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The Implementation of AHP for Determining Dominant Criteria in Higher Education Competitiveness Development Strategy Based on Information Technology

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ABSTRACT

The existence of Higher Education has a huge role in nation and state's life through tri dharma of Higher Education named education, research and community service. Higher Education can produce economic innovations based on knowledge so that, it will increase productivity and nation competitiveness. Higher Education must have strategies that will be carried out, therefore they are able to compete with other higher education according to stakeholder needs. The method of this reserach is AHP method in wich the data are collected through questionnaires to respondents in collage. The criteria of this research are internal management & organization, academic atmosphere and university competitive sustainability. The results of this research is the dominant criteria in the higher education competitiveness development strategy. The criteria most dominant are academic atmosphere, efficiency and productivity. The criteria most dominant obtained base on the information technology relationship model to internal management; and the model of information technology relations with internal management and efficiency & productivities.

I. Introduction

Competitiveness is one of the key elements of a national development strategy in global economic governance. The nations competitiveness is determined by the ability of competitiveness of the development actors or business actors the abelity of community and the ability of the country's competitiveness[1]. Indonesian nations competitiveness has lower position than neighboring countries. Not surprisingly, if further reviewed based on factors in the technological development level, out country's competitiveness is far in the 91st position[2]. The government hopes that higher education can produce development economic innovations based on knowledge, so that they will increase the productivity and nations competitiveness. It will influence on increasing economic growth and nations welfare.

The existence of Higher Education has a huge role in the nation and state's life through tri Dharma higher education, named education, research and community service[3]. Higher education can be climed to has competitiveness when a tertiary institution has completed certain achievement indicators starting from inputs, processes and outputs to practice the values of Tri Dharma of Higher Education. The higher education image is important to increase visibility in to public, both nationally and internationally will influance to the college's rankings. Every Universities has high aspirations, and they want to realize World Class University (WCU). One of the criteria is a number of acknowledgments in the international scope, they are research, quality of human

resources, laboratories, teaching and learning processes, including of information technology capacity and the popularity of the web[3].

The strategic concept towards a quality university ideally will occur if the tridarma of higher education increase is supported by information technology and entrepreneurship system and also realiable of human resources (HR)[2]. The development theories accentuated that development requires first science and technology, so no country can succeed without being listed as engineers in using the technology[4]. In addition, higher education must have same strategies to compete with other higher education. According to the higher education development. The direction of the higher education development used some criteria. They are academic atmosphere, internal management, sustainability, efficiency and productivity.

The Analytic Hierarchy Process (AHP) method is used to determine the most dominant criteria in Higher Education competitiveness development strategy with information technology based[5]. AHP's working principle is to simplify a complex problem that is not structured, strategic, dynamic into its parts, and arrange them in a hierarchy. The level of importance of each variable is subjectively assigned a numerical value about the importance meaning of variable relatively is compared to other variables. Based on various considerations, synthesis is carried out to determine variables that have high priority and play a role in influencing the results of a system[6]. The AHP model is a model based that is on goals, criteria, and alternative decisions[7]

In the research conducted as[8] will determine the most dominant criteria causing workload on call center operators with the AHP method. The criteria of workload are physical, mental, social and time. By knowing the criteria of the dominant workload, it can repair suitable work system, so that it can improve the performance of operator and the company.

This research conducted as two main stages. At the first stage a hierarchal model with 3 levels proposed to priorities the factors affecting success of high-tech SME's in Iran. At the second stage, using the CSF's and their relative weights, fuzzy TOPSIS method is used for evaluating the performance of 17 high-tech SME's located in Bio-Technology Incubator of Karaj and determining the ranking of them. With the factor weights found by using fuzzy AHP, it can be determined which factors has more effect on SME's success. The first three important main factors in SME's success are Product characteristics, Human resource and Entrepreneurs characteristics. The results of this research also suggest that initial Investment, Strategic planning and Access to skilled workforce are the most important sub-factors for high-tech SME's success [9].

This research has several limitations [10]. First, the sample size indicates limited generalization of the research results, and theresults should therefore be treated with caution. Second, although the resource-related enabling factors are internal factors, there may be external factors that should be taken into account. Third, respondents' views on the five-point Likert scale and the pairwise comparisons are based on their knowledge or perception. There may be a bias towards their point of view. However, using multiple respondents can reduce the risk of a biased perspective".

