Logaritmic Fuzzy Preference Programming Approach for Evaluating University Ranking Optimization

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Abstract

Assesing quality university's website trough webometrics is becoming one of many measures in World Class University. To get good grades, so that it can compete with other universities in the world, it needs to be pursued strategies based on the achievement of the perspective of cost (expenses) and the condition of the availability and readiness of human resource (HR owned) by the institution. Webometrics ranking optimization tailored to the institutional capacity is absolutely necessary, in order to achieve the expected goals effectively and fuel-efficient. Therefore, this paper discussed the application of the Analytical Hierarchy Process with Logarithmic Fuzzy Preference Programming combination proved to covered of the methods FPP on the university web ranking optimization. From the results of sub-criteria weighting based on the perspective of cost and human resources, earned the highest ranking among other factors recommended monitoring the ranking of sites ahrefs (C332) and majesticseo (C331) as well as increasing the number of links from other websites (C321).

Keywords: World Class University, Webometrics, Analytical Hierarchy Process, Logarithmic Fuzzy Preference Programming

1. INTRODUCTION

The growth of Internet use, has penetrated the world of academics from educational institutions. It encourages universities in Indonesia to be able to compete with world-class universities in order towards World Class University [1]. World Class University is a measure used to rank universities in the world by using survey [2]. Several quantitative studies to create a method measuring the quality of websites including The Times Higher Education Supplement (THES), Academic Ranking World Universities (ARWU), and webometrics as a benchmark for World Class University [3]. To get a good ranking Webometrics, it is necessary to make some strategies for the performance of the university's web attainment increases, as the valuation parameters. Efforts made the university to achieving these objectives, should be adjusted to the readiness and availability of human resources and financial conditions (costs) to carry out activities related to the increase in ranking. ST3 Telkom is the College are concerned about the Webometrics rankings from year to year. It is considered important, because it is one indicator of the performance of institutions, is also a path to a higher education institution of quality [4]. Limitations of HR and financial College encourages the campus to perform optimization ranking Webometrics.

Webometrics ranking optimization is a strategy to achieve quality objectives institutions, based on the indicators measured by the level of importance using fuzzy membership functions. From the measurement results, obtained on the actions required to be more precise and targeted in order to improve the Webometrics ranking [5]. Based on these problems, further research needs to be done to optimize the Webometrics ranking is based on the perspective of human resources and cost in accordance with the conditions of Higher Education. The optimization using Analytical Hierarchy Process that supports human subjective judgments [6] with a combination of logarithmic Fuzzy Preference Programming. This method is effective to determine the priority of the variables of importance, and can overcome the flaws in the previous method [7]. This method will be used to perform weighting on the variable webometrics.

