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DECISION SUPPORT SYSTEM OF DISCOUNT PRICING ANALYSIS USING METHOD OF ELIMINATION ET CHOIX TRADUISANT LA REALITÉ (ELECTRE)

Abstract *The development of e-commerce site operators in Indonesia is now faced with intense competition for defending the market segment, especially regarding how e-commerce sites are attracting consumers through specific marketing strategies. This study implements a decision support system approach to help marketers to determine price discount alternatives using the Elimination et Choix Traduisant la Realite (ELECTRE) method. The ELECTRE method is widely recognized for having good performance in analyzing customer behavior criteria; however, there is little information about discount analysis using the ELECTRE method. This study implements a method for consumer behavior simulation that can be affected by the criteria to make a purchase on a simulated e-commerce website. Our model estimates three parts of the matrices' analysis: (a) average value of discounted price (DP); (b) average value of product brand (PB); and (c) average value of purchase decision (PD). We used these as the main alternatives; e.g., price discounts as first alternative (A1), brand discount as second alternative (A2), and purchase discount as third alternative (A3). Based on the results of the dominant aggregation matrix, the study found that the results are dominated by brand discount (A2). In other words, it is recommended for the decision maker to focus their discount on certain brands more precisely as a marketing strategy than price discount or purchase discount.*

Keywords electré, price discount, decision support system (DSS)

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1. Introduction

Decision-making analysis through selection simulation has been debated among scholars, especially from the decision result quality to provide reasonable judgments and choices [11, 14]. There is little information to help decision makers take certain choices and alternatives, especially from customer research. The decision makers also face key issues ranging from sourcing alternatives and arriving at the best decision-making features. They must consider adequate selection properties and rules [10]. Such issues have become a main gap in the consumer theory literature.

1.1. Problem background

The study of decision analysis has been studied from the nature of decision theory [8, 10]. Previous studies have provided a new approach in consumer research by evaluating the effectiveness of marketing strategies to reach a targeted market and attract customers [1, 7]. However, there is a lack of information about suitable methods for measuring a marketing strategy through pricing discount [13]. Since setting prices and discounting can be problematic, the decision maker must consider their complex situation to evaluate three alternatives; e.g., product properties (such as product, distribution, and promotion, prices), brand popularity, and purchase decision (service and brand variety) [16]. Therefore, we propose a model to simplify the complexity in finding a pricing strategy through discount evaluation. This requires a systematic approach that involves setting goals and developing an appropriate pricing structure.

1.2. Contribution

In this study, we used a dataset of e-commerce website that give discounts (such as `Tokopedia.com` and `Bukalapak.com`). We provide simulated pricing discount estimation to measure its effectiveness in influencing consumer purchase behavior through the discount strategy. We also measure the effect of such a discount and branding strategy to attract consumers through simulated pricing combined with an enhanced decision support system. Therefore, based on the description above, the authors are interested in observing and integrating the ELECTRE method into the customer research computation.

This study provides a new approach in consumer research by evaluating the effectiveness of a marketing strategy to reach its targeted market and attracting buyers [1, 7]. However, there is a lack of information about suitable methods for measuring the marketing strategy through pricing discount [13]. Since setting prices and discounts can be problematic, the decision maker must consider their complex situation to evaluate three alternatives; e.g., product properties (such as product, distribution, and promotion, prices), brand popularity, and purchase decision (service and brand variety) [16]. Therefore, we propose a model to simplify the complexity of finding a pricing strategy through discount evaluation. It requires a systematic approach that involves setting goals and developing an appropriate pricing structure.

In this study, we used a dataset of e-commerce websites that give discounts such (as `Tokopedia.com`, and `Bukalapak.com`). We provide simulated pricing discount estimation to measure its effectiveness in influencing consumer purchase behavior through the discount strategy. We also measure the effect of such a discount and branding strategy to attract consumers through simulated pricing combined with an enhanced decision support system.

2. Theoretical review

2.1. Decision support system

A decision support system (DSS) is a concept of a systematic process to provide suggestions and recommendations for users to make decisions in complex situations to select certain alternatives [4, 9]. It is really important in management and needs a massive use of a dataset. To achieve the goal, they implement a decision-making system to overcome the complex problem of achieving the intended objectives and resolve the problem in a faster time and easier approach. In customer research, there are three major issues that must be managed; e.g., corrective problems, progressive problems, and creative problems. ELECTRE has been popularly known to resolve these issues.