Based on the background of the problem described above, the formulation of the problem in this study is how to determine the most dominant criteria in the strategy of developing university competitiveness based on the model produced based on RAISE ++.

II. Method

This research follows up the research that is conducted by previous researchers entitled Design Of The Analytic Hierarchy Process (AHP) Methods In higher education Competitiveness Development Strategy Based On Information Technology [11]. The result of this research are information technology has a contribution to internal management with weight is 0.632 and the internal management has contribution to the academic atmosphere with weigth is 0.798. Creating of questionnaires and criteria obtained from several variables in the RAISE ++ model suitable with the direction of the theme of education development are relevance, academic atmosphere, institutional management, sustainability, efficiency, leadership, and equity [3].

A. Collecting data Method

Data sources in this reserach are secondary data sources, namely data that is obtained from second parties who come to know or have a data [2]. The data sources in this research are taken from books, internet, magazines, literature, journals that suitable with the topic in this research. The data used in this research are secondary data.

Data collecting method of this reserach is a questionnaire method with direct studies or surveys. This method uses a number of closed questions or statements with a choice of answers that have been provided, namely 1 to 10 and open questions, where the respondent can answer according to the respondent opinion. The questionnaire distribution method uses self-administered method, with direct distribution of questionnaires to respondents and online questionnaire methods, by using internet.

B. Data Analysis Phase

Data analysis from questionnaire results using Structural Equation Modeling (SEM) Analysis with PLS models. PLS analysis is a multivariate statistical technique that makes comparisons between multiple dependent variables and multiple independent variables. PLS is a variant-based SEM statistical method based variant designed to complete multiple regression when specific problems occur, on data such as small research sample sizes, missing values, and multicollinearity [2]. The number of respondents 'data that can be analyzed they are 67 respondents' data.

III. Result

This research produced an output is determining dominant criteria in the higher education competitiveness development strategy that is using the AHP method. AHP is a method used to solve MADM problems in making decision[12]. AHP is a very flexible analytical tool and it can provide a strong analysis because the calculation result scores are obtained from pairwise comparison evaluations based existing criteria and alternatives. A set of criteria and alternatives will be calculated for each weight to be used in the calculation of the paired matrix. The higher weight of criteria and alternatives, the higher importance of the variable[13].

The most dominant criteria are based on the resulting model, namely the model of information technology relations to internal management and the relationship model of information technology to internal management and efficiency & productivities.

A. The information technology relatios model with internal management

AHP method is used to determine the most dominant criteria in the Higher Education competiiveness development strategy based on information technology. The some steps to resolve the problem of the Higher Education competitiveness strategy with AHP method based on information technology are as follows:

1. Determining several criteria. The criteria in this research are *Quality of ICT,* I = *Internal management & Organization*, A = *Academic Atmosphere*, S = *University Competitive Sustainbility*.
2. Determine the sub criteria for each criterion. The sub-criteria in this research are
   - The criteria of ***Quality of ICT*** have sub criteria are c*omputerized & internal based facilities, Implementation of e-learning, Paperless bureaucracy, Integrated information system, Excellence of digital libraries*, and *High Speed Internet*.
   - The criteria of ***Internal Management & Organization*** **(I)** have sub criteria are *Staff performance* (IM01)*, Planning system* (IM02)*, Budget allocation* (IM03)*, Operating prochecure excellence* (IM04)*, Transparant management system* (IM05)**;**
   - The criteria of ***Academic Atmosphere*** **(A)** have sub criteria are *cademic Society relationship* (AA1)*, The quality of educational processes* (AA2)*, Transparancy &*

accountability in academic life (AA3)*, Motivation to work in all academic activities* (AA4)*, Community invomen in academic & teaching-learning* (AA5);

- The criteria of ***University Competitive Sustainbility*** **(S)** have sub criteria are *Innovations* (UCS1)*, Networks* (UCS2)*, Reputation* (UCS3)*, Relevance* (UCS4)*, Commercialization* (UCS5).