2. METHODS

2.1. Research Method

Webometrics ranking of universities is based on four indicators, Visibility (V), Size (S), Rich Files (R) and Scholar (Sc). From this indicators, then made the hierarchical structure of the test criteria and sub-criteria based on the perspective of cost (cost) which was discussed in a paper [5], as well as the perspective of human resources is shown in Figure 1. The criteria and sub criteria described by adaptation Webometrics Ranking of Concept Mapping [8].
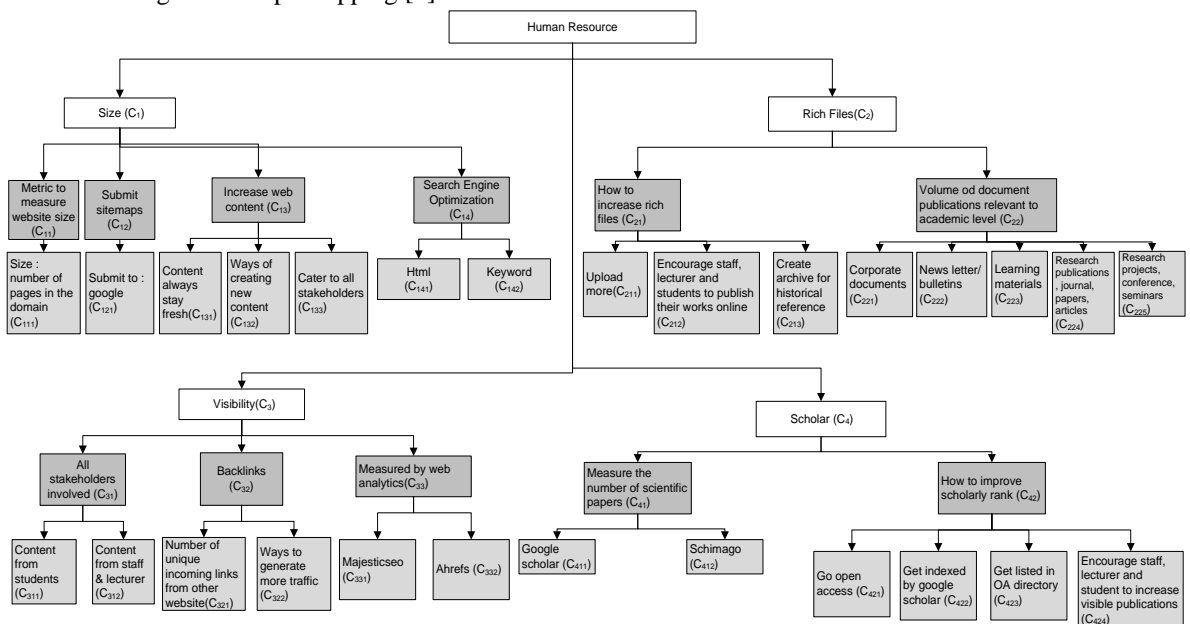

Figure 1. Classification of human resource characteristics into sub characteristics of size, rich files, visibility, and scholar

Figure 1 describes the characteristics of HR (human resource) into sub characteristics of size, rich files, visibility and scholar. The experts (academics and practitioners) in the field of discussion webometrics determine the weight of interest between criteria based on human resources held by the institution. Specialists were made respondents in this study are 1 Chief and 1 Staff of Information Systems. Furthermore, the weighting of criteria and sub-criteria using Analytical Hierarchy Process approach LFPP.

2.2. Mathematical Equations

LFPP method is a refinement of the FPP method in a few cases resulted in the final value of the negative course this makes the solution is expected to be less valid. LFPP method involves a logarithmic function original to correct deficiencies FPP method. LFPP method can be formulated [7].

Minimize

$$J = (1-\lambda)^2 + P.\sum_{i=1}^{k-1}\sum_{j=l+1}^{k}(\delta_{ij}^2 + \eta_{ij}^2)$$

Subject to

$$\begin{cases} x_i - x_j - \lambda \ln(m_{ij}/l_{ij}) + \delta_{ij} \geq \ln l_{ij}, \ i=1,...,k-1; \ j=i+1,...,k, \\ -x_i + x_j - \lambda \ln(u_{ij}/m_{ij}) + \eta_{ij} \geq -\ln u_{ij}, \ i=1,...,k-1; \ j=i+1,...,k, \\ \lambda, x_i \geq 0, \ i=1,...,k, \\ \delta_{ij}, \eta_{ij} \geq 0, \ i=1,...,k-1; \ j=i+1,...,k, \end{cases}$$

based on which, we have normalized LFPP priorities as

$$w_i^* = \frac{\exp(x_i^*)}{\sum_{j=1}^{k}\exp(x_j^*)}, \ i=1,...,k, \tag{1}$$

3. RESULT AND DISCUSSION

Calculation of weighted criteria and sub-criteria with the aim of improving the ranking Webometrics adjusted to the availability and readiness of Human Resources are calculated based on the formula (1).

