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Decision Support System for Determining Campus Promotion Media in New Student Admissions With Analytical Network Process and Regression Methods

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Abstrak

Promosi kampus dilakukan dalam upaya memperkenalkan kampus kepada masyarakat khususnya para calon peserta didik baru. Upaya tersebut dilakukan sebagai tindakan yang dinilai efektif dalam rekrutmen mahasiswa baru. Berbagai kendala yang dialami Perguruan Tinggi dalam penerapan promosi kampus yaitu kurangnya kebutuhan dana penunjang, Sumber Daya Manusia (SDM) yang terbatas, sistem keputusan yang tepat untuk pemilihan media promosi. Penelitian ini menganalisis sistem penunjang keputusan dalam pemilihan media promosi yang tepat untuk promosi kampus. Tujuan penelitian yaitu membantu manejemen kampus dalam melakukan pemilihan media promosi yang tepat dengan sistem pendukung keputusan penentuan media promosi penerimaan mahasiswa baru serta menentukan prioritas media promosi yang akan digunakan oleh Perguruan Tinggi Swasta (PTS) yang ada dikota Kendari. Sampel dalam peneltian ini berjumlah 40 responden yang bersumber dari 24 perguruan tinggi. Adapun metode yang digunakan yaitu dengan menggunakan metode Analitical Network Prosess (ANP) dan metode Regression menggunakan analisis faktor. Hasil analisis penelitian menununjukan bahwa media promosi dengan menggunakan website kampus memiliki rating nomor satu yaitu dengan nilai sebesar 26.2% sedangkan word of mouth dengan rating kedua yaitu 23.3%, kemudian media sosial dengan niali 23.1%, brosure 8.9%, media cetak dan media eltronik dengan nilai 6.2% serta baliho memiliki nilai 5.7%.

Kata kunci*—Media Promosi, Sistem Penunjang Keputusan, Analytical Netwok Process, Regresi.*

Abstract

Campus promotion is carried out in an effort to introduce the campus to the community, especially prospective new students. This effort was carried out as an action that was considered effective in recruiting new students. Various obstacles experienced by tertiary institutions in implementing campus promotion, namely the lack of need for supporting funds, limited human resources (HR), the right decision system for the selection of promotional media. This study analyzes the decision support system in selecting the right promotional media for campus promotion. The research objective is to assist campus management in selecting the right promotional media with a decision support system for determining the promotion media for new student admissions and determining the priority of the promotional media that will be used by private universities (PTS) in the city of Kendari. The sample in this study amounted to 40 respondents from 24 universities. The method used is the Analytical Network Process (ANP) method and the Regression method uses factor analysis. The results of the research analysis show that promotional media using the campus website has a number one rating, namely with a value of 26.2% while word of mouth has a second rating of 23.3%, then social media with a score of 23.1%, brochure 8.9%, print media and electronic media with a value of 6.2% and billboards have a value of 5.7%.

Keywords*—Promotion Media, Decision Support Systems, Analytical Network Process, Regression.*

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1. INTRODUCTION

Routine activities carried out by several universities (PT), both State Universities (PTN) and Private Universities (PTS) in facing the new academic year, are conducting campus promotions. Campus promotion is carried out in an effort to introduce the campus to the community, especially prospective new students. This effort was carried out as an action that was considered effective in recruiting new students. The purpose of campus promotion is so that prospective new students are interested and motivated to continue their studies at the higher education level. Each college has a strategy for campus promotion. The implementation of promotions carried out by tertiary institutions is inseparable from the various obstacles experienced by tertiary institutions, such as the lack of funding needed to support campus promotion, lack of human resources (HR) to carry out campus introduction promotions, there has been no right decision in the selection of promotional media to promote Higher Education thus becomes a problem for higher education institutions in netting new student admissions [3].

Campus promotion is all activities that originate from campus policies to provide information to the public about campus programs and advantages. Campus promotion is a routine activity carried out by universities in the new academic year. Promotion is carried out with the aim of obtaining sympathizers or attraction for new students. In particular, private universities in Kendari city and in general in Indonesia must carry out these activities and promotions are carried out using either electronic media or other media [17].

