DECISION SUPPORT SYSTEM FOR THE SELECTION OF DIGITAL ADVERTISING PROVIDER FOR CAR SALES USING WEIGHT PRODUCT METHOD (Case Study : PT. Media Tech Indonesia)

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ABSTRACT

This research is motivated by the internet which is starting to be seen as a potential media to be used as a means of advertising. Compared to other media such as television, the internet offers relatively lower rates for a longer installation period. If it costs 20 million rupiah, an advertiser can only display one ad for one slot for two times. Conversely, for the same fee, advertisers can place weeks of advertisements on the internet. Since online advertising has emerged, many digital ad providers have been able to advertise a product. When individuals or their companies (customers) want to advertise products, many of them still don't understand how to use digital advertising providers. The purpose of this study is to provide an information or description in the decision to choose a digital advertising provider for car sellers according to customer desires.
In this research, a system implemented using the Weight Product (WP) method has a vector V value that is different for each customer. The results of this study conducted by 20 individual customer types chose digital advertising providers Google Ads 30%, Facebook 55%, Instagram 10%, Youtube 5% and 20 corporate type customers chose the digital advertising provider Google Ads 15%, Facebook 45%, Instagram. 35%, Youtube 5%. It can be concluded that the test results show that individual customer types tend to choose the Facebook digital advertising provider (55%), while the corporate type customers tend to choose the Facebook digital ad provider (45%).

Keywords: Weight Product, Vector V, Digital Advertising Provider, Individual and Corporate Customers.

1. BACKGROUND

The development of the number of internet users in Indonesia over the last 8 years has shown a very rapid increase. It is noted that if at the beginning of 2000 the number of internet users in Indonesia only amounted to no more than 1.9 million users, it is estimated that by the end of 2007 there were 25 million users (Association of Indonesian Internet Service Providers 2007). With this growth, it means that every year, there is an increase in the number of users by 3.3 million. This makes the internet began to be seen as a potential medium to be used as a means of advertising. Compared to other media such as television, the internet offers relatively lower rates for a longer installation period. If it costs 20 million rupiah, an advertiser can only display one ad slot for two servings. On the other hand, for the same fee, advertisers can place ads for weeks on the internet. Since the emergence of online advertising a lot of popping up. Many providers of advertising providers to advertise a product. When individuals or companies (customers) want to advertise their products, there are still many who do not understand how to use advertising providers. PT. Media Tech Indonesia provides solutions to advertise a product and provide recommendations for alternative choices to customers according to customer needs

2. RESEARCH METHOD

2.1 Decision Support System (DSS)

According to Bonzek, et al, (in the book Decision Support System And Intelligent System, defines a Decision Support System (DSS) as a computer-based system consisting of three interacting components, a language system (a mechanism to provide communication between users and other Decision Support System components).), knowledge systems (repositories of problem domain knowledge that exist in Decision Support Systems or as data or as procedures), and problem processing systems (relationships between two other components, consisting of one or more general problem manipulation capabilities required for decision making)

2.2 Characteristic of Decision Support Systems

The characteristics of a decision support system are as follows:

1) Support a decision support system that focuses on Management by Perception.
2) The existence of a human/machine interface, where humans as users still control the decision-making process.
3) Support decision making in solving unstructured and semi-structured problems.
4) Using models, both mathematical models, statistics and other appropriate models to support the decision-making process.
5) Able to provide appropriate information for the needs of interactive models.
6) Have an integrated subsystem in a decision support system so that it can function as a unified system.
7) The existence of comprehensive data support to fulfill the existing functions at the management level.
8) Easy to use approach, meaning ease of use of the system, this is a characteristic of an effective decision support system, which allows users to be free and fast to interact.
9) Having the ability to adapt appropriately to changes that occur in other words the system can face problems that just arise as a result of changing conditions.

2.3 Weight Product (WP)

Weight Product is a popular multi-criteria analysis decision and is a multi-criteria decision-making method. Like all FMADM methods. The FMADM method to solve cases where the data consists of many attributes of interest consists of the Simple Additive Weighting Method (SAW), Weighted Product (WP), ELECTRE, TOPSIS, and Analytic Hierarchy Process (AHP) (Kusumadewi in Lestari, S., 2013). WP is a finite set of decision alternatives described in terms of several decision criteria (Ningrum, 2012). This WP method is different from the SAW method in the initial treatment of the results of the decision attribute assessment. In the WP method, no matrix manipulation is needed because this method multiplies the results of the assessment of each attribute. The multiplication result has not been compared (divided) with the standard value, in this case the ideal alternative is often used as a standard weight value. . According to Yoon (in Kusumadewi's book, 2006), the Weight Product method uses a multiplication technique to connect attribute ratings, where the rating of each attribute must be raised first with the weight of the attribute concerned. The steps taken in solving the problem using the Weighted Product method are:

The steps for the completion of the Weighted Product are as follows:

1) Determine the criteria
   Namely the criteria that will be used as a reference in making decisions, namely Ci and the nature of each criterion.
2) Determine the compatibility rating
   That is, rating the suitability of each alternative on each criterion, and making a decision matrix.
3) Normalize the weights
   Normalized Weight = The weight of each criterion / the sum of all the weights of the criteria.
   The value of the total weight must meet the equation:
   WP . method weight normalization formula

$$W_j = \frac{w_j}{\sum w_j} \quad \text{.....(3.1)}$$

Information :

W : rank is positive for profit attribute, and rank is negative for cost attribute and W index to j. example for W_1 is 5, W_2 is 3 and so on.

ΣW_j : the sum of W is for example 5+3+4+4+2

After this calculation, the value of W will be between 0 and 1, where the total of all W is 1. Then, W is multiplied by 1 for the benefit-valued attribute and W is multiplied by -1 for the cost-valued attribute.

4) Determine the value of the vector S
   By multiplying all the criteria for an alternative with the weight as a positive power for the benefit criterion and the weight functioning as a negative power on the cost criterion.
   The formula for calculating the preference value for alternative Ai is given as follows:
   $S_i = \prod_{j=1}^{n} X_{i_j}^{W_j}$ .....(3.2)
   Information:
   S : represents an analogous alternative as a vector S
   x : declares the criterion value
   w : declares the weight of the criteria
   i : declare alternative
   j : state the criteria
   n : states the number of criteria
5) Determine the value of the Vector V
   That is the value that will be used for ranking.
   The relative preference value of each alternative can be calculated by the formula:
   $V_i = \frac{\prod_{j=1}^{n} X_{i_j}^{W_j}}{\prod_{j=1}^{n} X_{i_j} * W_j}$ ..... (3.3)
   Where, V_i is the result of alternative preference to – i and $\prod_{j=1}^{n} X_{i_j} * W_j$ is the sum of the multiplication of alternative ratings per attribute.
6) Ranking the values of the Vector V
   Concluding as a final stage.

3. SYSTEM ANALYSIS AND DESIGN

3.1 Analysis

In the development of this system, there are two users who can interact with the system. These two users are admin and customer (individual and corporate). Admin is the user who manages the system as well as the user in charge of inputting data for account data, criteria data and alternative data which is then processed in the calculation of WP (Weight Product) and ranked and reported. customer is a user as a user to fill in the match table that has been provided by the system.

Table 1 User Identification in the Decision Support System for Selection of Digital Advertising Providers for Car Sales Using the Weight Product Method

User Type	User Description
Admin	User who manages the system as well as the user in charge of inputting data for account data, criteria data and alternative data which is then processed in the calculation of WP (Weight Product) and ranked and report
customer	User as a user to fill in the match table that has been provided by the system

In the decision support system for selecting digital advertising providers for car sales using the Weight Product method, there are several criteria and alternatives that serve as a reference / basis for customers. These criteria become a reference in calculating using the Weight Product (WP) method. These criteria are shown in table 2 as follows:

Table 2 Criteria Table

Criteria	**Description**
C1	Advertising Price
C2	Number of Search Keywords
C3	Showtime
C4	Number Of Characters Ad Description
C5	Cost Per Click

The following is an alternative that becomes a reference in performing calculations using the Weight Product (WP) method. The alternatives are shown in table 3 as follows:

Table 3 Alternative Table

Alternative	**Description**
Al1	Google Ads
Al2	Facebook
Al3	Instragram
Al4	Youtube

The following is the level of importance (weight) of each criterion that is used as a reference in decision making. The following are the criteria used in this system:

1 = Very low,
2 = Low,
3 = Enough,
4 = Height,
5 = Very High.

3.2. System Design

The system designed is a software application that applies the WP (Weight Product) method. The implementation of the WP method in this system is as shown in the following flowchart:

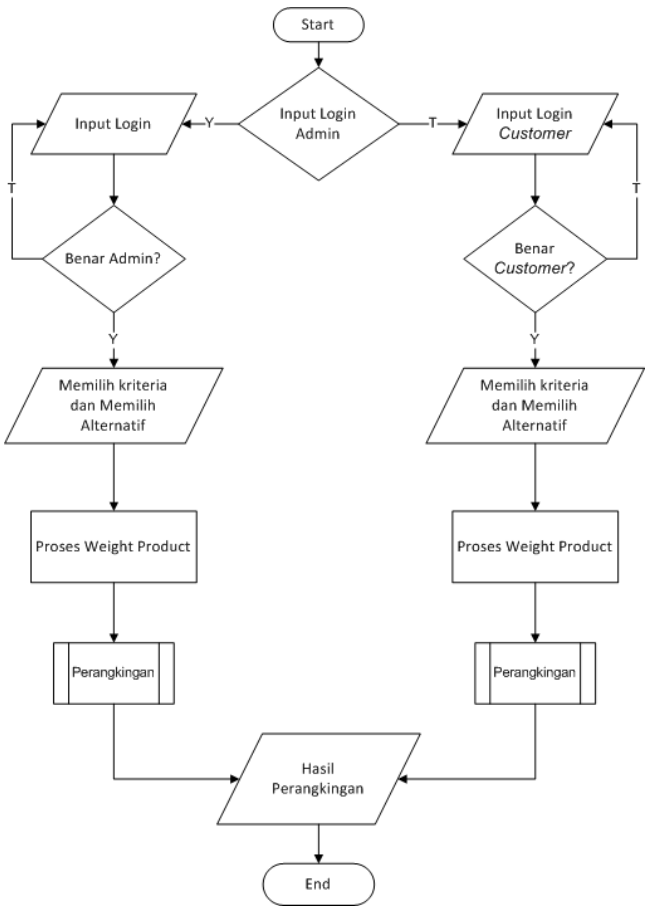

Figure 1 Flowchart of the Main Functions of the Software

4. RESULT AND DISCUSSION

In the results and discussion of this research, it is described how the WP can solve the existing problems, namely by using the multiplication of the criterion value against the criterion weight. The elaboration of the research results is shown by describing the system design and mathematical calculations from WP in determining the ranking of digital advertising providers.

4.1 WP Implementation Test Result on The System

In the test results in the application of wp on the system, there are 2 types of customers, namely individual customers and corporate customers.

Table 4 Tests Carried Out by 20 Individual Type Customers with The Following Results:

No	Nama	Advertising Price	Number of Search Keywords	Showtime	Number Of Characters Ad Description	*Cost Per Click*	Output System
1	Vivi Dwi Ariyanti	3	3	4	3	4	Facebook
2	Ibaz Kurniawan	4	3	4	3	3	Facebook
3	Hanif Suryo Adi	4	3	3	2	3	Facebook
4	Jesika Sembiring	3	4	3	3	4	Facebook
5	Siska Christin	5	2	3	4	4	Facebook
6	Reza Abror Syuhada	5	4	4	4	3	Facebook
7	David Ota Firmanu	3	3	4	2	5	Google Ads
8	Mitha Rohmawati	4	3	4	2	5	Google Ads
9	Ikbar Hafidz	4	2	4	2	5	Youtube
10	Dodik Pratomo	4	2	4	3	3	Google Ads
11	Achmad Tohiri	3	4	3	2	3	Instagram
12	Fajar Sukma	4	4	3	4	3	Google Ads
13	Hendra Prasetyo	4	4	3	2	3	Facebook
14	Iwan Dwi Kurniawan	3	3	3	3	3	Google Ads
15	Iqballudin Ramadhan	3	3	3	3	4	Facebook
16	Bunga Sapadyna	4	4	3	4	3	Facebook
17	Diyah Dianawati	4	2	4	3	3	Facebook
18	Tono Buky	3	3	3	3	3	Facebook
19	Misca Ety	2	4	3	2	3	Instagram
20	Ellina Fibri	4	2	4	3	3	Google Ads

Table 5 Tests Carried Out by 20 Corporate Type Customers with The Following Results:

No	Nama	Advertising Price	Number of Search Keywords	Showtime	Number Of Characters Ad Description	*Cost Per Click*	Output System
1	PT.Beton Abadi Prima	3	3	3	3	3	Instagram
2	PT.Duta Bayu Citra	3	4	3	4	3	Facebook
3	PT.Atlantic Intraco	4	3	3	3	3	Facebook
4	PT.Fortune Mandiri Indonesia	3	2	3	3	4	Facebook
5	PT.Valvian Starshine	3	2	3	3	4	Youtube
6	PT.First Tama Global Pasifik	3	2	3	3	4	Instagram
7	PT.United Motors Center	4	2	3	4	2	Instagram

8	PT.Toyota Liek Motor Cabang Jember	4	3	2	4	3	Facebook
9	PT.Indomobil Trada Nasional	4	3	3	3	3	Facebook
10	PT.Himalaya Mitra Sukses	3	4	4	3	3	Instagram
11	PT.Osaka Envirotama Prabunya	2	4	4	3	3	Google Ads
12	CV.Sintech Rakindo	3	3	3	3	4	Facebook
13	CV.Sentratama Sejahtera	3	4	3	3	4	Facebook
14	PT.Global Paket Solusi	3	2	3	4	3	Instagram
15	PT.Nissan Motor Indonesia	2	4	3	3	4	Instagram
16	PT.Asri Motor	3	2	3	4	3	Instagram
17	PT.Astra International Tbk	2	4	4	3	3	Google Ads
18	PT.Arista Jaya Lestari	3	4	3	3	4	Google Ads
19	PT.Istana Mobil Surabaya Indah	3	3	3	4	3	Facebook
20	PT.Sejahtera Buana Trada	4	2	3	4	3	Facebook

So the analysis of the test results from the table above is

1) The results of testing 20 individual customers, the provider that is often chosen is the Facebook provider with 11 customers.
2) The results of testing 20 corporate customers, the provider that is often chosen is the Facebook provider with 9 customers

4.2 Discussion

WP calculation is done, the steps are as follows:

1) Determine the criteria that will be used as a reference in decision making, namely Ci and the nature of each criterion.