Eg. size = C_1, Rich file = C_2, Visibility = C_3, Scolar = C_4

Table 1. Level of importance of the four criteria from the perspective of Human Resource

Criteria	C_1	C_2	C_3	C_4	LFPP priorities
C_1	(1,1,1)	(2, 3, 4)	(1/6, 1/5, 1/4)	(4, 5, 6)	0,2037
C_2	(1/4, 1/3, 1/2)	(1,1,1)	(1/7, 1/6, 1/5)	(4, 5, 6)	0,1362
C_3	(4, 5, 6)	(5, 6, 7)	(1,1,1)	(6, 7, 8)	0,6092
C_4	(1/6, 1/5, 1/4)	(1/6, 1/5, 1/4)	(1/8, 1/7, 1/6)	(1,1,1)	0,0509

Minimize $R = (1-\lambda)^2 + P.\sum_{i=1}^{3}\sum_{j=i+1}^{4}(\delta_{ij}^2 + \eta_{ij}^2)$

Subject to :

$$
\begin{cases}
x_1 - x_2 - \lambda \ln(3/2) + \delta_{12} \geq \ln(2) \\
-x_1 + x_2 - \lambda \ln(4/3) + \eta_{12} \geq -\ln(4) \\
x_1 - x_3 - \lambda \ln(6/5) + \delta_{13} \geq \ln(1/6) \\
-x_1 + x_3 - \lambda \ln(5/4) + \eta_{13} \geq -\ln(1/4) \\
x_1 - x_4 - \lambda \ln(5/4) + \delta_{14} \geq \ln(4) \\
-x_1 + x_4 - \lambda \ln(6/5) + \eta_{14} \geq -\ln(6) \\
x_2 - x_3 - \lambda \ln(7/6) + \delta_{23} \geq \ln(1/7) \\
-x_2 + x_3 - \lambda \ln(6/5) + \eta_{23} \geq -\ln(1/5) \\
x_2 - x_4 - \lambda \ln(5/4) + \delta_{24} \geq \ln(4) \\
-x_2 + x_4 - \lambda \ln(6/5) + \eta_{24} \geq -\ln 6 \\
x_3 - x_4 - \lambda \ln(7/6) + \delta_{34} \geq \ln(6) \\
-x_3 + x_4 - \lambda \ln(8/7) + \eta_{34} \geq -\ln(8) \\
\lambda, x_1, x_2, x_3, x_4, \delta_{12}, \delta_{13}, \delta_{14}, \delta_{23}, \delta_{24}, \delta_{34}, \eta_{12}, \eta_{13}, \eta_{14}, \eta_{23}, \eta_{24}, \eta_{34} \geq 0
\end{cases}
$$

Optimal solution:

$x_1^* = 1.5024 \qquad x_2^* = 1.1000$

$x_3^* = 2.5979 \qquad x_4^* = 0.1161 \qquad \lambda = 0$

$\delta_{12}^* = 0.2908 \qquad \delta_{13}^* = 0 \qquad\qquad \delta_{14}^* = 0 \; \delta_{23}^* = 0 \qquad\qquad \delta_{24}^* = 0.4024$

$\delta_{34}^* = 0 \qquad\qquad \eta_{12}^* = 0$

$\eta_{13}^* = 0.2908 \qquad \eta_{14}^* = 0$

$\eta_{23}^* = 0.1116$

$\eta_{24}^* = 0 \qquad\qquad \eta_{34}^* = 0.4024$

Normalized LPP priorities:

$w_1^* = \exp(x_1^*)/\sum_{i=1}^{4}\exp(x_1^*) = 0{,}2037, \quad w_2^* = \exp(x_2^*)/\sum_{i=1}^{4}\exp(x_2^*) = 0{,}1362$

$w_3^* = \exp(x_3^*)/\sum_{i=1}^{4}\exp(x_3^*) = 0{,}6092, \quad w_4^* = \exp(x_4^*)/\sum_{i=1}^{4}\exp(x_4^*) = 0.0509$

Table 1 shows that the value LFPP Priorities for C_1, C_2, C_3, dan C_4 respectively 0,2037; 0,1362; 0,6092; 0,0509.

Using the same way, it is also calculated weighted assessment criteria pairwise comparisons between sub-criteria, obtain the following result.