Promotion is an element of the marketing mix that is oriented towards notification, persuading, and reminding consumers of the company's brands and products [13]; [14]; [10]. Meanwhile, according to Buchory and Saladin in Aris Jatmika Diyatma, promotion is one of the elements in the company's marketing mix that is used to inform, persuade, and remind about the company's products [9]. So that promotion is a tool or media for communicating that influences potential consumers to be interested in buying, using a service or a product sold by an agency or company. There are many types of promotional media such as mass media, which can be done by advertising products to be sold to the public in newspapers, magazines, pamphlets, brochures, banners [1]; [2]; [4]. Online media such as social media are used by uploading a complete image display with information about the details of the study program as well as a brief review of the advantages of each study program, details of the costs of each study program, the initial cost if prospective students pay semester fees at the beginning of registration, and Miscellaneous expense. However, there are advantages and disadvantages of promotional media, so it requires more study to learn which promotional media is appropriate to decide and use which is reviewed based on the dimensions of the promotional mix and the dimensions of digital marketing [14]; [23]; [16].

Daryanto and Kotler define promotion is a one-way flow of information or persuasion that can direct an organization or a person to create transactions between buyers and sellers [7]; [13]. In the implementation of promotional activities, there are several important things that must be considered in promotional activities, namely by considering environmental aspects of promotion, costs, tools and promotional resources.[5];[6];[8].

The concept of Decision Support Systems is characterized by a computer-based interactive system that helps decision making by utilizing data and models to solve unstructured and semi-structured problems. Decision support systems are defined as computer-based systems consisting of interacting components, namely language systems, knowledge systems, and problem processing systems. [24];[25]. G. R. Terry, suggests that decision making is a selection based on certain criteria on two or more possible alternatives [19]. Decision making is the selection among alternatives regarding a way of acting, namely the essence of planning, a plan cannot be said to be non-existent [21].

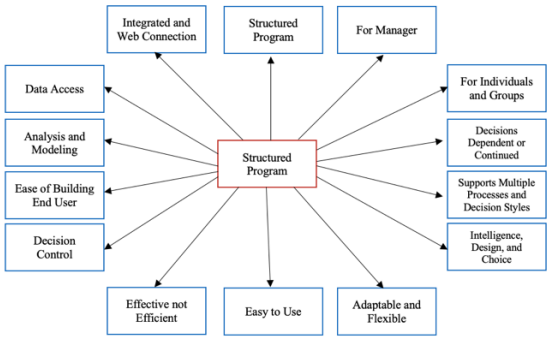


Figure 1 Structure Model of the Decision Support System

2. METHODS

2.1 Problems

The implementation of promotions carried out by tertiary institutions is inseparable from the various obstacles experienced by tertiary institutions, such as the lack of funding needed to support campus promotion, lack of human resources (HR) to carry out campus introduction promotions, there has been no right decision in selecting promotional media to promote Higher Education thus becomes a problem for higher education institutions in netting new student admissions. To overcome the problem of selecting the right promotional media in new student admissions, a method is needed to determine the percentage achieved in each period after promotion.

2.2 Data Collection

The data used in the process of selecting campus promotion media is to determine the statement items presented in the form of a questionnaire which will be addressed to respondents. Data processing based on survey results in the form of a questionnaire will be processed using Microsoft Excel tools. The population of 201 respondents came from 24 private universities (PTS) in the city of Kendari while the sample was 40 respondents.

The stages in the research can be described as follows:

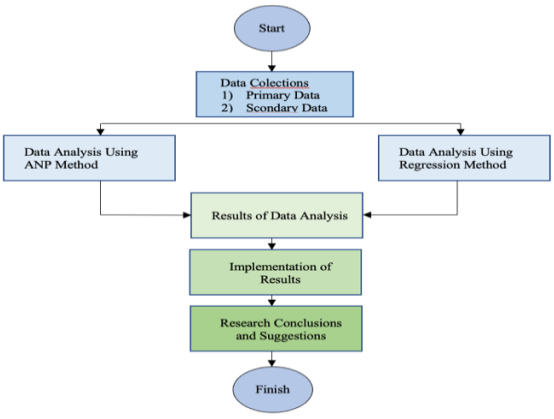


Figure 2 Research Flowchart

2.3 Analitical Network Process (ANP)

Analytic Network Process (ANP) is a mathematical theory that is able to analyze the effect by using an assumption approach to solve the shape of the problem. This method is used in the form of a solution with consideration of adjusting the complexity of the problem by means of a synthesis decomposition accompanied by a priority scale that produces the greatest priority effect. ANP is also able to explain the dependence factors model and its feedback systematically. Decision making in the ANP application is by considering and validating

empirical experiences. The network structure used, namely benefits, opportunities, cost and risk (BOCR), makes this method possible to identify, classify and arrange all the factors that affect the output or the resulting decisions [15]; [22].