3. Creating a hierarchy diagram of the technology relationship model for internal management, as shown in Figure 1

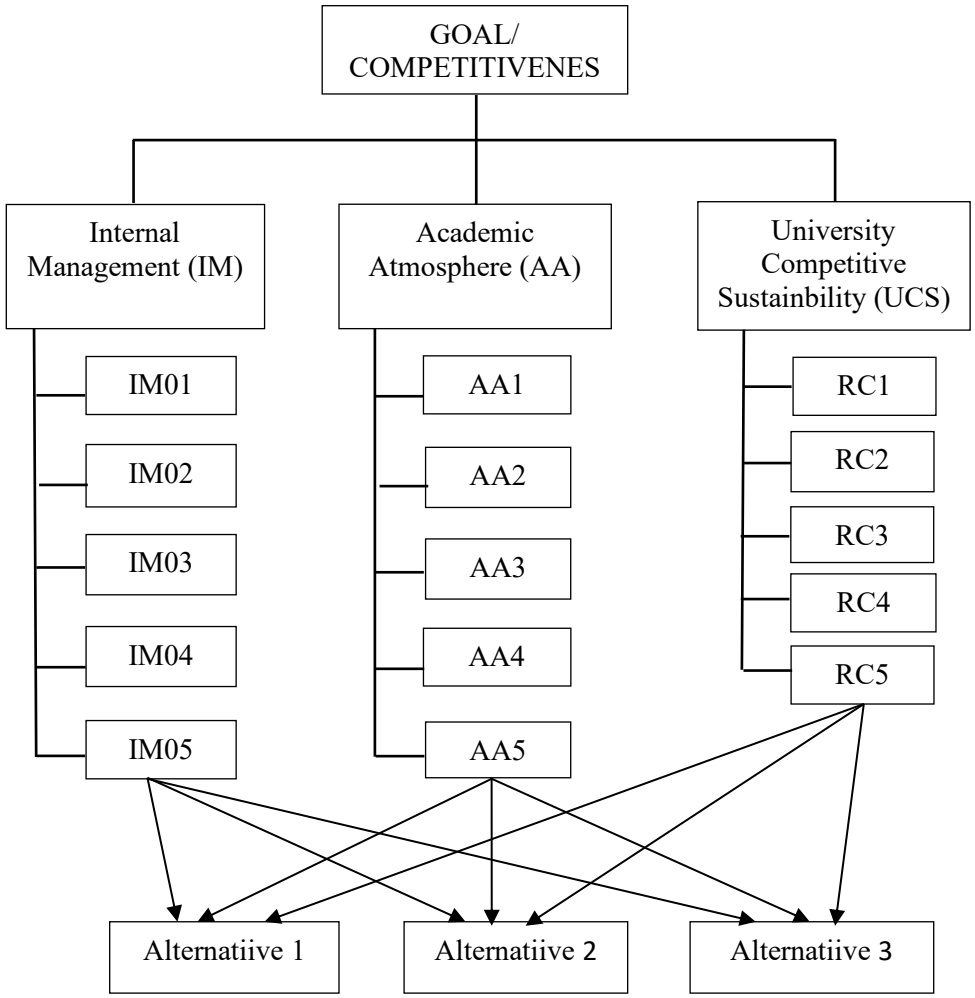

Figure 1. Hierarchy Diagram of the technology relationship model for internal management

4. Determinating Priority (Weighting) for criteria
   This process is weighted against the criteria, which are used to determine the most important factors. This paired comparison matrix is built on base on the perceptions or opinions of the evaluator by comparing between criteria and choices. The results of the pairwise comparison matrix calculation obtained eigen vector values as priority weight values for each[6].

   The calculation of priority weights is taken from the results of the respondents' questionnairedata analysis on several respondents, obtained by the weighting average criteria and priorities of each criterion as shown in Table 1.

Table 1. Weigthing Average of a Criteria first Model

Criteria	Weigth	Priority
Internal Management & Organization	0.400	Ke-3
Academic Atmosphere	0.637	Ke-1
University Competitive Sustainbility	0.628	Ke-2

Based on Table 1. can be determined the weighting average for each sub-criteria, the results can be seen in Table 2.