Table 2. Result of The Calculation of Weighted Criteria

		C_{11}	0.3638	C_{111}	1.0000	0.074106
		C_{12}	0.3781	C_{121}	1.0000	0.077019
C_1	0,2037	C_{13}	0.0513	C_{131}	0.4443	0.004643
				C_{132}	0.4446	0.004646
				C_{133}	0.1111	0.001161
		C_{14}	0.2067	C_{141}	0.5000	0.021052
				C_{142}	0.5000	0.021052
C_2	0,1362	C_{21}	0.6667	C_{211}	0.2857	0.025943
				C_{212}	0.1428	0.012967
				C_{213}	0.5715	0.051895
		C_{22}	0.3333	C_{221}	0.6087	0.027632
				C_{222}	0.2485	0.011281
				C_{223}	0.1015	0.004608
				C_{224}	0.0414	0.001879
C_3	0,6092	C_{31}	0.0769	C_{311}	0.2500	0.011712
				C_{312}	0.7500	0.035136
		C_{32}	0.3075	C_{321}	0.2500	0.046832
				C_{322}	0.7500	0.140497
		C_{33}	0.6156	C_{331}	0.5000	0.187512
				C_{332}	0.5000	0.187512
C_4	0.0509	C_{41}	0.9000	C_{411}	0.8333	0.038173
				C_{412}	0.1667	0.007637
		C_{42}	0.1000	C_{421}	0.4117	0.002096
				C_{422}	0.1616	0.000823
				C_{423}	0.3527	0.001795
				C_{424}	0.0740	0.000377

Table 2 shows the results of calculation of the weight of each criterion, then in Table 3 carried the highest ranking of 10 sub-criteria. From the calculation, we get majesticseo as the first rank and corporate documents as the tenth rank.

Table 3. Top 10 Rankings Weighted Sub-Criteria

Rank	Weight	Sub Criteria	Rank	Weight	Sub Criteria
1	0.187512	Majesticseo (C331)	6	0.051895	Create archive for historical reference (C213)
2	0.187512	Ahrefs (C332)	7	0.046832	Number of unique incoming links from others website(C321)
3	0.140497	Ways to generate more traffic (C322)	8	0.038173	Google scholar (C411)
4	0.077019	Submit to: google (C121)	9	0.035136	Content from staff & lecturer (C312)
5	0.074106	Size: number of pages in the domain (C111)	10	0.027632	Corporate documents(C221)

Sub criteria on human resources perspective, then comparing the cost perspective (4). After comparison, there are seven sub-criteria are the same, with different weights. The weight of the sub criteria in the perspective of human resources and cost, and in total the, and obtained the first rank is ahrefs, and google scholar is the seventh rank.

Table 4. Weighted Sub-Criteria Based on Human Resources and Cost Rank

Sub criteria	Human Resource Weight	Cost Weight	Total Weight
Ahrefs (C332)	0.187512	0.286421	0.473933
Majesticseo (C331)	0.187512	0.057291	0.244803
Number of unique incoming links from others website(C321)	0.046832	0.189439	0.236271
Size: number of pages in the domain (C111)	0.074106	0.132169	0.206275
Ways to generate more traffic (C322)	0.140497	0.027063	0.16756
Submit to: google (C121)	0.077019	0.048436	0.125455
Google scholar (C411)	0.038173	0.027136	0.065309

4. CONCLUSION

Monitoring the university web ranking conducted through two websites and information providers, there are ahrefs and majesticseo which can be accessed free of charge, and requires a number of human resources of the people with low skills. The number of unique links that refer to the university's web, can be done by utilizing the resource apprentice students or intern students, to reduce costs. Increasing the number of pages on the web, in addition to be done alone by the unit Sisfo and public relations (writing daily news), can also be done through policies upload articles research and community service as a condition the demand letter of assignment for reporting lecturer performance. Increase the number of visitor traffic, to increase the number of backlinks, among others, performed by connecting the web to social media such as twitter, facebook, LinkedIn. Can also be done by making articles with headlines that really atracted. One of the parameters votes by webometrics is to see how many pages can be found by search engine Google, the cheapest way and can be done by a limited number of human resources is to include articles one by one through the Google Add URL or through Google Webmaster Tools. Google Scholar is one of webometrics assessment criteria used to calculate the scholar/excellent. Therefore, the need for awareness of each lecturer to reproduce the work, and upload it to your account each google scholar. Making number of citations of scientific papers competition in college is the way to

increase google scholar score. It is considered quite inexpensive, and requires the involvement of HR Information Systems parts are few in number.

5. REFERENCES

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