by the expression:

$$Q_i = v \cdot QS_i + (1 - v) \cdot QR_i,$$

where is:

$$QS_i = \frac{S_i - S^*}{S^- - S^*}; \quad QR_i = \frac{R_i - R^*}{R^- - R^*}$$

By calculating QS_i , QR_i , and Q_i sizes for each action, three independent rankings can be formed. Q_i size represents the establishment of a compromise ranking list combining QS_i and QR_i sizes. By choosing a smaller or larger value for v , the decision maker can favor the influence of QS_i size or QR_i size in the compromise rankings. The labels used have the following meaning:

$$S_i = \sum_{j=1}^n w_j \cdot \frac{f_j^* - f_{ij}}{f_j^* - f_j^-} = \sum_{j=1}^n w_j \cdot d_{ij}, \quad i = 1, 2, \dots, m$$

$$R_i = \max_j w_j \cdot \frac{f_j^* - f_{ij}}{f_j^* - f_j^-} = \max_j w_j \cdot d_{ij}, \quad i = 1, 2, \dots, m$$

$$S^* = \min_i S_i; \quad S^- = \max_i S_i; \quad R^* = \min_i R_i; \quad R^- = \max_i R_i$$

$$f_j^* = \max_i f_{ij}, \quad j = 1, 2, \dots, n$$

$$f_j^- = \min_i f_{ij}, \quad j = 1, 2, \dots, n.$$

Action a_i is better than action a_k , by the j^{th} criterion, if:

- $f_{ij} > f_{kj}$ (for $\max f_j$, or when the criterion has a maximum requirement),
- $f_{ij} < f_{kj}$ (for $\min f_j$, or when the criterion has a minimum requirement)

The action a_i is better than the action a_k (in total, according to all criteria), if: $Q_i < Q_k$. The relevant ranking list by VIKOR method is the compromise rank list for the value $v = 0,5$. In order for an action to be adopted as the best, according to the VIKOR method, it must be first on the compromise rank list and meet two conditions (U1 and U2).

2. Multicriteria analysis of promotional activities by example

2.1. The problem of multicriteria analysis

Defining the problem of multicriteria analysis involves identifying and adopting a list of available actions, as well as the criteria on which to make a choice. In this section, experts from the observed company were also consulted, as well as existing literature, for example (Đorđević & Čočkaló, 2004; Nikolić, 2012b). The experts are employed in the marketing function of the observed company.

For the promotion of the observed product group, in the observed company, the following forms of promotion are available (these are also actions in this multicriteria analysis problem):

a_1 - Commercial propaganda. Advertising is also called economic or commercial propaganda. Propaganda is a paid means of mass communication with consumers. Economic propaganda has three main goals: to inform, persuade and remind. The key strength of propaganda is that it addresses a wide audience. According to Gordon (2011), The Institute of Practitioners in Advertising (IPA), as a professional institute for leading UK advertising agencies, defines advertising as follows: Advertising presents the most persuasive sales messages for products or services at the lowest possible cost.

a_2 - Personal sale. Personal selling is a form of promotion that involves direct contact between businesses and customers. This is where the personal contact of the seller and the buyer occurs. Under such conditions, sales talk is being held and the chances of a sale being increased. The goal is to increase sales volume.

a_3 - Sales promotion. Sales promotion covers all activities (except propaganda, personal selling and publicity) that further stimulate sales. These include: various

exhibitions, presentations, exhibitions, demonstrations, sweepstakes, sales campaigns and more.

a₄ - Publicity. Publicity is the publication of positive (but also negative) information about an organization, which is not funded by the company. The emphasis is on information, not persuasion. It is used to create or increase affection for the company. The main advantages of publicity (especially in relation to economic propaganda) are the following: the placement of information in the most important media, in the hit points, at the time of impact and not paid (although there are costs of preparing the material for publication).

a₅ - Public relations. Generally, there are the following similarities between marketing and public relations. They: (a) deal with the organization's connections and use similar communication tools in addressing the public; (b) have the primary task of ensuring the success of the organization and its economic survival (Wilcox & Cameron, 2009). According to the same authors, the main difference between marketing and public relations is that marketing is focused on customers and sales of products and services, and public relations takes care of building relationships and creating goodwill in public for the organization (Wilcox & Cameron, 2009). Similarly, Grunig (1992) states a clear distinction between marketing and PR: marketing should communicate with markets related to an organization's products and services, and PR should care for all the organization's publics.

a₆ - Direct marketing. Direct marketing is the direct communication with the target segments. Communication is done through various media, but the most commonly used are email, telephone and online communication over the Internet. He interacts directly with the consumer, the individual, so that he or she can talk directly through the conversation through answering questions.