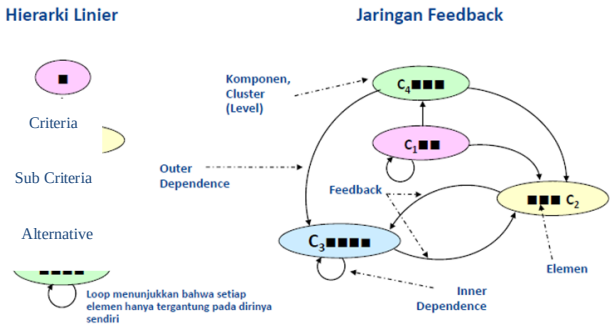


Figure 3 ANP Model

The concept of the Analytic Network Process (ANP) includes, [22]:

1. Feedback, inner, and outer dependence
2. Effect with respect to a criterion
3. Hierarchy or system control
4. Supermatrix
5. Limiting supermatrix and limiting priorities
6. Primitivity, irreducibility, cyclicity
7. Creating a stochastic supermatrix limiting: why clusters should be compared
8. Synthesis of criteria from a hierarchical control or a control system
9. Synthesis for profit, cost, opportunity, and risk control hierarchy
10. Formulation for calculating the limit
11. Relationship to the Neural Network Firing-ongoing case
12. The density of neural firing and its distribution and application to reproduce visible imagery and symphonic composition.

In ANP the number of respondents is not a measure of validity. Requirements for respondents who are valid (valid) in the ANP are that they are people who are experts in their fields. The questions in the ANP questionnaire are in the form of pairwise comparisons (pairwise comparisons) between elements in the cluster to find out which of the two is more influential (more dominant) and how big the difference is (on a scale of 1-9) seen from one side. [18].

Verbal Rating Scale	Numeric Scale
Very much greater importance	9
	8
Very greater level of importance	7
	6
Greater importance	5
	4
Slightly greater level of importance	3
	2
Same leve of importance	1

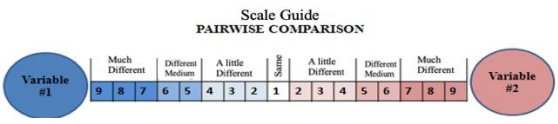


Figure 4 Verbal scale and numeric scale

In accordance with its basic principles, there are three main functions of ANP, namely structuring complexity, measurement, and synthesis [20];[21]:

1) Structuring complexity

ANP functions to handle complex problems by structuring complexity hierarchically into homogeneous clusters of factors.

2) Measurement into the ratio scale

The previous decision-making methodologies generally used low level measurements (ordinal or interval measurements), while the ANP methodology used ratio scale measurements which were believed to be the most accurate in measuring the factors that make up the hierarchy. One of the advantages of the ANP approach is its priority measurement based on ratios and proportions to capture relationships and influences so as to produce accurate predictions and correct decisions. The measurement levels from lowest to highest are nominal, ordinal, interval, and ratio. Each level of measurement has all the meanings that the lower level has with the addition of new ones.

3) Synthesis

Synthesis is the process of bringing all the parts together into one unit. Because of complexity, in situations of critical decisions, estimates, or resource allocation, it often involves too many dimensions for humans to be able to synthesize, so we need a way to synthesize. Although ANP facilitates analysis, an even more important function in ANP is its ability to assist us in measuring and synthesizing a number of factors in a hierarchy or network.