In determining the price for each item, many managers have considered their decision from the previous sales data and the number of purchases made by the customer. There is a general rule that the more items that are purchased, the more discounts will be earned. One type of system that is popularly used among enterprise managers is the Decision Support System (DSS). DSS is a management system to provide decisions for managers.

Gottschlich has defined Decision Support Systems (DSS) as a set of model-based procedures for processing and assessing data to help managers make decisions [4, 9]. The system must be simple, easier to use, fast, easy to control, adaptive, and completely capable of resolving important issues.

Other scholars [5, 9, 20] proposed models of DSS as computer-based systems consisting of three interacting components; e.g., a language system (a mechanism for communicating between users and other DSS components), knowledge system, problem processing system (relationships of components), and manipulation capabilities (ability to resolve problems through computation to handle complex data). The components are fundamental in shaping an effective DSS.

From a management perspective, there are different approaches used by scholars. They have considered that a good DSS is influenced greatly by their users to decide a problem based on the ability, experience, knowledge, and intuition (even though it is unstructured). From computer system scholars, a good DSS must have a certain methodology, and the decision-making process must be structured systematically. In fact, there are various DSS that have been created for diverse users to help them solve unique cases.

2.2. Discount price

A good system must have a combined method of algorithms that can be expanded to measure and analyze the input of numbers and text, including the user's thought (which must be based on a semi-structured method) [11]. The method can bridge the corporate users and general common intention. Liu et al. [11] describes the relationship of the components in a good system must contain computation, DSS, and user features (Fig. 1).

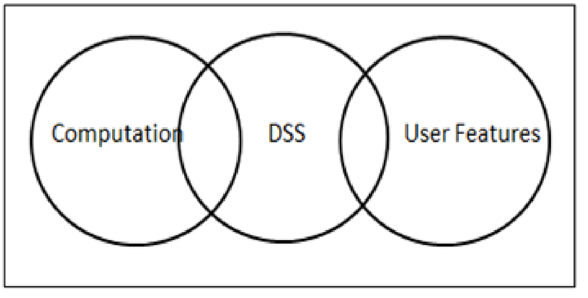

Figure 1. Relationship between computation algorithms, DSS, and user features

Discounting is a common type of sales-promotion strategy. Basically, discounting is a price reduction from normal price for a certain period of time. It is a sales-promotion approach that forms a direct persuasion through incentives to stimulate customer behavior to purchase a product [3]. As a sales-promotion effort, discounts have been considered to be a core principle in marketing campaigns [18]. It is comprised of a collection of incentive tools (mostly short term) that are designed to stimulate a customer to purchase a larger volume of certain products or frequent services. Mbaga [12] mentioned several sales-promotion tools such as discounts, special events, in-store demonstrations, coupons, and contests.

2.3. Purchase intention

Purchase intention is a main topic in consumer-behavior research. Amaro et al. [2] defined purchase intention as consumer desire in consuming, selecting, paying, or choosing a product. It is based on consumer experience or trial and error when purchasing or consuming the products. Consumer purchase intention has been studied in many previous studies [6]. They explained why marketers increase their marketing spending, since it can leverage a consumers intention to buy a branded products or brand-switching to another. In addition, they explained that purchase intention can be identified through four indicators (as given in Table 1).

Table 1
Customer Purchase Intention Rating

Type of Intention	Example	Rating
Transactional intention	User tendency to buy product	4
Referential intention	User tendency to reference a product to others	3
Preferential intention	User main preference to select a product	2
Explorative intention	User trial and error to seek new experience from new product	1

In transactional intention, customers have a tendency to buy a product. Their behavior is important in the decision study on how a marketer can estimate the user spending their money and their involvement in high-volume transaction activities. As users have a high frequency of transactions, they tend to be involved in referential activity as their tendency to reference the product to others. In preferential intention, the users have the intention or behavior to select a product with a certain brand or with a high popularity as their main preference for the product [8]. This preference can only be changed if something happens with their perception about the preferred product and experience meaning in their thought.