The criteria on the basis of which the above actions are ranked (for promotion of the observed product group, in the observed company) are as follows:

- f₁ - Effects of a given promotion form,
- f₂ - Cost of a given promotion (minimum requirement),
- f₃ - Consistency of a given form of promotion with consumer preferences,
- f₄ - The suitability of a given form of promotion in relation to the promotional activities of competitors and
- f₅ - Human resources engagement for a given form of promotion (minimum requirement).

2.2. Defining Initial Decision Conditions - Expert Method

The next step is to define the initial decision conditions. Initial decision conditions involve evaluating each action against each criterion in the model. For the given case (promotion of the observed product group, in the observed enterprise), defining the

initial decision conditions was made by the expert test method, by having the experts express their opinions on the values of the available shares for each set criterion. The procedure involved ten experts. Qualitative assessments of the first expert (Expert 1) are given as an example in Table 1.

Table 1: Initial Decision Matrix (Expert 1)

Actions (promotion forms)	Criteria				
	f_1 - Effects	f_2 - Costs	f_3 - Consumers	f_4 - Competition	f_5 - Hum. resources
	Request for max / min criteria				
	max	min (-)	max	max	min (-)
a ₁ - Economic propaganda	Very High	Very High	Very High	High	Average
a ₂ - Personal sales	Average	Average	Low	Average	Very High
a ₃ - Sales promotion	High	Low	Average	Low	High
a ₄ - Publicity	Average	very low	High	Average	Low
a ₅ - Public relations	Average	High	Average	High	Average
a ₆ - Direct marketing	Low	Low	Low	High	High

Source: the authors' research

As in Table 1, all actions are rated with qualitative ratings, it is necessary to quantify the qualitative attributes. This is done here via the interval scale (Table 2). Consideration should be given to whether there are requirements for maximization or minimization for particular criteria. In the observed case, the requirement for minimization exists on two criteria (f_2 and f_5). In the VIKOR method, the translation of a minimum into a maximum is performed in the next step, so quantification is performed as if all criteria had a requirement for the maximum. The initial decision matrix with such quantified attributes, for Expert 1, is given in Table 3. The initial decision matrix with quantified attributes, individually for all ten experts, is given in Table 4. The initial decision matrix with average values of quantified attributes, for all ten experts, is given in Table 5. The average values in Table 5 are divided by 10 so that the scores are in the interval [0; 1], used in the VIKOR method.

Table 2: Interval scales for quantification of qualitative attributes

Qualitative rating	Very Bad	Poor	Average	Very Good	Excellent	Criteria type
Quantitative rating	1	3	5	7	9	max
	9	7	5	3	1	min

Source: (Nikolić, 2012a)

Table 3: Initial decision matrix with quantified attributes (Expert 1)

Actions (promotion forms)	Criteria				
	f_1 - Effects	f_2 - Costs	f_3 - Consumers	f_4 - Competition	f_5 - Hum. resources
	Request for max / min criteria				
	max	min (-)	max	max	min (-)

a ₁ - Economic propaganda	9	9	9	7	5
a ₂ - Personal sales	5	5	3	5	9
a ₃ - Sales promotion	7	3	5	3	7
a ₄ - Publicity	5	1	7	5	3
a ₅ - Public relations	5	7	5	7	5
a ₆ - Direct marketing	3	3	3	7	7

Source: the authors' research

Table 4: Initial decision matrix with quantified attributes (all experts individually)