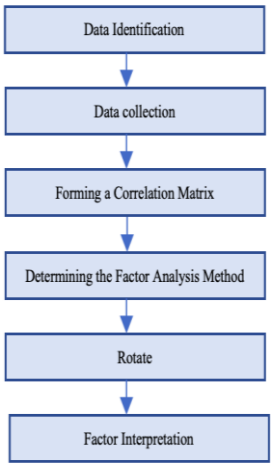
2.4 Linear Regression

Linear Regression Analysis - Simple Linear Regression or the same as factor analysis is a statistical method that functions to test the extent of the causal relationship between the Causal Factor Variable (X) and the Consequential Variable. The Causative Factor is generally denoted by X or also known as Predictor while the resultant variable is denoted by Y or also known as Response. Simple Linear Regression or often abbreviated as SLR (Simple Linear Regression) is also a statistical method used in production to forecast or predict quality and quantity characteristics. [11];[18].

The factor analysis model is as follows:

$$X_1 - \mu_1 = \ell_{11}F_1 + \ell_{12}F_2 + ... + \ell_{1m}F_m + \varepsilon_1 \qquad X_p - \mu_p = \ell_{p1}F_1 + \ell_{p2}F_2 + ... + \ell_{pm}F_m + \varepsilon_p$$

The regression procedure in determining factor analysis is first to formulate the problem and identify the original variable to be factor analyzed. Then a correlation matrix of the variables is established and the factor analysis method is selected. Researchers determine the number of factors to be selected (extracted) from these many variables and the rotation method will be used. Further interpret the rotational yield factor [11]; [12]. The steps of factor analysis when illustrated by a flow chart are as follows:



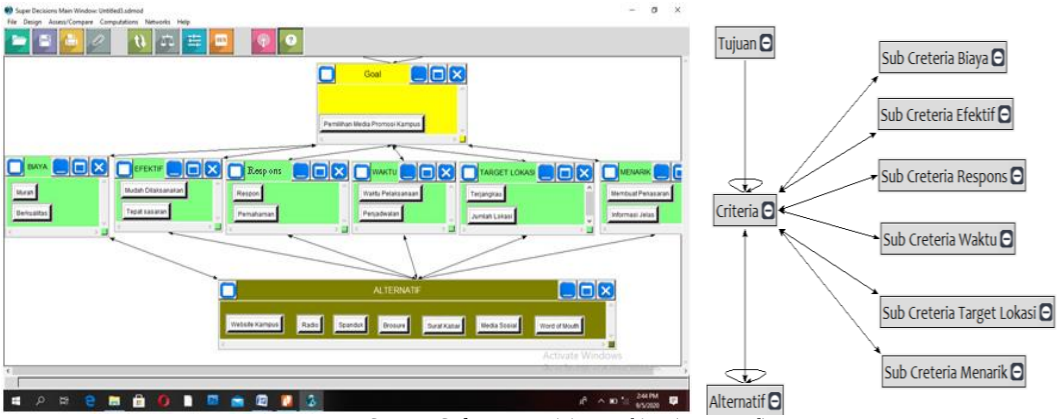
Step 1	Step 2	Step 3	Step 4	Step 5	Step 6	Step 7
Correlation matrix examination, through: 1. Uji Bartlett 2. Uji KMO 3. Uji MSA	Extracting factors, through: 1. Component Analysis (PCA) 2. Common Factor Analysis (CFA)	Rotation factor, through: 1. Rotasi Orthogonal 2. Varimax	Calculating Score Factor 1. Wiight Least Square 2. Regresi	Interpretation Factor	Factor Making	Selection of surrogate variables or summated scale

Figure 5 Steps for Factor Analysis

3. RESULTS AND DISCUSSION

3.1 Results of Analysis ANP Method

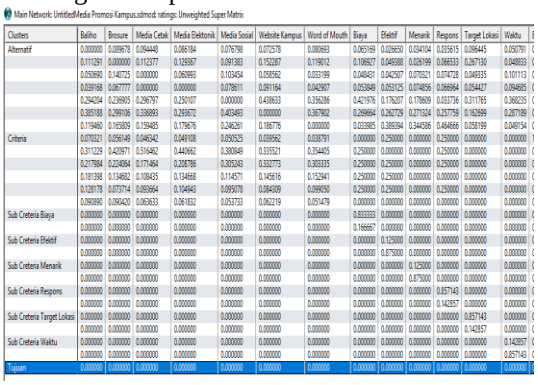
At the stage of making the ANP network structure, each criterion and sub criterion will be determined whether it affects one another. The criteria used are cost, efficiency, response, time, target location, and attractiveness. Alternatives in the selection of promotional media will be the main target in selecting campus promotion media. Alternatives in the selection of campus promotion media are campus websites, electronic media, banners, brochures, print media, social media, and word of mouth. The ANP network structure that is formed is:



Source: *Software Decision Making* (processed)

Figure 6 Main Network Structure Model

Unweighted Super Matrix



Weighted Super Matrix

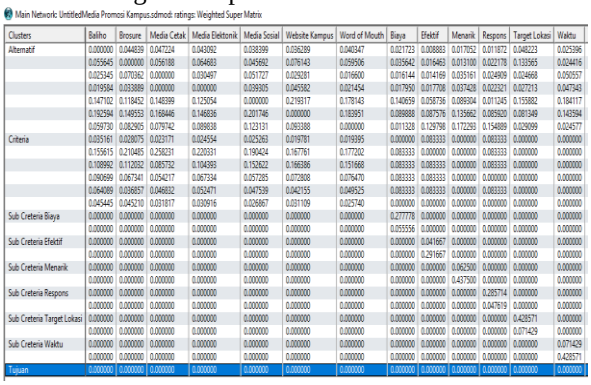
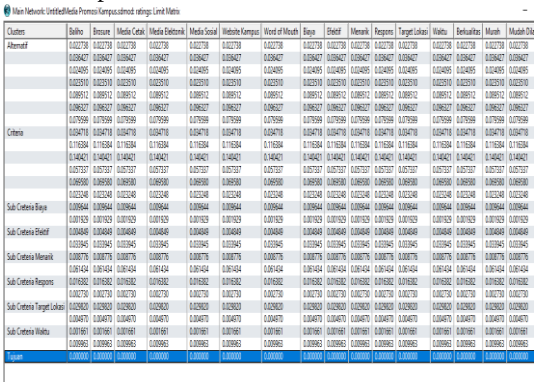


Figure 7 Main Network Ratings: Unweighted Supermatrix and Weighted Super Matrix of Campus Promotion Media

Limit Supermatrix Results

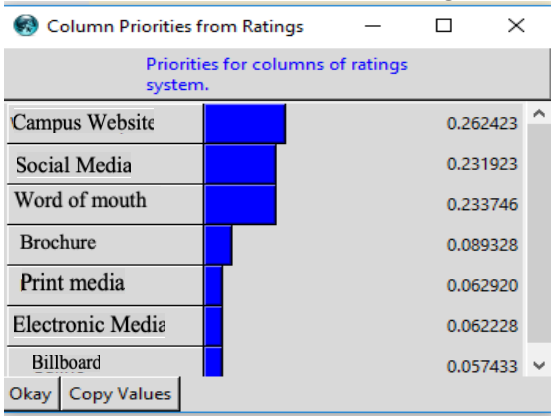


Priority Recapitulation

PRIORITIES			
No	Name	Normalized By Cluster	Limiting
1	Baliho	0.05743	0.022973
2	Brosure	0.08933	0.035731
3	Media Cetak	0.06292	0.025168
4	Media Elektonik	0.06223	0.024891
5	Media Sosial	0.23192	0.092769
6	Website Kampus	0.26242	0.104969
7	Word of Mouth	0.23375	0.093498
8	Biaya	0.04619	0.018477
9	Respon	0.13819	0.055274
10	Efektif	0.37461	0.149845
11	Menarik	0.28534	0.114135
12	Target Lokasi	0.0937	0.037479
13	Waktu	0.06197	0.024788
14	Berkualitas	0.83332	0.007699
15	Murah	0.16668	0.00154
16	Pemahaman	0.85715	0.023689
17	Respon	0.14285	0.003948
18	Mudah Dilaksanakan	0.125	0.009365
19	Tepat Sasaran	0.875	0.065557
20	Kejelasan Informasi	0.12499	0.007133
21	Membuat Penasaran	0.87501	0.049934
22	Jangkauan	0.85715	0.016063
23	Jumlah Lokasi	0.14285	0.002677
24	Jadwal Pelaksanaan	0.14288	0.001771
25	Waktu Pelaksanaan	0.85712	0.010624

Figure 8 Main Network Ratings: Limit Matrix and Priority Weights of Campus Promotion Media