Table 2. weighting average for each sub-criteria of the second model

Criteria	Sub Criteria	Weight
Quality of ICT	1. Computerized & internal based facilities	0.677
	2. Implementation of e-learning	0.816
	3. Paperless bureaucracy	0.801
	4. Integrated information system	0.886
	5. Excellence of digital libraries	0.833
	6. High Speed Internet	0.717
Internal Management	1. Staff performance	0.804
	2. Planning system	0.809
	3. Budget allocation	0.905
	4. Operating prochecure exellence	0.882
	5. Transparant management system	0.863
Academic Atmosphere	1. Academic Society relationship	0.795
	2. The quality of educational processes	0.905
	3. Transparancy & accountability in academic life	0.872
	4. Motivation to work in all academic activities	0.838
	5. Community invomen in academic & teaching-learning	0.795
University Competitive Sustainbility	1. Innovations	0.914
	2. Networks	0.913
	3. Reputation	0.907
	4. Relevance	0.787
	5. Commercialization	0.849

Based on Table 2. it can be seen that the information technology criteria have the highest weight sub criteria in Integrated information system with weight is 0.886, the Internal Management criteria have the highest weight sub criteria in budget allocation with weight is 0.905. The quality of educational processes weighs is 0.905, and university competitive sustainbility has the highest weight sub criteria in inovations with a weight of 0.914

B. The Information technology relation model with internal management and efficiency & productivities

AHP method is used to determine the most dominant criteria in Higher Education competitiveness development strategy based on infortmation technology. The steps to resolve the problem are applied:

1. Determining several criteria. Criteria in this research are *Quality of ICT*, I = *Internal management & Organization*, E = *Efficiency & Productivities*, and S = *University Competitive Sustainbility*.
2. Determining the sub criteria for each criteria. The sub-criteria in this research are

- The criteria of **Quality of ICT** have sub criteria are Computerized & internal based facilities, Implementation of e-learning, Paperless bureaucracy, Integrated information system, Excellence of digital libraries, dan High Speed Internet.
- The criteria of **Internal Management & Organization (I)** have sub criteria are Staff performance (IM01), Planning system (IM02), Budget allocation (IM03), Operating prochecure excellence (IM04), Transparant management system (IM05)**;**
- The criteria of **Efficiency & Productivities (E)** have sub criteria are Timely Research Periods (EP1), Reduced number of drop out (EP2), HR optimalization (EP3), Phyalcall Asset Optimalization (EP4), Unit cost efficiency (EP5);
- The criteria of **University Competitive Sustainbility (S)** have sub criteria are Innovations (UCS1), Networks (UCS2), Reputation (UCS3), Relevance (UCS4), Commercialization (UCS5).

3. Creating a hierarchy diagram of the information technology relation model between internal management and efficiency & productivities, as shown in Figure 2.