Table 5 Determines The Criteria

CRITERIA	NATURE	NATURE
C1 : Advertising Price	Cost	4
C2 : Number of Search Keywords	Cost	3
C3 : Showtime	Benefit	3
C4 : Number Of Characters Ad Description	Benefit	3
C5 : Cost Per Click	Cost	3

2) Determine the suitability rating of each alternative on each criterion

Table 6 Table of Suitability Ratings for each Alternative

ALTERNATIVE	CRITERIA				
	C1 (Rp)	C2	C3	C4	C5
Google Ads	1200000	50	30	90	1800
Facebook	700000	35	30	60	1200
Instagram	1000000	40	40	50	1300
Youtube	2900000	50	30	70	1000

3) Normalize the weights
   W = (4, 3, 3, 3, 3)
   W1 = 4 / (4 + 3 + 3 + 3 + 3) = 4 / 16 = 0.25,
   If cost will multiply by -1 so 0.25 *(-1) = -0.25
   W2 = 3 / (4 + 3 + 3 + 3 + 3) = 3 / 16 = 0.1875 rounded up to = 0.19,
   If cost will multiply by -1 so 0.19 *(-1) = -0.19
   W3 = 3 / (4 + 3 + 3 + 3 + 3) = 3 / 16 = 0.1875 rounded up to = 0.19,
   If the benefit will be multiplied by 1 so 0.19 *1 = 0.19
   W4 = 3 / (4 + 3 + 3 + 3 + 3) = 3 / 16 = 0.1875 rounded up to = 0.19,
   If the benefit will be multiplied by 1 so 0.19 *1 = 0.19
   W5 = 3 / (4 + 3 + 3 + 3 + 3) = 3 / 16 = 0.1875 rounded up to = 0.19,
   If cost will multiply by -1 so 0.19 *(-1) = -0.19

4) Determine the value of the vector S by multiplying all criteria for an alternative with the weight as a positive power for the benefit criterion and the weight functioning as a negative power on the cost criterion.
   $S1 = (1200000^{-0.25}) * (50^{-0.19}) * (30^{0.19}) * (90^{0.19}) * (1800^{-0.19}) = 0.015519$
   $S2 = (700000^{-0.25}) * (35^{-0.19}) * (30^{0.19}) * (60^{0.19}) * (1200^{-0.19}) = 0.019002$
   $S3 = (1000000^{-0.25}) * (40^{-0.19}) * (40^{0.19}) * (50^{0.19}) * (1300^{-0.19}) = 0.017028$
   $S4 = (2900000^{-0.25}) * (50^{-0.19}) * (30^{0.19}) * (70^{0.19}) * (1000^{-0.19}) = 0.013269$

5) Determining the value of the vector V to be used for ranking The value of the vector V to be used for ranking can be calculated as follows
   Vn = Sn / Stotal
   V1 = 0.015519 / 0.064818 = 0.239424
   V2 = 0.019002 / 0.064818 = 0.293159
   V3 = 0.017028 / 0.064818 = 0.262704
   V4 = 0.013269 / 0.064818 = 0.204711

6) Rank the Value of Vector V by looking at point number 5.

Table 7 Ranking of V Vector Values

Alternative	Result	Rank
Al2	0.2931593	1
Al3	0.2627048	2
Al1	0.2394242	3
Al4	0.2047117	4

5. CONCLUSION

The conclusions obtained in this study are:

1) The design of the information system using the WP (Weighted Product) method has been successfully built and has successfully gone through several test processes on several functions with good results.
2) The implementation of this system can function as a tool for selecting digital advertising providers by displaying output in the form of ranking information for digital advertising providers.
3) The results of system testing conducted by 20 individual types of customers chose digital advertising providers Google Ads 30%, Facebook 55%, Instagram 10%, Youtube 5%.
4) The results of system testing conducted by 20 corporate type customers chose digital advertising providers Google Ads 15%, Facebook 45%, Instagram 35%, Youtube 5%.
5) The test results show that individual type customers tend to choose Facebook digital advertising provider (55%), while corporate type customers tend to choose Facebook digital advertising provider (45%).

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