

## Implementing Analytical Hierarchy Process (AHP) Method for Higher Education Competitiveness Development through RAISE++

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**Abstract:** Higher education must have a strategy to be able to compete with other universities. A good method had to be needed to find out the alternative strategies used to improve the competitiveness among higher education. Analytical Hierarchy Process (AHP) method was the decision-making method to obtain alternative strategies that were suitable to the needs of higher education according to the new paradigm of higher education management. The criteria used in this study were based on RAISE++. There were relevance, academic atmosphere, internal management, sustainability, efficiency and productivity, leadership, access and equity. The relevance had five sub-criteria; the academic atmosphere had four sub-criteria; the internal management had five sub-criteria; the sustainability had four sub-criteria; the efficiency and productivity had six sub-criteria; the leadership had five sub-criteria; and, the access and equity had five sub-criteria. The alternative strategy for developing the competitiveness of higher education was through the questionnaires and contained 18 strategies alternative. These alternatives were classified through the AHP method. The result of this study was that certain alternatives must be considered for higher education competitiveness e.g., management quality, leadership, human resource quality, quality control and evaluation, and good Human Resources investment. These alternatives were regarded as a recommendation for higher education to determine strategies in developing higher education competitiveness.

**Keywords:** Analytic Hierarchy Process, Higher Education Competitiveness, RAISE++

### 1. INTRODUCTION

Higher education is currently faced by four challenges the global revolution, namely (a) High quality of human resources is useful to encourage education in answering new challenges that arise due to globalization, (b) High capacity of management which is essentially professionalism is useful to increase capacity management in competing in the global market, (c) Internationalization as a result of the opening of tertiary institutions and as a result of networking built by tertiary institutions and (d) Global competitiveness in the world of tertiary education [1].

The development of competitiveness of human resources in developing a global competition strategy needs to be done by all parties. This division of roles needs to be carried out by the government, universities, and the business community as well as the community in formulating a global framework for higher education competitiveness in the long term. This opportunity must be given to the growth and development of tertiary institutions to provide good quality so that they have competitive advantages, especially in the face of global competition[1].

Advances in technology that continue to develop encourage higher education to take an anticipatory step through the policies and strategies of higher education to stay ahead in all fields or certain fields. Improvements made by higher education to face intense competition within higher education. One of them is to improve the quality of management of higher education by the new paradigm of higher education management that has been included in the RAISE ++ criteria.

RAISE ++ criteria as a new paradigm of higher education management can be used as a basis for increasing the competitiveness of higher education because RAISE ++ can identify the main problems that often occur in higher education [2].

Higher education has competitiveness when Higher education has met certain indicators of achievement ranging from inputs, processes, and outputs to the practice of the tri dharma values of higher education. Besides for higher education to be competitive it must have strategies to be able to tackle the problems that arise in a higher education based on these criteria. While alternative strategies that need to be carried out in improving the competitiveness of higher education are required to apply a good method.

The AHP method is a very flexible analytical tool and can provide a strong analysis because the calculation results are obtained from the basis of relative pairwise evaluation evaluations of the existing criteria and alternatives. A set of criteria and alternatives will be weighted respectively to be used in the calculation of paired matrices. The higher weights of the criteria and alternatives, then the higher the importance level of the variable [3].

Analytical Hierarchy Process (AHP) method is a method of decision making to obtain alternative strategies that are appropriate to the needs of higher education [3]. The decision-making is based on the RAISE ++ criteria as an operational guide to determine the criteria for the higher education process in which some sub-criteria that can be used as guidelines in determining alternative strategies to improve the competitiveness of higher education.

The purpose of this research was to apply the Analytical Hierarchy Process (AHP) method as a method of decision making in choosing the best alternative based on the priority weight which was useful to increase the competitiveness of higher education. The benefits of this research were as a recommendation from the higher education about strategies that needed to be considered in improving the competitiveness of higher education.

The criteria in this research were seven according to RAISE++, namely relevance, academic atmosphere, internal management, sustainability, efficiency and productivity, leadership, and access and equity. Relevance had five sub-criteria, the academic atmosphere had four sub-criteria, internal management had five sub-criteria, sustainability had four sub-criteria, efficiency and productivity had six sub-criteria, leadership had five sub-criteria, access and equity had five sub-criteria.

## 2. LITERATURE RIVIEW

RAISE ++ describes a production cycle of relations between the providers and users in higher education services. Higher education services produce two products, namely graduate products and research products. As the provider side is the higher education and as the user is the community.