If a product reaches its maturity in its lifecycle, the users will be bored when using their old products and tend to seek new experience for using new products. This means that the user will be involved in a new habit with an explorative intention. This intention describes the user behavior pattern to seek information and gain new experiences from new product. This means that the users will be willing to spend more money and effort to get the information and product and seeking information to support their consuming behavior.

3. Methodology

In this study, we used a dataset of e-commerce websites that give discounts (such as Tokopedia.com, and Bukalapak.com). This study examined the discount on apparel products for men and women that are sold on site and at bukalapak.com and tokopedia.com. The data was studied for two months. The questionnaires are taken online using google.doc to consumers of tokopedia.com and bukalapak.com with inclusion criteria of at least 1x shopping on the site for the last month.

In the data collected, as many as 235 respondents were grouped into 3 groups: price discount (DP), product brand values (PB), and purchase decision (PD). We provide simulated pricing discount estimation to measure its effectiveness in influencing consumer purchase behavior through the discount strategy. In the process of determining a discounted price, this study used the ELECTRE method after determining the priority weight of each criterion [15, 17, 19].

As a decision support system will include the discounted price, it will estimate three main alternatives with sub-basic-criteria:

1. Price discounts (DP) (double-save discount, voucher discount, and brand discount).
2. Product brand values (PB) (brand popularity, brand likeness, brand feature).
3. Purchase decision (PD) (total discount, brand variance, and service variance).

This study calculate the average value of each criterion for each alternative on the determination of price discounts with the following rules:

1. The average value of $DP = 2.75$ for alternative A1 (double-save discount), 2.56 for alternative A2 (voucher discount), and 2.91 for alternative A3 (brand discount).
2. The Average value of $PB = 3.25$ for alternative A1 (brand popularity), 3.00 for alternative A2 (brand likeness), and 3.25 for alternative A3 (brand feature).
3. The average value of PD (purchase decision) = 3 for alternative A1 (total discount), 3 for alternative A2 (brand variance), and 1 for alternative A3 (Service variance).

3.1. Normalized matrices

In this step, it is focused on normalizing the matrices of alternative rating matrices and criteria. Each attribute is converted to a compatible value. Any normalization of the r_{ij} step is estimated by Equation (1).

$$R_{ij} = \frac{x_{ij}}{\sqrt{\sum\limits_{i=1}^{m} x_{ij}^2}} \; where\; i = 1, 2, , m; \; and \; j = 1, 2, , n \tag{1}$$

In normalized matrix R, m denotes an alternative, n states the criterion, and r_{ij} is the normalized choice from the ith alternative as it relates to the jth criterion.

3.2. Weighting normalized matrix

After normalizing each column of matrix R, the element in the matrix is multiplied by weights w_i and collected as matrix W, with the weight elements of each criterion describing its relative importance. It is derived from Equation (2).

$$W = (w_1, w_2, \ldots, w_n) \; where \sum_{j=1}^{n} w_j = 1 \tag{2}$$

Then, the weight is multiplied by the pairwise comparison metrics that form matrix V, so weighted normalized matrix $V = RW$ is written in Equation (3) and the elements of V_{ij} are given in Equation (4).

$$V = RW \tag{3}$$

$$V_{ij} = r_{ij} W_j \tag{4}$$

3.3. Concordance index

A criterion in an alternative includes concordance when it has fulfilled Equation (5).

$$C_{k_l} = (j|V_{k_j} \geq V_{l_j});\ for j = 1, 2, ..., n \tag{5}$$

where C_{k_l} is concordance and j is a set of criteria.

At this stage, matrix C has a diagonal value of 0. Each cell value or matrix element C other than the diagonal is obtained by the following calculation rule.

To get value c_{12}, each row element value (1) with row (2) of the same columns in matrix V is compared. If the element value in row (1) $\geq$ row (2), then, in column i is entered to the ith weight position.