Actions (promotion forms)	Criteria				
	f ₁ - Effects	f ₂ - Costs	f ₃ - Consumers	f ₄ - Competition	f ₅ - Hum. resources
	Request for max / min criteria				
	max	min (-)	max	max	min (-)
a ₁ - Economic propaganda	9; 9; 7; 9; 7 9; 9; 9; 9; 9	9; 7; 7; 9; 7 9; 7; 7; 9; 9	9; 9; 7; 9; 7 9; 9; 9; 9; 9	7; 5; 7; 7; 9 7; 7; 9; 7; 7	5; 5; 7; 5; 5 7; 3; 5; 5; 5
a ₂ - Personal sales	5; 7; 5; 5; 3 3; 5; 7; 5; 3	5; 7; 7; 5; 5 5; 5; 7; 5; 7	3; 7; 7; 3; 3 5; 3; 3; 1; 3	5; 7; 5; 5; 7 3; 3; 5; 3; 7	9; 7; 7; 9; 7 5; 7; 9; 7; 9
a ₃ - Sales promotion	7; 7; 5; 7; 7 5; 7; 7; 5; 5	3; 5; 3; 5; 5 5; 5; 3; 1; 3	5; 7; 7; 5; 3 5; 5; 5; 3; 3	3; 5; 3; 3; 3 5; 3; 1; 3; 5	7; 7; 7; 9; 7 5; 9; 7; 5; 7
a ₄ - Publicity	5; 5; 5; 5; 5 5; 3; 7; 7; 5	1; 3; 1; 5; 3 3; 3; 3; 3; 3	7; 7; 5; 5; 9 5; 9; 7; 7; 5	5; 3; 5; 5; 7 7; 5; 3; 7; 7	3; 3; 3; 5; 3 1; 5; 3; 3; 3
a ₅ - Public relations	5; 3; 5; 5; 7 3; 5; 5; 3; 5	7; 5; 7; 7; 9 5; 7; 5; 7; 5	5; 5; 5; 3; 7 3; 5; 5; 3; 5	7; 7; 3; 7; 7 5; 7; 5; 7; 7	5; 5; 3; 5; 5 7; 3; 1; 5; 5
a ₆ - Direct marketing	3; 1; 3; 3; 3 5; 3; 1; 3; 1	3; 3; 5; 3; 7 5; 3; 3; 1; 3	3; 1; 5; 3; 5 1; 3; 5; 1; 3	7; 7; 5; 7; 7 9; 7; 5; 7; 5	7; 5; 5; 7; 7 5; 3; 7; 5; 7

Source: the authors' research

Table 5: Initial decision matrix with average values of quantified attributes (all experts together)

Actions (promotion forms)	Criteria				
	f ₁ - Effects	f ₂ - Costs	f ₃ - Consumers	f ₄ - Competition	f ₅ - Hum. resources
	Request for max / min criteria				
	max	min (-)	max	max	min (-)
a ₁ - Economic propaganda	0.86	0.80	0.86	0.72	0.52
a ₂ - Personal sales	0.48	0.58	0.38	0.50	0.76
a ₃ - Sales promotion	0.62	0.38	0.48	0.34	0.70
a ₄ - Publicity	0.52	0.28	0.66	0.54	0.32
a ₅ - Public relations	0.46	0.64	0.46	0.62	0.44
a ₆ - Direct marketing	0.26	0.36	0.30	0.66	0.58

Source: the authors' research

2.3. Defining criteria weights in the model - Expert method

The weight of the criteria in the model was also determined by the expert method. The same ten experts gave an estimate of the weights of the defined criteria. The weights of the criteria, as estimated by each expert individually, are presented in Table 6. In the

last row of Table 6, the average weights of each criterion were calculated according to the pattern Σ / n_E , where: $n_E = 10$ - number of experts. Thus, the final weights of the individual criteria are: $w_1 = 0.330$; $w_2 = 0.295$; $w_3 = 0.135$; $w_4 = 0.135$; $w_5 = 0.105$. Here: $w_j = 1$, where: j is the ordinal number of criteria, $j = 1, 2, \dots, n$. It is noted that the experts appreciated the first two criteria more, which was expected.

Table 6: Criteria weights (all experts individually and average)

Experts	Criteria				
	f_1 - Effects	f_2 - Costs	f_3 - Consumers	f_4 - Competition	f_5 - Hum. resources
Expert 1	0.3	0.3	0.15	0.15	0.1
Expert 2	0.4	0.3	0.1	0.1	0.1
Expert 3	0.3	0.3	0.2	0.1	0.1
Expert 4	0.35	0.35	0.1	0.1	0.1
Expert 5	0.3	0.4	0.1	0.1	0.1
Expert 6	0.4	0.2	0.1	0.2	0.1
Expert 7	0.3	0.25	0.2	0.2	0.05
Expert 8	0.25	0.25	0.2	0.2	0.1
Expert 9	0.3	0.3	0.1	0.1	0.2
Expert 10	0.4	0.3	0.1	0.1	0.1
Σ / n_E	0.330	0.295	0.135	0.135	0.105

Source: the authors' research

2.4. Multicriteria analysis problem solving - VIKOR method

Each column of Table 5 (within each criterion) contains the maximum and minimum values, which are given in Table 7. For the criteria with the minimum requirement (f_2 and f_3), the smallest value is the best and the lowest is the highest value. In this way, the criteria with the minimum requirement are translated into the criteria with the maximum requirement, in the VIKOR method.