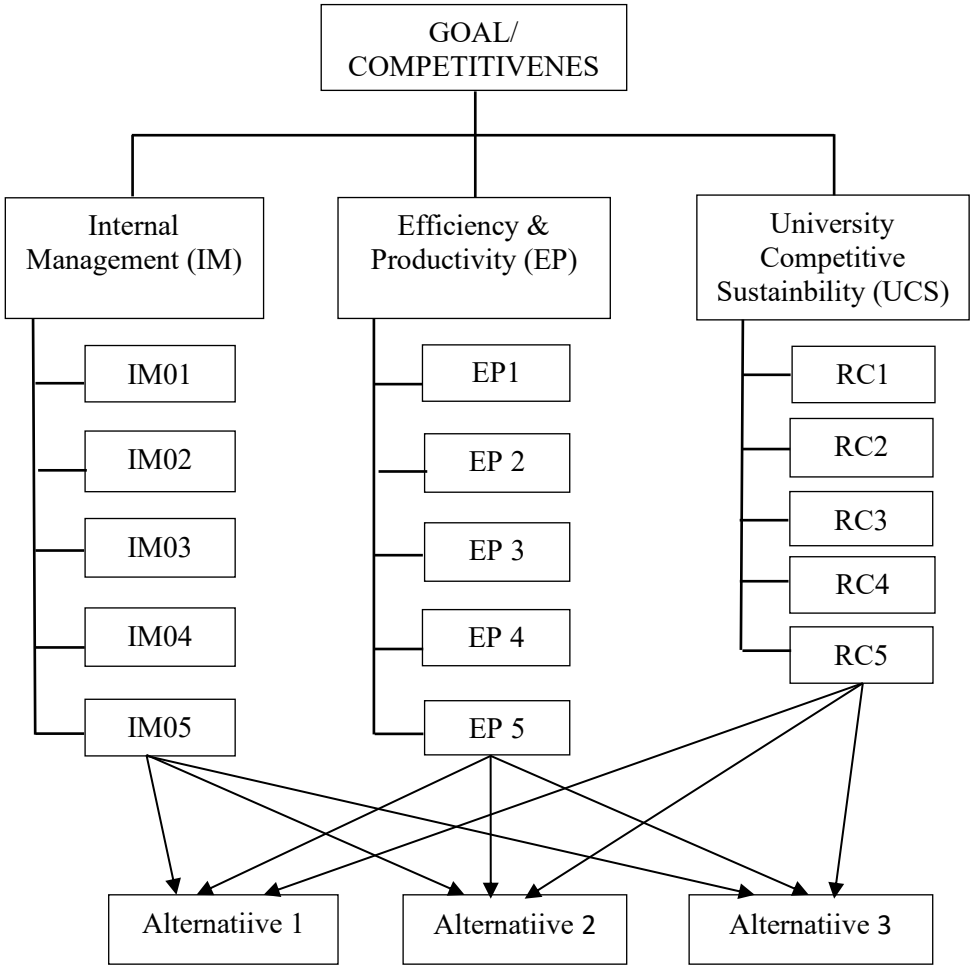

Figure 2. Hierarchy Diagram of Information Technology Relations Model between internal management and efficiency & productivities

4. Determining of Priority (Weighting) for criteria
   This process is weighted against the criteria, which are used to determine the most important factors. This paired comparison matrix is built on the perceptions or opinions of the evaluator by comparing between criteria and choices. The results of the pairwise comparison matrix calculation are obtained eigen vector values as priority weight values for each [6].

   The calculation of priority weights is taken from the results of the data analysis of respondents' questionnaire on several respondents, obtained by the average of weighting criteria and priorities of each criterion as shown in Table 3.

Table 3. The weighting of average for critecia of second model

Criteria	Weight	Priority
Internal Management	0.400	Ke-2
Efficiency & Productivity	0.594	Ke-1
University Competitive Sustainbility	0.399	Ke-3

Based on Table 3. can be determined the weighting average for each sub-criteria, the results can be seen in Table 4

Table 4. The weighting average for sub each sub criteria of second model

Criteria	Sub Criteria	Weight
Quality of ICT	1. Computerized & internal based facilities	0.686
	2. Implementation of e-learning	0.809
	3. Paperless bureaucracy	0.788
	4. Integrated information system	0.884
	5. Excellence of digital libraries	0.832
	6. High Speed Internet	0.734
Internal Management	1. Staff performance	0.840
	2. Planning system	0.798
	3. Budget allocation	0.904
	4. Operating prochecure exellence	0.881
	5. Transparant management system	0.868
Efficiency & Productivity	1. Timely Study Periods	0.509
	2. Reduced number of drop out	0.540
	3. HR optimalization	0.824
	4. Phyalcall Asset Optimalization	0.831
	5. Unit cost efficiency	0.824
University Competitive Sustainbility	1. Innovations	0.919
	2. Networks	0.913
	3. Reputation	0.911
	4. Relevance	0.780
	5. Commercialization	0.846

Based on Table 4. It can be seen that the criteria have the highest weighting sub criteria is the Integrated information system with a weight is 0.884, the Internal Management criteria has the highest weight sub criteria is Budget allocation with weight is 0.904, Efficiency & Productivity criteria have the highest weight sub criteria is Phyalcall Asset Optimalization with weight is 0831, and University Competitive Sustainbility criteria has the highest sub criteria is innovations with weight is 0.919.

IV. Conclusion

Based on the results of the research that criteria most dominant or criteria that have the highest priority, namely the academic atmosphere with weight is 0.637 based on the information technology relationship model with internal management, and Efficiency & Productivity with weight is 0.594 based on the information technology relationship model on internal management and efficiency & productivity.

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