For each pair of alternatives k and l (k, l = 1,2,3,...,m and $k \neq l$), the set of criteria j is divided into two subsets; namely, concordance and discordance. The criteria to determine the alternative as concordance is given in Equation (6).

$$C_{k_l} = (j|V_{k_j} \geq V_{l_j});\ where\ C_{k_l} \in concordance; and\ j \in criteria \tag{6}$$

3.4. Discordance index formation

Conversely, the complement of this subset is discordance when it is fulfilled is given in Equation (7).

$$D_{k_l} = (j|V_{k_j} \leq V_{l_j});\ for\ j = 1, 2, ..., n \tag{7}$$

Therefore, to calculate the Discordance matrix, we have to determine the value of the elements in the discordance matrix by dividing the maximum of the difference of the criterion value included in the discordance subset with the maximum value difference of all of the existing criteria. This is mathematically given in Equation (8).

$$d_{k_l} = \frac{[max|V_{k_j} - V_{l_j}|]\ j \in D_{k_l}}{[max|V_{k_j} - V_{l_j}|]\ \forall\ D_{k_l}} \tag{8}$$

The Disconcordance Index Formation has diagonal value = 0. Thus, each cell value in the matrix element other than diagonal can be estimated. Each cell value of the matrix element can be found by comparing each row element with other. For example, we can compare row element value (1) with row element value (2) in column i which belongs to D_{k_j}, then, its maximum value can be gained. if the element value in row (1) > row (2) in column i, then the matrix will be fulfiled with the maximum absolute difference between $V_{k_j} - V_{i_j}$. The resulted numbers will be divided by the maximum value of the absolute difference of all elements in the matrix.

3.5. Threshold value of concordance and discordance matrices

At the first step, the dominant matrix concordance is constructed by using the threshold value. It is conducted by comparing each value of the concordance matrix element with the threshold value that $C_{k_l} > \underline{\mathrm{c}}$; where C_{k_l} is the concordance and $\underline{\mathrm{c}}$ is the threshold value. With threshold value $\underline{\mathrm{c}}$, we get the dominant matrix of concordance.

3.6. Concordance matrix dominant F with threshold $\underline{\mathrm{c}}$

The value of each element of matrix F is must have threshold $\underline{\mathrm{c}}$ following the rule in Equation (9).

$$f_{k_l} = \begin{cases} 1, & \text{if } C_{k_l} \geq \underline{\mathrm{c}}; \\ 0, & C_{k_l} < \underline{\mathrm{c}}. \end{cases} \tag{9}$$

where f_{k_l} is the dominant matrix of concordance and $\underline{\mathrm{c}}$ is a member of the dominant matrix of concordance.

3.7. Dominant discordance matrix G with threshold $\underline{\mathrm{c}}$

Matrix G as the dominant matrix of discordance has elemental values that are determined as in Equation (10) by substituting g_{k_l} as the dominant matrix of discordance and $\underline{\mathrm{d}}$ as the discordance values.

$$g_{k_l} = \begin{cases} 1, & \text{if } d_{k_l} \geq \underline{\mathrm{d}}; \\ 0, & d_{k_l} < \underline{\mathrm{d}}. \end{cases} \tag{10}$$

3.8. Aggregation of dominant matrix

For the dominant aggregation matrix obtained from the combination of matrix F and G, based on Equation (11), we can determine the final alternatives.

$$e_{k_l} = f_{k_l} \times g_{k_l} \tag{11}$$

The calculation of Equation (11) will give Dominant Matrix of Aggregation E which represent first alternative (A_1), second alternative (A_2) and the n-th alternatives.

4. Discussion and result

This study conducts an assessment from the three criteria above so that it results in a pairwise comparison of each alternative in each criterion. The following steps are taken to determine the intention factor (weight) for each criterion of price discount (DP) product brand values (PB), and purchase decision (PD) as the first-, second-, and third-alternatives, respectively. Furthermore, the calculation after implementing ELECTRE is given below.

4.1. Average value of each criterion for each alternative

The average matrix of the value of each criterion for each alternative has been measured, and the result is given in Table 2.

Table 2

Average matrix of value of each criterion for each alternative

Alternative	Criteria		
	Discounted Price (DP)	Product Brand Values (PB)	Purchase Decision (PD)
A1	2.75	3.25	3
A2	2.56	3.00	3
A3	2.91	3.25	1

4.2. Normalized matrices of alternative rating matrices and criteria

The normalization of matrix is conducted through the completion and calculation of the normalized decision matrix and provides a value of X_1, X_2, X_3.