Table 7: Best and worst stock values for all criteria

	f_1	f_2	f_3	f_4	f_5
f_j^*	0.86	0.28	0.86	0.72	0.32
f_j^-	0.26	0.80	0.30	0.34	0.76

Source: the authors' research

For simpler calculation, the size d is introduced:

$$d_{ij} = \frac{f_j^* - f_{ij}}{f_j^* - f_j^-}$$

Table 8 gives the calculated values for d_{ij} , $w_j \cdot d_{ij}$, S_i i R_i . Examples of calculating some values in Table 8:

$$d_{11} = \frac{0,86 - 0,86}{0,86 - 0,26} = 0 \quad ; \quad d_{12} = \frac{0,28 - 0,80}{0,28 - 0,80} = 1$$

$$d_{21} = \frac{0,86 - 0,48}{0,86 - 0,26} = 0,6333 \quad ; \quad d_{22} = \frac{0,28 - 0,58}{0,28 - 0,80} = 0,5769$$

$$w_1 \cdot d_{11} = 0,330 \cdot 0 = 0 \quad ; \quad w_2 \cdot d_{12} = 0,295 \cdot 1 = 0,2950$$

$$w_1 \cdot d_{21} = 0,330 \cdot 0,6333 = 0,2090 \quad ; \quad w_2 \cdot d_{22} = 0,295 \cdot 0,5769 = 0,1702$$

$$S_1 = \sum_{j=1}^n w_j \cdot d_{1j} = 0 + 0,2950 + 0 + 0 + 0,0477 = 0,3427$$

$$S_2 = \sum_{j=1}^n w_j \cdot d_{2j} = 0,2090 + 0,1702 + 0,1157 + 0,0782 + 0,1050 = 0,6781$$

$$R_1 = \max_j w_j \cdot d_{1j} = \max(0; 0,2950; 0; 0; 0,0477) = 0,2950$$

$$R_2 = \max_j w_j \cdot d_{2j} = \max(0,2090; 0,1702; 0,1157; 0,0782; 0,1050) = 0,2090$$

Table 8: Calculated values for d_{ij} , $w_j \times d_{ij}$, S_i and R_i

Actions a_i	d_{ij}					$w_j \cdot d_{ij}$					S_i	R_i
	f_1	f_2	f_3	f_4	f_5	f_1	f_2	f_3	f_4	f_5		
a_1	0	1	0	0	0.4545	0	0.2950	0	0	0.0477	0.3427	0.2950
a_2	0.6333	0.5769	0.8571	0.5789	1	0.2090	0.1702	0.1157	0.0782	0.1050	0.6781	0.2090
a_3	0.4000	0.1923	0.6786	1	0.8636	0.1320	0.0567	0.0916	0.1350	0.0907	0.5060	0.1350
a_4	0.5667	0	0.3571	0.4737	0	0.1870	0	0.0482	0.0639	0	0.2991	0.1870
a_5	0.6667	0.6923	0.7143	0.2632	0.2727	0.2200	0.2042	0.0964	0.0355	0.0286	0.5847	0.2200
a_6	1	0.1538	1	0.1579	0.5909	0.3300	0.0454	0.1350	0.0213	0.0620	0.5937	0.3300

Source: the authors' research

From the last two columns of Table 8, the values required for the further budget are read: $S^* = 0.2991$; $S^- = 0.6781$; $R^* = 0.1350$; $R^- = 0.3300$. Table 9 gives the calculated values for QS_i , QR_i , $Q_i(v = 0.5)$, $Q_i(v = 0.25)$ and $Q_i(v = 0.75)$. Examples of calculating some values in Table 9:

$$QS_1 = \frac{S_1 - S^*}{S^- - S^*} = \frac{0.3427 - 0.2991}{0.6781 - 0.2991} = 0.1150$$

$$QS_2 = \frac{S_2 - S^*}{S^- - S^*} = \frac{0.6781 - 0.2991}{0.6781 - 0.2991} = 1$$

