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What are the most important factors for investment to have sales more effectively?

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Abstract: In purchasing process, whether in traditional or online, we face the problem of comparison and decision-making. Also given the fact that the main criteria which are considered by most customers in purchasing process are marketing mix (4Ps), (Price, Product, Place, Promotion), in this paper we defined most important criteria for laptop selecting with respect to marketing mix, then the most important criterion for laptop selecting and also the cause and effect criterion which affect the process of decision making has determined using DEMATEL method. To define the criteria and their importance with respect to each other expert's comment has used.
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1. Introduction

We are facing decision-making and selecting (goods) during the day and do it continuously in our life. In decision-making issue, we always face choosing one option from various options as related criteria and then we make a decision. One of the aspects of decision-making which people, organizations and managers of industrial plants encounter is decision-making about purchasing required goods and equipment. There are a variety of multiple criteria techniques to aid selection in conditions of multiple criteria. The acronym TOPSIS stands for technique for preference by similarity to the ideal solution (K. Yoon, 1980). TOPSIS is attractive in that limited subjective input is needed from decision makers. The only subjective input needed is weights (D.L. Olson, 2004). In purchasing process, criteria are different from buyer and seller's point of view and each of them tries to maximize their profit rate. Buyers and customers most consider these criteria in other aspects and based on them, they decide about purchasing, Finally there are different prices, different qualities and features, various supply places , numerous services and side advantages for a certain or special goods which make some problems decision-making purchasing suitable goods. By considering the high level of uncertainty and fuzziness of the criteria the problem of decision-making is doubled. Our suggested method for solving this problem is to use Fuzzy TOPSIS technique, which based on the decision-maker, can have the best selection (Basirat, Emam, 2011). Regarding the uncertainty of these criteria and also considering that, these criteria should be estimated in ranges and limits which are present through different sellers, they can be represented in fuzzy form and decisions are made based on these fuzzy criteria.

2. Literature review

Estimated criteria in this process have been considered in numerous studies (Ji- eunCha ,SooyoungKim,YeonheeLee, 1981). TOPSIS was initially presented by Hwang and Yoon (1981, 1995), Lai et al (1994). TOPSIS has been applied to a number of applications (1987, 1993), although it is not nearly as widely applied as other multi attribute methods (S.H. Zanakis, 1998). A variant of TOPSIS was used for selection of grippers in flexible manufacturing (1991, 1992). TOPSIS was applied to financial investment in advanced manufacturing systems (O.L. Chau and C. Parkan, 1995). In other manufacturing applications, it has been used in a case selecting a manufacturing process (O.L. Chau and C. Parkan, 1995) and in an application selecting robotic processes (C. Parkan and M.L. Wu, 1997, 1999). Neural network approaches to obtain weights for TOPSIS have been applied (G. Kim, C. Park and K.P. Yoon, 1997), and fuzzy set extensions implemented (2003, 2002). TOPSIS has also been used to compare company performances (H. Deng, C.-H. Yeh, 2000) and financial ratio performance within a specific industry(C.-M. Feng and R.-T. Wang, 2001).criteria which are commonly considered between buyers and sellers is called marketing mix

which expressed by Kotler and Borden in (1964). After that, many other people did some research in this respect (Mosad Zineldin and Sarah Philipson) Other people examined the criteria of marketing mix and considered those criteria for different times (Claudio Vignali). But as regards to all studies and research which have been done, it can be observed that the only criteria which is expressed and estimated in all studies and research is marketing mix (4Ps). Buyers and customers most consider these criteria in other aspects and based on them, they decide about purchasing. These criteria are just price, quality characteristics or product, purchasing place and promotion. Also research have been done regarding using method and degree of importance of these criteria and transposition of these criteria estimations of options and decision-making in purchasing issue are explained (Chun–An Chen, 2009).