$$|X_1| = \sqrt{(2.75)^2 + (2.56)^2 + (2.91)^2} = 4.75$$

$$|X_2| = \sqrt{(3.25)^2 + (3.00)^2 + (3.25)^2} = 5,5$$

$$|X_3| = \sqrt{(3^2 + 3^2 + 1^2)} = 4.35$$

For normalization r, it uses the rule that each cell value or matrix element R is obtained by the following calculation:

$$R_{11} = \frac{a_{11}}{(a_{11})^2 + (a_{21})^2 + (a_{31})^2} = \frac{2.75}{(2.75)^2 + (2.56)^2 + (2.91)^2} = 0.58$$

$$R_{21} = \frac{a_{21}}{(a_{11})^2 + (a_{21})^2 + (a_{31})^2} = \frac{2.56}{(2.75)^2 + (2.56)^2 + (2.91)^2} = 0.58$$

$$R_{31} = \frac{a_{31}}{(a_{11})^2 + (a_{21})^2 + (a_{31})^2} = \frac{2.91}{(2.75)^2 + (2.56)^2 + (2.91)^2} = 0.49$$

$$R_{12} = \frac{a_{12}}{(a_{12})^2 + (a_{22})^2 + (a_{32})^2} = \frac{3.25}{(3.00)^2 + (3.00)^2 + (3.25)^2} = 0.59$$

$$R_{22} = \frac{a_{22}}{(a_{12})^2 + (a_{22})^2 + (a_{32})^2} = \frac{3.00}{(3.25)^2 + (3.00)^2 + (3.25)^2} = 0.55$$

$$R_{32} = \frac{a_{32}}{(a_{12})^2 + (a_{22})^2 + (a_{32})^2} = \frac{3.25}{(3.25)^2 + (3.00)^2 + (3.25)^2} = 0.59$$

$$R_{13} = \frac{a_{13}}{(a_{13})^2 + (a_{23})^2 + (a_{33})^2} = \frac{2}{(3)^2 + (3)^2 + (1)^2} = 0.69$$

$$R_{23} = \frac{a_{23}}{(a_{13})^2 + (a_{23})^2 + (a_{33})^2} = \frac{2}{(3)^2 + (3)^2 + (1)^2} = 0.69$$

$$R_{33} = \frac{a_{33}}{(a_{13})^2 + (a_{23})^2 + (a_{33})^2} = \frac{2}{(3)^2 + (3)^2 + (1)^2} = 0.23$$

Thus, the result of the normalization rule gives Matrix R as below.

$$R = \begin{pmatrix} 0.58 & 0.59 & 0.69 \\ 0.54 & 0.55 & 0.69 \\ 0.61 & 0.59 & 0.23 \end{pmatrix}$$

Therefore, we also get Matrix of Weights W representing all criteria of DP, PB, and PD.

$$W = \begin{pmatrix} DP & PB & PD \\ 0.5 & 0.3 & 0.2 \end{pmatrix}$$

At this step, each cell value of the matrix element V is obtained by calculating each R element with W element as below:

$$v_{11} = r_{11} \times w_{11} = 0.58 \ \times \ 0.5 = 0.29$$

$$v_{21} = r_{21} \times w_{11} = 0.54 \ \times \ 0.5 = 0.27$$

$$v_{31} = r_{21} \times w_{11} = 0.61 \ \times \ 0.5 = 0.31$$

$$v_{12} = r_{12} \times w_{12} = 0.59 \ \times \ 0.3 = 0.18$$

$$v_{22} = r_{22} \times w_{12} = 0.55 \ \times \ 0.3 = 0.16$$

$$v_{32} = r_{32} \times w_{12} = 0.59 \ \times \ 0.3 = 0.18$$

$$v_{13} = r_{13} \times w_{13} = 0.69 \ \times \ 0.2 = 0.14$$

$$v_{23} = r_{23} \times w_{13} = 0.69 \ \times \ 0.2 = 0.14$$

$$v_{33} = r_{33} \times w_{13} = 0.23 \ \times \ 0.2 = 0.05$$

Therefore, we get matrix-weighted normalized V with their specific values.

$$V = \begin{pmatrix} 0.29 & 0.18 & 0.14 \\ 0.27 & 0.16 & 0.14 \\ 0.31 & 0.18 & 0.05 \end{pmatrix}$$

4.3. Establishment of concordance index

The calculation of the value and elements of Matrix C is conducted by comparing each row element value (1) with row (3) for each element of the same columns in Matrix V as below:

$c_{12} : (0.29 > 0.27);\ (0.18 > 0.16);\ (0.14 = 0.14);\ \to c_{12} = 1, 2, 3 = w_1 + w_2 + w_3 =$
$0.5 + 0.3 + 0.2 = 1$

$c_{13} : (0.29 > 0.31);\ (0.18 = 0.18);\ (0.14 > 0.05);\ \to c_{13} = 2, 3 = w_2 + w_3 =$
$0.3 + 0.2 = 0.5$

$c_{21} : (0.27 > 0.29);\ (0.16 > 0.18);\ (0.14 = 0.14);\ \to c_{21} = 3 = w_3 = 0.2$

$c_{23} : (0.27 > 0.31);\ (0.16 > 0.18);\ (0.14 = 0.05);\ \to c_{23} = 3 = w_3 = 0.2$

$c_{31} : (0.31 > 0.29);\ (0.18 = 0.18);\ (0.05 < 0.14);\ \to c_{31} = 1, 2 = w_1 + w_2 =$
$0.5 + 0.3 + 0.8$

$c_{32} : (0.31 > 0.27);\ (0.18 > 0.16);\ (0.05 = 0.14);\ \to c_{32} = 1, 2 = w_1 + w_2 = 0.2$

By comparing element values in row (2) and row (1), we get the entire members of Matrix C. Thus, the element value in row (1) is considered more important as a priority than the element value in row (2). This means that equation $C_{k_l} = jV_{k_j} \geq V_{l_j}$ is important to get matrix concordance C as below.

$$C = \begin{pmatrix} 0 & 1 & 0.5 \\ 0.2 & 0 & 0.2 \\ 0.8 & 0.8 & 0 \end{pmatrix}$$

4.4. Formation of discordance index

The discordance elements are measured based on the comparison of the highest and lowest values of each element in Matrix D as below.

$$d_{12} : (0.29 < 0.31);\ (0.18 > 0.16);\ (0.14 = 0.14);$$

$$d_{12} = (0) = \frac{max|0|}{max|0.29 - 0.31|; |0.18 - 0.16|; |0.14 - 0.14|} = 0$$

$$d_{13} : (0.29 < 0.31);\ (0.18 = 0.18);\ (0.14 > 0.05);$$

$$d_{13} = (1) = \frac{max|0|}{max|0.29 - 0.31|; |0.18 - 0.18|; |0.14 - 0.005|} = 0.19$$

$$d_{21} : (0.29 < 0.32);\ (0.18 > 0.17);\ (0.10 < 0.15);$$

$$d_{21} = (1.3) = \frac{max|0.29 - 0.32|; |0.10 - 0.15|}{max|0.29 - 0.32|; |0.18 - 0.17|; |0.10 - 0.15|} = 0$$

$$d_{23} : (0.29 < 0.25);\ (0.18 > 0.17);\ (0.10 = 0.10);$$

$$d_{23} = 0 = \frac{max|0|}{max|0.29 - 0.25|; |0.18 - 0.17|; |0.10 - 0.10|} = 0$$

$$d_{31} : (0.25 < 0.32);\ (0.17 = 0.17);\ (0.10 < 0.15);$$

$$d_{31} = \frac{max|0.10 - 0.15|}{max|0.25 - 0.32|; |0.17 - 0.17|; |0.10 - 0.15|} = 1$$

$$d_{32} : (0.25 < 0.29);\ (0.17 > 0.18);\ (0.10 = 0.10);$$

$$d_{32} = \frac{max|0.25 - 0.29||0.17 - 0.18|}{max|0.25 - 0.29||0.17 - 0.18|; |0.10 - 0.10|} = 1$$

Finally, the matrix discordance of the Index provides several values; e.g., $d_{12} = 0$, $d_{13} = 0.19, d_{21} = 1, d_{23} = 0.41, d_{31} = 1$, and $d_{32} = 1$. Thus, they are arranged into their position in the discordance matrix, and we get Matrix D.

$$R = \begin{pmatrix} 0 & 0 & 0.19 \\ 1 & 0 & 0.41 \\ 1 & 1 & 0 \end{pmatrix}$$

For the value of d_{12}, it is necessary to compare each row element value (1) with row (2) on each of the same columns in Matrix V. If the element value in row (1)<row (2) in column i, then the maximum value of its absolute difference ("selected elements") will be divided by the maximum value of the absolute difference of all of the comparable elements.