The seven components in RAISE ++ are based on the business processes contained in Higher education, namely are [2]: **Relevance**; showed the level of sensitivity of higher education institutions to the environment in which the institution was located. For education programs, relevance was seen from two sides, namely the quality of graduates and the absorption of graduates in the target world of work. Some indicators in relevance were the waiting time for graduates to get a job, the amount of initial salary, and research collaboration with the industry. **Academic Atmosphere** was a component related to the academic atmosphere. A conducive academic atmosphere was an absolute requirement for an interaction between lecturers and students, fellow lecturers, and fellow students. **Internal Management & Organization**; Commitment to improving it led to the implementation of an effective and efficient educational program, including Efforts to improve performance and motivation among staff, Reform planning and budgeting systems that reflected priorities, Development of systems and mechanisms for internal supervision and evaluation, Systems efficient procedures and decision making, Reduction of bureaucracy, and tips that ensured transparent management of institutions and effective and efficient use of resources. **Sustainability**; was a component of relevance. Relevance viewed the community as an object, while

sustainability views tertiary institutions as an object. Three things that needed to be considered in developing educational institutions, namely: Aspects of sustainability that guaranteed the existence of institutions (operational funds that had been obtained through various sources), Sustainability aspects that guaranteed quality levels achieved through its development program (to what extent good practice was adopted to carry out in the implementation of activities that were routine and sustainable), and the aspect of sustainability of resources that had been held/invested resources (efforts made by these institutions in maintaining and maintaining resources). **Efficiency and Productivity**; Some related aspects were: completion of academic programs punctually, study period with the curriculum punctually, minimization of drop-out rates, and improvement in the quality of new students. **Access and Equity**; has complete learning resources, diverse and wide acceptance mechanisms. **Leadership**; universities in managing human resource management were not able to be separated from leadership factors, both those who led and (in part) who were led were lecturers.

Analytic Hierarchy Process (AHP) is an analysis technique that supports the decision-making process which aims to determine the best choice from several alternatives. AHP's working principle is to compile a hierarchy of existing criteria and alternatives. Each criterion will be compared with the other criteria using a paired matrix [3].

The steps to problem-solving with using the AHP method in this research are [3] :

- a. Build a hierarchical model  
This model is used to describe the factors that influence the ranking or decision-maker, namely criteria and alternatives.
- b. Designing the questionnaire  
The questionnaire was designed to accommodate the pairwise comparative assessment of each criterion and alternative.
- c. Determination of priorities (weighting) for criteria  
The determination of the weight was carried out by using the Smart PLS analysis
- d. Conducting consistency checking  
If Consistency Index (CI)=0 then A consistent; If  $CI/RI_n \leq 0,1$  then A fairly consistent; and if  $CI/RI_n > 0,1$  then A very inconsistent [14].
- e. Determination of the priority scale of each alternative  
Suppose there are n goals and m alternatives to AHP, then the alternative ranking process can be done through the following steps:
  - For each objective i assign a pairwise comparison matrix A for m alternatives
  - Find a weight vector for each  $A_i$  that represents the relative weight of each to j alternative to i objective ( $S_{ij}$ )
  - Calculate the total score
- f. Alternative ranking, Choose the alternative with the highest score.

### 3. METHOD

Objects that were targeted in this research include the strategies used by higher education to improve their competitiveness. Sources of research data are sourced from books, the internet, and previous research in the form of seminar articles and journals. The population in this research were lecturers and managers of private higher education in Sumatra and Java consisting of higher education cluster III, cluster IV, and cluster V. The samples in this research were Lecturers, Employees, Librarians, Laboratory Staffs, Middle Management (bureau chief, passage chief, head of the department, head of a study program), top management (vice-rector 1, vice-rector 2, vice-rector 3, vice-rector 4), and Higher Education Leaders with 100 respondents.

The instruments used in this research were (1) a closed method questionnaire, where the answers to the questionnaire questions were provided; (2) Each criterion is translated into several sub-criteria which are then converted into several statements to obtain qualitative data. This data will then be converted into a quantitative form with a statistical analysis approach; (3) At the end of the questionnaire, the respondent is asked to mention a maximum of 5 alternative strategies undertaken by higher education institutions in dealing with competitiveness. The data will then be processed as an alternative strategy in implementing AHP.

The scoring technique used in this questionnaire is the Likert scale technique. This questionnaire has answers arranged on a scale of 1 to 10, the higher the score given means that the respondent agrees with the sub-criteria (closed questions) mentioned and if the smaller the score is given, the respondent disagrees with the existing sub-criteria. The questionnaire consists of 39 sub-criteria with details as follows: 5 sub-criteria from the relevance criteria, 5 sub-criteria from the academic atmosphere criteria, 5 sub-criteria from the Internal Management criteria, 4 sub-criteria from the Sustainability criteria, 6 sub-criteria from the Efficiency and Productivity criteria, 5 sub-criteria from the Access criteria and Equity, 5 sub-criteria for leadership criteria, and 5 sub-criteria for competitiveness criteria.