3. Define the criteria for purchase selection

The main objectives are the selection of the best purchase in a dynamic environment and find the most important criterion. The decision-makers can estimate the relative weights - ratios for each pair of alternatives under every attribute as well as the relative weights ratios for the attributes .Application of common criteria to all purchases makes objectives comparisons possible. The criteria considered here in selection of the best purchase in a dynamic environment are:

- Price (Product cost, Transportation cost, Development & tooling cost)
- Product (Quality, Installation ease, Life cycle, Characteristics)
- Place (Lead time, Distance)
- Promotion (Guarantee, Flexibility of service)

4Ps contains many Variables that can affect our decisions, Product cost, Transportation cost, Development & tooling cost, Quality, Installation ease, Life cycle, Characteristics, Lead time, Distance, Guarantee, Flexibility of service. These criteria Appear in our example as variables like cost ,ram ,monitor, graphic ,Guarantee ,HDD ,Battery, CPU, service, lead time , and tooling cost which are C1 to C11 respectively.

4. Methodology

4.1. The DEMATEL Method

The DEMATEL (Decision Making Trial and Evaluation Laboratory) method, developed by the Science and Human Affairs Program of the Battelle Memorial Institute of Geneva between 1972 and 1976, was used to research and solve complicated and intertwined problem groups (Fontela, E. and Gabus 1974). DEMATEL is designed to deal with important issues of world societies as a causal analysis technique for gaining causal knowledge. It is a useful causal analysis technique for acquiring causal knowledge because it can visualize the structure of complicated causal relationships. The conventional DEMATEL approach (C. J. Lin, W. W. Wu,2008) has been applied in various fields .
DEMATEL approach has been considered as one of the best tools for dealing with the importance and causal relationships among the evaluation criteria (Fontela & Gabus, 1976 ;).
According to opinions of some researchers (Tamura and Akazawa, 2005; Makuyi and Samani, 2005), it is preferred to use DEMATEL method for the following reasons:

1. This method extracts mutual impressible and effective relations of elements by using graph theory so that it score rate of each relation by a number.

2. This method uses a feedback of relations; namely, each element can affect other elements in the same, upper, and lower levels and be affected by them.

3. The importance and weight of each element in this model are determined not only by upstream and downstream factors, but also by all available factors or total model.

4.2. The steps of the DEMATEL method are described as follows:

Suppose a system contains a set of criteria C = {C_1, C_2, ..., C_n} and particular pair wise relations are determined for modeling with respect to a mathematical relation.

Definition1. The initial direct-relation matrix Z is a n×n matrix obtained by pair-wise comparisons in terms of influences and directions between criteria, in which z_{ij} is the degree to which the criterion C_i affects criterion C_j. Accordingly, all principal diagonal elements z_{ii} of matrix Z are set to zero.

$$Z = \begin{array}{c} \\ C_1 \\ \vdots \\ C_n \end{array} \begin{array}{c} \begin{array}{ccc} C_1 & \cdots & C_n \end{array} \\ \begin{bmatrix} 0 & \cdots & Z_{1n} \\ \vdots & 0 & \vdots \\ Z_{n1} & \cdots & 0 \end{bmatrix} \end{array}$$

Definition2. Let*:*

$$S=\max\left\{\left\{\max_{1\le i\le n}\left(\sum_{j=1}^{n} Z_{ij}\right), \max_{1\le j\le n}\left(\sum_{i=1}^{n} Z_{ij}\right)\right\}\right\} \quad (1)$$

the normalized direct-relation matrix X can be obtained through formula (1).

$$X = \frac{z}{s} \quad (2)$$

The DEMATEL method further assumes that at least one i such that $\sum_{j=1}^{n} Z_{ij} < S$ or one j such that $\sum_{i=1}^{n} Z_{ij} < S$.