4.5. Determination of threshold value for concordance and discordance

$$\underline{c} = \sum_{k=1} c^m = \frac{\sum_{l=1}^{m} C_{k_l}}{m(m-1)} = \frac{1 + 0.5 + 0.2 + 0 + 0.8 + 0.8}{3(3-1)} = \frac{3.3}{6} = 0.58$$

$$\underline{d} = \sum_{k=1} c^m = \frac{\sum_{l=1}^{m} d_{k_l}}{m(m-1)} = \frac{0 + 0.19 + 1 + 0.14 + 1 + 1}{3(3-1)} = \frac{3.33}{6} = 0.60$$

4.6. Concordance-dominant Matrix F with threshold $\underline{c}$

We also calculate the concordance matrix and its domination after substituting threshold $\underline{c}$ to get the matrix as concordance dominant Matrix F.

$$F = \begin{pmatrix} 0 & 1 & 0 \\ 0 & 0 & 0 \\ 1 & 1 & 0 \end{pmatrix}$$

4.7. Dominant discordance Matrix G with threshold $\underline{d}$

Conversely, we also can get Matrix G after substituting threshold $\underline{d}$ into Matrix G

$$G = \begin{pmatrix} g_{11} & 0 & \dots & 0 \\ 0 & g_{22} & \dots & 0 \\ \dots & \dots & \dots & \\ 0 & 0 & \dots & g_{mn} \end{pmatrix} \to G = \begin{pmatrix} 0 & 0 & 0 \\ 1 & 0 & 0 \\ 1 & 1 & 0 \end{pmatrix}$$

4.8. Dominant Matrix of Aggregation E

$$G = \begin{pmatrix} e_{11} & e_{22} & e_{33} & \dots & e_{1n} \\ e_{21} & e_{22} & e_{23} & \dots & e_{2n} \\ e_{31} & e_{32} & e_{33} & \dots & e_{3n} \\ \dots & \dots & \dots & \dots & \dots \\ e_{m1} & e_{m2} & e_{m3} & \dots & e_{mn} \end{pmatrix} \to G = \begin{pmatrix} 0 & 0 & 0 \\ 1 & 0 & 0 \\ 1 & 1 & 0 \end{pmatrix}$$

At the final step, we get that there are two alternatives left in Matrix E. Thus, from dominant Matrix E, we obtained the following: (a) the alternative at the position of e_{31} or first alternative ("A_1") is dominated by the value of 1; (b) the alternative at the position of e_{32} or second alternative ("A_2") is dominated by the value of 1. In other words, it is recommended for the decision maker to give a discount on a certain brand ("brand discount") as a marketing strategy compared to other alternatives of price discounts or voucher discounts.

5. Conclusion

The ELECTRE method in this study has been used to design and build an estimation of product-price discounts for marketing recommendations. The criteria that are used in this study are price discount, brand discount, and purchase discount. The criteria are used as an alternative to determine a marketing decision and to help the decision maker to understand consumer intent when a strategy must be made. As this study has a goal of determining which alternative is the best, we used three main alternatives; e.g., price discounts as first alternative (A1), brand discount as second alternative (A2), and purchase discount as third alternative (A3).

Based on analysis results using a dominant aggregation matrix, the study found that the recommendation result is dominated by A2; e.g., brand discount. In other words, it is recommended that the decision maker focus their discount choice on a certain brand as a marketing strategy than the other alternatives. Finally, to determine which areas of the alternatives can be acceptable to the customer, the decision must be made by the marketing manager through an objective assessment by evaluating the consumer's behavior and choice of discounted purchase. This means that the marketing manager must understand how their customer will select certain products, brands, prices, and discounts. This is important when the manager establishes a promo-discount event or product expo with short alternative for their brand and discount decision.

6. Suggestion

Further study can expand the ELECTRE-based system with other methods to increase its accuracy and robustness. In order to understand customer and market trends, the manager must learn to update their knowledge on more decision skills, especially measuring how their customer will behave after a certain marketing strategy is implemented. In addition, our proposed system can be expanded with other more-updated and objective criteria analysis methods. Finally, we suggest a system can be combined with other methods, such as the AHP, SAW, WP, TOPSIS, or Promethee approaches.