$$QR_1 = \frac{R_1 - R^*}{R^- - R^*} = \frac{0.2950 - 0.1350}{0.3300 - 0.1350} = 0.8205$$

$$QR_2 = \frac{R_2 - R^*}{R^- - R^*} = \frac{0.2090 - 0.1350}{0.3300 - 0.1350} = 0.3795$$

$$Q_{1(v=0.5)} = v \cdot QS_1 + (1 - v) \cdot QR_1 = 0.5 \cdot 0.1150 + (1 - 0.5) \cdot 0.8205 = 0.4678$$

$$Q_{2(v=0.5)} = v \cdot QS_2 + (1 - v) \cdot QR_2 = 0.5 \cdot 1 + (1 - 0.5) \cdot 0.3795 = 0.6897$$

$$Q_{1(v=0.25)} = v \cdot QS_1 + (1 - v) \cdot QR_1 = 0.25 \cdot 0.1150 + (1 - 0.25) \cdot 0.8205 = 0.6475$$

$$Q_{2(v=0.25)} = v \cdot QS_2 + (1 - v) \cdot QR_2 = 0.25 \cdot 1 + (1 - 0.25) \cdot 0.3795 = 0.5346$$

$$Q_{1(v=0.75)} = v \cdot QS_1 + (1 - v) \cdot QR_1 = 0.75 \cdot 0.1150 + (1 - 0.75) \cdot 0.8205 = 0.2914$$

$$Q_{2(v=0.75)} = v \cdot QS_2 + (1 - v) \cdot QR_2 = 0.75 \cdot 1 + (1 - 0.75) \cdot 0.3795 = 0.8449$$

Table 9: Calculated values for QSi , QRi , $Qi(v=0.5)$, $Qi(v=0.25)$ and $Qi(v=0.75)$

a_i	QSi	QRi	$Qi(v=0.5)$	$Qi(v=0.25)$	$Qi(v=0.75)$
a_1	0.1150	0.8205	0.4678	0.6475	0.2914
a_2	1	0.3795	0.6898	0.5346	0.8449
a_3	0.5459	0	0.2730	0.1364	0.4094
a_4	0	0.2667	0.1333	0.2000	0.0667
a_5	0.7536	0.4359	0.5948	0.5153	0.6742
a_6	0.7773	1	0.8886	0.9444	0.8330

Source: Authors research

The results from Table 9 can be presented graphically (Figure 1). In this figure, the ranking of individual actions can be visually observed, depending on the weight v . According to the obtained QSi , QRi and Qi sizes for each action (Table 9 and Figure 1), three independent rank lists can be formed (Table 10). The QSi criterion is the best action a_4 , and the QRi criterion the best action a_3 . Overall, according to $Qi(v=0.5)$, the best action is a_4 .

Testing conditions U1:

The threshold of “sufficient advantage” in a given case, for the number of actions $m = 6$:

$$DQ = \min\left(0.25; \frac{1}{m-1}\right) = \min\left(0.25; \frac{1}{6-1}\right) = 0.2$$

Analysis of the next action (second in rank - action a_3):

$$Q(a_3) - Q(a_4) = 0.2730 - 0.1333 = 0.1397 < DQ = 0.2$$

Condition U1 is not fulfilled here. Action a_3 enters a set of compromise solutions, since the first action a_4 does not have a “sufficient advantage” over the second ranked action a_3 . Next action analysis (3rd in rank - action a_1):