Promotional Media Alternative Rating



Most Influential Criteria Weights Graph

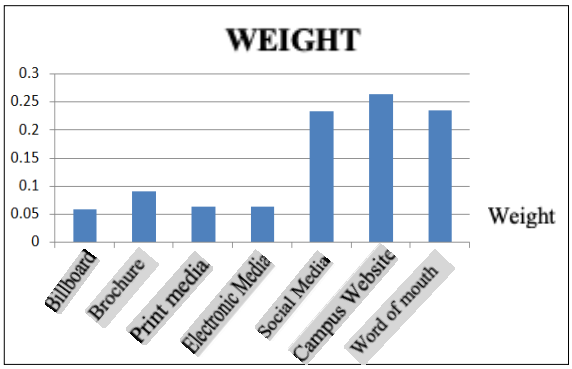


Figure 9 Alternative Ratings and Weighting Criteria Most Influential Graphs of Promotional Media

3.2 Factor Analysis with Regression Approach

1. Barlett test (Bartleet's Test of Sphericity)

Table 1 Value KMO dan Bartlett's Test of Sphericity Each Factor Correlation

KMO and Bartlett's Test

		Campus Website	Electronic Media	Billboard	Brochure	Print media	Social Media	Word of Mouth
Kaiser-Mayer-Olkin Measure of Sampling Adequcy		.536	.765	.528	.684	.578	.628	.703
Bartle Test of Sphericity	Approx Chi-Square	43.036	42.298	50.275	57.238	32.111	38.909	53.462
	df	15	15	15	15	15	15	15
	Sig.	.000	.000	.000	.000	.001	.001	.000

Source: Processed promotional media data (processed)

2. Test the Measure of Sampling Adequacy (MSA)

The MSA test is a test used to measure the homogeneity between variables and to filter between variables so that only the variables that meet the requirements can be further processed. Where the MSA value is 0.5 - 1.0. In the image matrices part of the anti-image correlation and the variables formed after the MSA test are as follows:

Table. 2 Anti Image Matrices Correlation Variable Value after MSA test

Anti-image Matrices

	Campus Website	Electronic Media	Billboard	Brochure	Print media	Social Media	Word of Mouth
Anti-image Correlation							
Cost	.598[a]	.787[a]	.469[a]	.476[a]	.558[a]	.623[a]	.465[a]
Effective	.538[a]	.715[a]	.542[a]	.669[a]	.530[a]	.581[a]	.703[a]
Response	.408[a]	.829[a]	.454[a]	.784[a]	.631[a]	.619[a]	.622[a]
Time	.541[a]	.666[a]	.527[a]	.673[a]	.540[a]	.696[a]	.757[a]
Target Location	.440[a]	.815[a]	.532[a]	.733[a]	.670[a]	.623[a]	.755[a]
Interesting	.564[a]	.760[a]	.691[a]	.635[a]	.583[a]	.601[a]	.810[a]

a. Measures of Sampling Adequacy(MSA)

Source: Processed promotional media data (processed)

3. Factoring or extraction process

The factoring or extraction process is a process of separating variables that meet the correlation from the MSA value, where a variable is said to be correlated if the MSA value is greater than 0.5. The method used is Principal Components Analysis (PCA). The number of variables to be extracted is shown in Table 3 of the contribution of the extracted variables.

Table 3 Contribution of Extraction Results

	Campus Website	Electronic Media	Billboard	Brochure	Print media	Social Media	Word of Mouth
Communalities		**Extraction**					
Cost	.598	.560	.702	.591	.765	.684	.771
Effective	.704	.741	.687	.808	.771	.467	.684
Response	.341	.422	.329	.710	.744	.631	.771
Time	.537	.821	.811	.671	.727	.578	.636
Target Location	.689	.442	.642	.481	.584	.646	.553
Interesting	.645	.628	368	.536	.748	.623	.470

Extraction Method: Principal Component Analysis.
Source: Processed promotional media data (processed)

Table 4 PCA Extraction Results

	Campus Website	Electronic Media	Billboard	Brochure	Print media	Social Media	Word of Mouth
Component	**Initial Eigenvalues**						
	Total	Total	Total	Total	Total	Total	Total
1	2.153	2.599	2.279	2.482	2.062	2.129	2.593
2	1.360	1.014	1.260	1.315	1.224	1.501	1.293
3	.911	.767	.998	.795	1.052	.862	.709
4	.788	.630	.733	.728	.730	.575	.615
5	.496	.528	.487	.422	.536	.516	.405
6	.292	.462	.244	.258	.396	.417	.385