This assumption is satisfied in almost all practical cases. Hence, matrix X just resembles the sub-stochastic matrix obtained from an absorbing Markov chain matrix by deleting all rows and columns associated with absorbing states. It had been proved that $\lim_{n\to\infty}(X)^n = O$ and $\lim_{n\to\infty}(I + X + X^2 + \cdots + X^n) = (I - X)^{-1}$ where O is the null matrix and I is the identity matrix (Goodman, 1988).

Definition3. The total relation matrix T can be acquired by formula (2).

$$T = \lim_{n\to\infty}(I + X + X^2 + \cdots + X^n) = X(I - X)^{-1} \quad (3)$$

Definition4. Let t_{ij} (i , j =1, 2,…, n) be the elements of the total-relation matrix T , then the sum of rows and the sum of columns, denoted as r_i and c_j respectively, can be obtained through formulas (3) and (4).

$$r_i = \sum_{j=1}^{n} t_{ij} \quad (i = 1, 2, \ldots, n) \quad (4)$$

$$c_j = \sum_{i=1}^{n} t_{ij} \quad (j = 1, 2, \ldots, n) \quad (5)$$

Definition5. A causal diagram can be acquired by mapping the ordered pairs of ($r_i + c_i$, $r_i - c_i$), where the horizontal axis (r + c), named "Prominence", is made by adding c_i to r_i, and the vertical axis (r − c), named "Relation", is made by subtracting c_i from r_i.

The horizontal axis "Prominence" of the causal diagram shows how important the criterion is, whereas the vertical axis "Relation" may divide the criteria into the cause group and effect group. Generally, when the value ($r_i - c_i$) is positive, the criterion belongs to the cause group. If the value ($r_i - c_i$) is negative, the criterion belongs to the effect group. Hence, causal diagrams can visualize the complicated causal relationships between criteria into a visible structural model, providing valuable insight for problem solving. Further, with the help of a causal diagram, we may make proper decisions by recognizing the difference between cause and effect criteria.

The normalized initial direct-relation matrix was generated by using Eqs. (1) and (2). The total relation matrix was computed by using Eq. (3) has shown in Table 1 and the Degree of influence on each criterion has shown in table 2 and the Influence map of total relationship among criteria is shown in Figure 1.

Table 1. Total influence matrix for criteria

	C1	C2	C3	C4	C5	C6	C7	C8	C9	C10	C11
C1	0.275	0.3018	0.3726	0.3108	0.2725	0.3042	0.5561	0.4897	0.2358	0.2803	0.2497
C2	0.395	0.2105	0.3332	0.3402	0.1614	0.2330	0.3164	0.2398	0.1539	0.2699	0.2084
C3	0.347	0.3439	0.1995	0.3015	0.1472	0.2044	0.2985	0.2192	0.1655	0.2446	0.1934
C4	0.422	0.3710	0.3387	0.2327	0.2770	0.2790	0.5514	0.2997	0.1904	0.2741	0.3204
C5	0.281	0.1814	0.1838	0.2050	0.1583	0.2543	0.2765	0.3411	0.1755	0.2841	0.2214
C6	0.231	0.1896	0.1815	0.1780	0.3352	0.1977	0.3333	0.3500	0.1648	0.2800	0.1939
C7	0.188	0.1920	0.1785	0.1325	0.2578	0.2446	0.1723	0.3100	0.1461	0.2518	0.1753
C8	0.246	0.2302	0.2115	0.1560	0.2745	0.3344	0.2618	0.2518	0.2335	0.3430	0.1646
C9	0.227	0.2106	0.2116	0.1827	0.2170	0.3404	0.2121	0.3594	0.1497	0.3742	0.1906
C10	0.253	0.2556	0.2409	0.1953	0.1758	0.3220	0.2259	0.4049	0.2875	0.2287	0.3265
C11	0.306	0.2567	0.2917	0.2998	0.1381	0.2155	0.2594	0.1938	0.1398	0.1959	0.1454