References

[1] Alden D.L., Friend J.M., Lee A.Y., de Vries M., Osawa R., Chen Q.: Culture and medical decision making: Healthcare consumer perspectives in Japan and the United States, *Health Psychology*, vol. 34(12), pp. 1133–1144, 2015.

[2] Amaro S., Duarte P.: An integrative model of consumers' intentions to purchase travel online, *Tourism Management*, vol. 46, pp. 64–79, 2015.

[3] Aydinli A., Bertini M., Lambrecht A.: Price promotion for emotional impact, *Journal of Marketing*, vol. 78(4), pp. 80–96, 2014.

[4] Cabrerizo F.J., Morente-Molinera J.A., Pérez I.J., López-Gijón J., Herrera-Viedma E.: A decision support system to develop a quality management in academic digital libraries, *Information Sciences*, vol. 323, pp. 48–58, 2015.

[5] Chamberlain B.C., Carenini G., Oberg G., Poole D., Taheri H.: A decision support system for the design and evaluation of sustainable wastewater solutions, *IEEE Transactions on Computers*, vol. 63(1), pp. 129–141, 2014.

[6] Flanagin A.J., Metzger M.J., Pure R., Markov A., Hartsell E.: Mitigating risk in ecommerce transactions: perceptions of information credibility and the role of user-generated ratings in product quality and purchase intention, *Electronic Commerce Research*, vol. 14(1), pp. 1–23, 2014.

[7] Frederiks E.R., Stenner K., Hobman E.V.: Household energy use: Applying behavioural economics to understand consumer decision-making and behaviour, *Renewable and Sustainable Energy Reviews*, vol. 41, pp. 1385–1394, 2015.

[8] Gineikiene J., Schlegelmilch B.B., Auruskeviciene V.: "Ours" or "theirs"? Psychological ownership and domestic products preferences, *Journal of Business Research*, vol. 72, pp. 93–103, 2017.

[9] Gottschlich J., Hinz O.: A decision support system for stock investment recommendations using collective wisdom, *Decision Support Systems*, vol. 59, pp. 52–62, 2014.

[10] Korenevskiy N.: Application of fuzzy logic for decision-making in medical expert systems, *Biomedical Engineering*, vol. 49(1), pp. 46–49, 2015.

[11] Liu S., Chan F.T., Ran W.: Decision making for the selection of cloud vendor: An improved approach under group decision-making with integrated weights and objective/subjective attributes, *Expert Systems with Applications*, vol. 55, pp. 37–47, 2016.

[12] Mbaga M.H.: *The Role of Sales Promotion in Consumer Buying Behaviour: The case of Tanzania Breweries Limited*, Ph.D. thesis, Mzumbe University, 2015.

[13] McDonald M., Wilson H.: *Marketing Plans: How to prepare them, how to profit from them*, John Wiley & Sons, 2016.

[14] Miller K., Mansingh G.: OptiPres: a distributed mobile agent decision support system for optimal patient drug prescription, *Information Systems Frontiers*, vol. 19(1), pp. 129–148, 2017.

[15] Omar M.H., Nursal A.T., Nawi M.N.M., Haron A.T., Goh K.C.: A Preliminary Requirement of Decision Support System for Building Information Modelling Software Selection, *Malaysian Construction Research Journal*, vol. 15(2), pp. 11–28, 2014.

[16] Rosenbaum-Elliott R., Percy L., Pervan S.: *Strategic brand management*, Oxford University Press, USA, 2015.

[17] Sangaiah A.K., Gopal J., Basu A., Subramaniam P.R.: An integrated fuzzy DEMATEL, TOPSIS, and ELECTRE approach for evaluating knowledge transfer effectiveness with reference to GSD project outcome, *Neural Computing and Applications*, vol. 28(1), pp. 111–123, 2017.

[18] Schmeling T., Rugh C., Fishel G., Burr J.: Sales promotion using product comparison, 2015. US Patent App. 14/750,507.

[19] Shafiee M.: A fuzzy analytic network process model to mitigate the risks associated with offshore wind farms, *Expert Systems with Applications*, vol. 42(4), pp. 2143–2152, 2015.

[20] Shook E., Turner V.K.: The socio-environmental data explorer (SEDE): a social media–enhanced decision support system to explore risk perception to hazard events, *Cartography and Geographic Information Science*, vol. 43(5), pp. 427–441, 2016.

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