Source: Processed promotional media data (processed)

The variables that become criteria are based on the extraction results, 2 factors are formed for the campus website, electronic media, billboards, brochures, social media and word of mouth while 3 factors are formed based on the extraction results from the print media facilitators which can be seen in Table 4 the number of factors extracted (pca), from each of the formed factors, it appears that all factors have an eigenvalue> 1, for example in print media the total column factor 1 = 2,599 >1.

4. Rotation Factor

The rotation process is carried out on each variable after it is carried out in the MSA test and meets the requirements as a variable forming factor. Once it is known that the factors are formed. The Component Matrix after rotation shows the distribution of 6 variables to the formed factors. The rotation results can be seen in Table 5 Component Matrix as follows:

Table 5 Component Matrix after Varimax rotation

	Campus Website		Electronic Media		Billboard		Brochure	
Rotated Component Matrix[a]	**Component**							
	1	2	1	2	1	2	1	2
Cost	.767	.102	.696	.274	.091	.833	.348	.685
Effective	.822	.166	.838	-.198	.117	.821	.899	-.026
Response	.452	-.369	.536	.367	.541	.190	.828	.158
Time	.731	-.048	.025	.906	.900	-.040	.800	-.174
Target Location	-.097	.824	.590	.307	.796	.088	.450	.528
Interesting	.320	.736	.525	.509	.596	.111	-.117	.723

	Print media			Social Media		Word of Mouth	
Rotated Component Matrix[a]	**Component**						
	1	2	3	1	2	1	2
Cost	.260	-.109	.828	.816	.134	.131	.868
Effective	.876	.014	-.058	.657	-.187	.689	.458
Response	.388	.764	-.099	.772	.187	.678	-.558
Time	-.091	.816	.230	.377	.660	.797	.027
Target Location	-.089	.337	.680	.019	.804	.743	-.041
Interesting	.788	.154	.322	-.105	.782	.656	.199

Source: Processed promotional media data (processed)

From these results it can be concluded that the values used by campus management when using promotional media, whether using promotional media in the form of campus websites, electronic media, using billboards, using brochures, using print media, using social media and using word of mouth, need to consider the first factor, then the second and third factors and other factors in considering choices in the use of campus promotion media. If the campus management will use promotional media using word of mouth as the choice of promotional media, it can be seen from the effective criteria, response, time, target location and attractiveness if it is accumulated with an average value of 0.713, meaning that 71.3% of campus management can consider these criteria. as the main factor while 28.7% from the second factor and the next factor.

4. CONCLUSION

The decision-making system for selecting campus promotion media is proposed based on priority values, namely reach with an interest value of 85.7%, effective 37.4% attracting 28.5%. As for the criteria chosen based on ranking 1 to 4 in the selection of campus promotion media, namely the campus website in the first place is 26.2%, word of mouth is in the second place with a value of 23.3%, social media is in third place with a value of 23.1%, brochures in fourth place with a value of 8.9%, print media is in the fifth order of 6.29%, electronic media is in the sixth order of 6.22% and billboards are in the seventh order with a value of 5.7%. In addition, the results of the analysis show that in the decision-making system in the selection of promotional media used by campus management when using promotional media, both using campus websites, electronic media, billboards, brochures, print media, social media and using word of mouth as promotional media campus, it is necessary to consider the main factors recommended from the results of this study, namely based on existing criteria and sub-criteria.

The research only examines a number of criteria and sub-criteria as well as alternatives based on the relevance of a campus promotion media selection, the data of which are derived from the results of intensive interviews between researchers and experts representing universities as decision makers who come from 24 private campuses in Kendari city, so it is expected In the future, we can add decision makers who come from outside the institution, for example stakeholders who come from external institutions so that the results of the analysis of the selection of promotional media will be more reliable. Further research can carry out a broader study with different objects of study, the selection of promotional media in larger manufacturing companies is more advisable and can also add new analytical methods as collaborative methods or comparative analysis.

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