Table 2. Degree of influence on criteria

	r_i	c_i	$r_i + c_i$	$r_i - c_i$
C1	3.649718	3.176902	6.82662	0.472816
C2	2.862448	2.743765	5.606214	0.118683
C3	2.665873	2.744201	5.410074	-0.07833
C4	3.557429	2.535163	6.092592	1.022267
C5	2.563736	2.415289	4.979025	0.148447
C6	2.63588	2.930153	5.566033	-0.29427
C7	2.249998	3.464236	5.714234	-1.21424
C8	2.708437	3.459943	6.16838	-0.75151
C9	2.675944	2.043203	4.719147	0.632741
C10	2.916985	3.027135	5.94412	-0.11015
C11	2.443525	2.389982	4.833507	0.053543

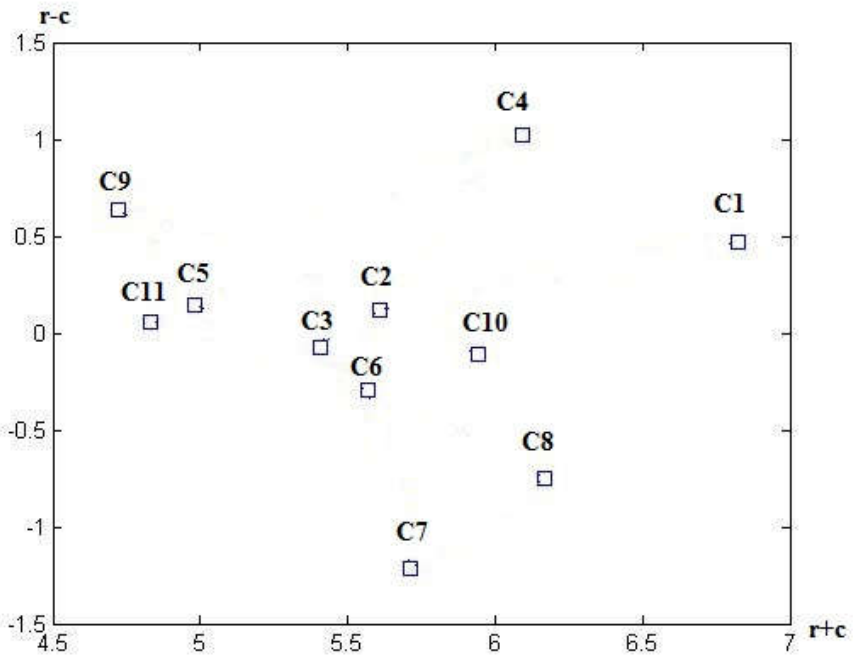

Fig.1. Influence map of total relationship among criteria

Considering the significance of investment among the criteria to have sales more effectively the importance can be prioritized as C1＞C8＞C4＞C10＞C7＞C2＞C6＞C3＞C5＞C11＞C9 in terms of degree of importance $r_i + c_i$.

Incorporating the analysis of DEMATEL evidence, cost (C1), CPU (C8), and graphic (C4) are the top three most important criteria with the values of 6.82662, 6.16838, and 6.092592, respectively. Tooling cost (C11) and service (C9) are the least important criteria with the values of 4.833507 and 4.719147, respectively.

5. Conclusion

The conceptual framework and operational model for investment to have sales more effectively have been presented. By using DEMATEL, the structure and interrelationships have not only been recognized, the key criteria that influence in investment for sales more effectively have also been determined. Results indicate that the three most important criteria are cost, CPU, and graphic. Compared with the previous investigations, the proposed method may have following contributions.

First, a new model for investment with emphasis on sales has been developed. Such a framework has never been found in the previous literature. Secondly, the DEMATEL method was applied in ranking criteria, it is rarely found from the previous studies. DEMATEL can deal with the complicated and intertwined problems and determine the causal relationships among the Evaluation criteria by identifying the structure and interrelationships, the key criteria that influence sales in investment effectively have been recognized.

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