The data collection technique used in this study includes several stages as follows : (1) Data collection techniques by distributing questionnaires to the management of private universities offline and online according to the instructions that have been prepared; (2) Collecting research instruments that have been filled in by the respondent; (3) Tabulation of research data; (4) Statistical analysis using the Smart PLS application as a tool in determining the weight of each criterion and sub-criteria; (5) Application of the AHP method to determine the best alternatives in strategies to increase the competitiveness of higher education. At the statistical data processing stage using the Smart PLS application, which includes variables, in this case, namely all the criteria contained in the study which are further divided into independent variables (X) and dependent variables (Y). The process of statistical data processing aims to determine weight of each criterion and sub-criteria which the weights will then be used as a basis for calculating in the application of the AHP method.

The steps to problem-solving with using the AHP method in this research are [3] :

**a. Build a hierarchical model**

The criteria in this research are RAISE ++ which consists of relevance, academic atmosphere, internal management, sustainability, efficiency and productivity, access and equity, leadership, and competitiveness. Criteria and sub-criteria in this research can see in Table 1.

**Table 1. Criteria and Sub criteria**

Criteria	Sub-criteria
Relevance	<ol style="list-style-type: none"> <li>1. Competence of graduates</li> <li>2. The quality of graduates</li> <li>3. Curriculum Compliance</li> <li>4. The waiting period for graduates</li> <li>5. Collaboration with universities</li> </ol>
Academic Atmosphere	<ol style="list-style-type: none"> <li>1. A healthy relationship between PT and lecturer</li> <li>2. Interaction between lecturers and students</li> <li>3. High student activities</li> <li>4. The discipline of the academic community</li> </ol>
Internal Management	<ol style="list-style-type: none"> <li>1. Performance improvement training</li> <li>2. Reliable management system</li> <li>3. Decision making is fast and efficient</li> <li>4. A good bureaucratic system</li> <li>5. Effective and efficient use of resources</li> </ol>
Sustainability	<ol style="list-style-type: none"> <li>1. Sources of income other than student funds</li> <li>2. Good management reputation</li> </ol>

	3. Quality lecturers
	4. Strategic resource investment
Efficiency & Productivity	1. Study period on time
	2. Low dropout rate
	3. Strict selection system
	4. Ratio of lecturers according to criteria
	5. Financing efficiency
	6. High physical utility
Leadership	1. Good leader selection
	2. Quality leaders
	3. Innovative leaders
	4. Leader's reputation
	5. Evaluate the performance of the leader
Access & Equity	1. Complete learning resources
	2. Manicured learning resources
	3. Optimizing the use of learning resources
	4. Student diversity
	5. Student facilities outside the area

Based on the results of filling out the questionnaire by the respondents, there are 18 alternative strategies for higher education competitiveness. An alternative table can be seen in Table 2.

**Table 2. Alternative strategies for higher education competitiveness**

No	Alternative
1	Quality of HR
2	Quality of infrastructure
3	Institutional collaboration
4	Academic service quality
5	Student selection system
6	Scholarship program
7	Curriculum
8	Accreditation score
9	Training/workshops for students
10	Quality of graduates
11	HR investment
12	Students graduate on time
13	Leadership
14	Management Quality of higher education
15	Online based information system
16	Conducive academic activities
17	Tridarma higher education
18	Quality control and evaluation

The research hierarchy using the AHP method can be seen in Figure 1.