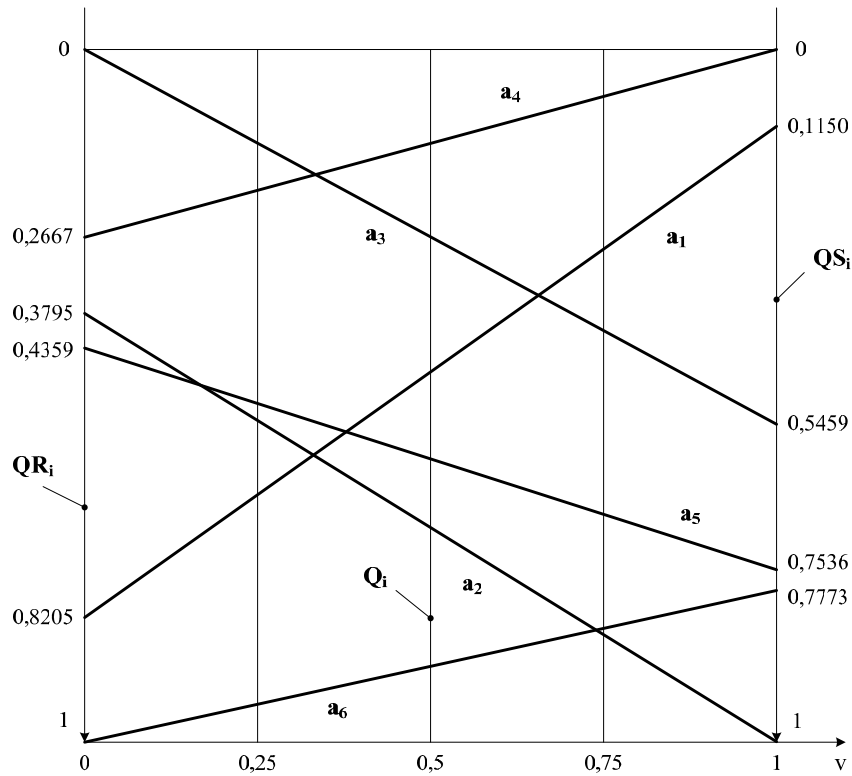
$$Q(a_1) - Q(a_4) = 0.4678 - 0.1333 = 0.3345 > DQ = 0.2$$

Here condition U1 is fulfilled. Action a_1 does not fall into the set of compromise solutions, since the first action a_4 has a “sufficient advantage” over the third ranked action a_1 . Other actions need not be further tested under this condition.

Testing conditions U2:

Condition U2 is fulfilled since action a_4 has the first position in the ranking list and according to the QS criterion. Thus, under condition U2, action a_4 has a “stable enough” first place.

Figure 1: Rank of individual actions depending on weight v



Source: Authors research

Table 10: Rank list based on sizes QS_i , QR_i i Qi

a_i	QS_i	QR_i	$Q_i (v = 0.5)$
a_1	2	5	3
a_2	6	3	5
a_3	3	1	2
a_4	1	2	1
a_5	4	4	4
a_6	5	6	6

Source: Authors research

The final solution is defined by a set of compromise solutions that include actions a_4 and a_3 .

3. Discussion of results

Using the VIKOR method, a set of compromise solutions was defined for a given problem of multicriteria analysis: the choice of the form of promotion of a particular product group. This set included the following actions: a_4 - Publicity and a_3 - Sales promotion. In general, publicity has come first, owing in large part to the low costs it requires, but also to the very good potential effects. The problem is that publicity is not such a reliable form of promotion: it sometimes exists and then it should certainly be exploited to the maximum, but sometimes it simply is not sufficiently present.

This makes it a significant second in the stock rankings, which is Sales promotion. If Publicity is accepted as the best action, if any, then Sales promotion, in this case, can be conditionally regarded as a first-rate action. Then the importance of the next rank of actions, which is a_1 - Economic propaganda, becomes important. For these reasons, it is useful to check condition U1 between actions a_3 - Sales promotion and a_1 - Commercial propaganda:

$$Q(a_1) - Q(a_3) = 0.4678 - 0.2730 = 0.1948 < DQ = 0.2$$

Condition U1 is not met because action a_3 does not have a "sufficient advantage" over action a_1 . So, action a_1 - Economic propaganda can be found in a set of compromise solutions. Practically, in a given situation, where the presence of the first ranked action is often uncertain, the set of compromise solutions is adjusted in the direction of expansion. Undoubtedly, economic propaganda brings significant effects, but also the greatest costs.

A limitation of the research is that the example presented is unique, that is, it is valid for the analyzed situation of choosing a form of promotion. In some other conditions (another company, another product/service group, and environmental conditions), the results may be the same, similar, but quite different.

Conclusion

The application of the expert method contributed to the increased objectivity in the process of forming the initial decision matrix (Table 5), as well as in the procedure for determining the weights of criteria in the model (Table 6). Also, the VIKOR method proved to be very suitable for solving the analyzed problem. First, because it maximally respected the initial data obtained by the expert method: it was these data that went directly into the further calculation, which from that point was precise and completely objective. Another advantage of the VIKOR method is the ability to form a set of compromise solutions, which proved to be very useful in this case. The final conclusion and recommendation for the marketing department of the observed company is the following: in the promotion of the analyzed products group, publicity should be maximized if it exists, economic propaganda should be applied in accordance with financial possibilities, and most attention and energy should be directed towards sales promotion activities.

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