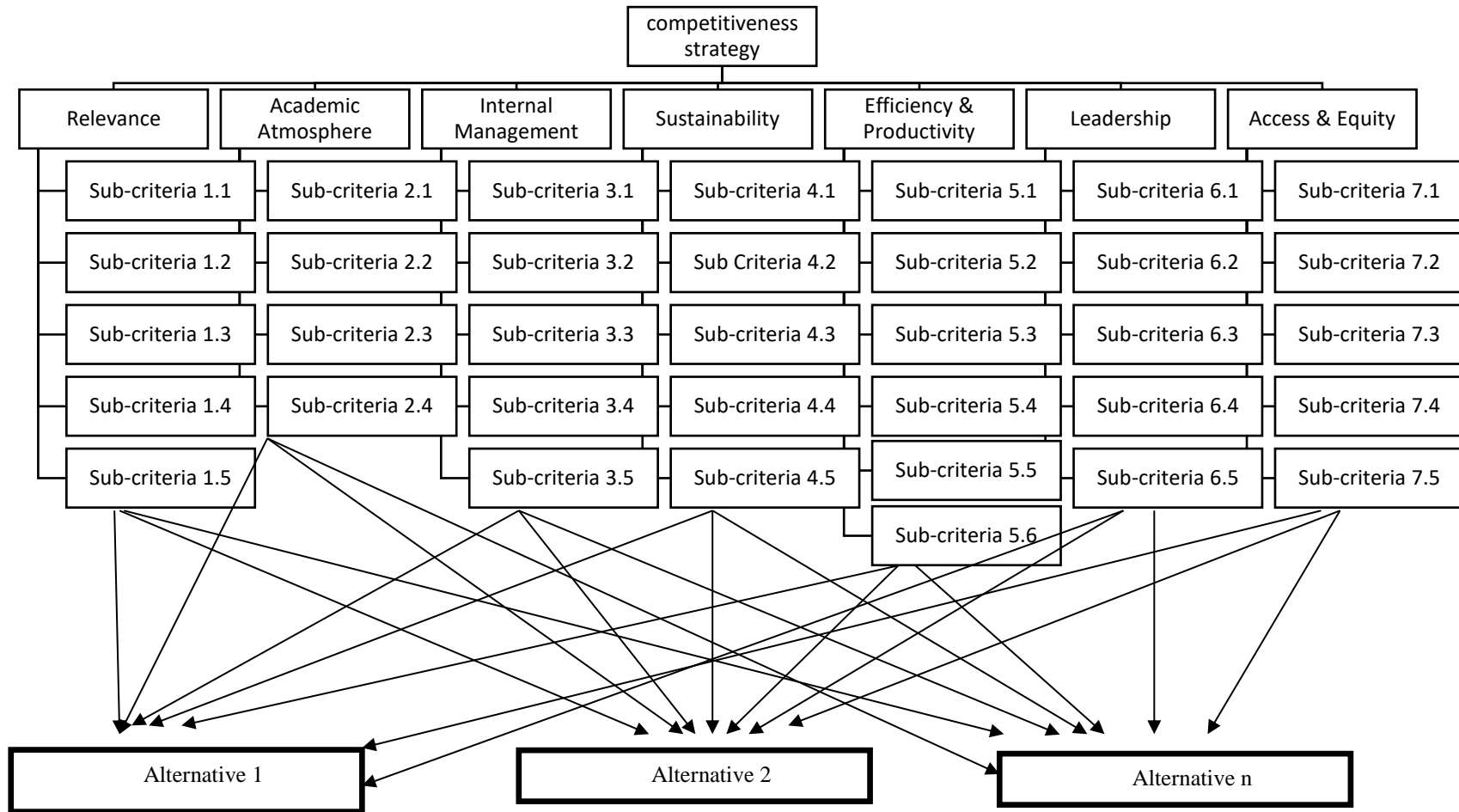


Figure 1. Hierarchy of model college competitiveness strategy

### b. Designing the questionnaire

The questionnaire consists of 39 sub-criteria with details as follows: 5 sub-criteria from the relevance criteria, 5 sub-criteria from the academic atmosphere criteria, 5 sub-criteria from the Internal Management criteria, 4 sub-criteria from the Sustainability criteria, 6 sub-criteria from the Efficiency and Productivity criteria, 5 sub-criteria from the Access criteria and Equity, 5 sub-criteria for leadership criteria, and 5 sub-criteria for competitiveness criteria.

The analytical method is chosen to analyze the data must be by the patterns and variables under study. After distributing questionnaires and collecting data, the results will be analyzed first using the Structural Equation Model analysis technique with Smart PLS software because PLS uses the bootstrapping method or random multiplication. The results of Smart PLS bootstrapping in the form of weighted values will then be used as the basis for the application of the AHP (Analytical Hierarchy Process) method. The role of AHP, in this case is as a method of decision making to determine which strategies can increase the competitiveness of higher education. The tool used in the application of the AHP method is using the Expert Choice application.

## 4. RESULT AND DISCUSSION

Base on the analytical method next steps to problem-solving with using the AHP method in this research are [3] :

### a. Determination of priorities (weighting) for criteria,

The determination of the weight was carried out by using the Smart PLS analysis. Based on the results of the analysis of the questionnaire data, the criteria weights were obtained the Relevance criteria of 0.134, the Academic Atmosphere criteria of 0.030, the Internal Management criterion of 0.138, the Sustainability criterion of 0.415, the Efficiency & Productivity criterion of 0.070, the Access & Equity criteria is 0.039, and the Leadership criteria is 0.226. Weight of Criteria was seen in table 1. and sub-criteria was seen in table 2.

**Table 1. Weight of Criteria**

Criteria	Weight
Relevance	0.134
Academic Atmosphere	-0.016
Internal Management	0.319
Sustainability	0.628
Efficiency & Productivity	0.245
Leadership	0.494
Access & Equity	0.102

Table 1. Sustainability criteria had the greatest weight compared to other criteria. This stated that the criteria for sustainability were the most influential in determining the strategy of Higher Education competitiveness.

**Table 2. Weight of Criteria**

Criteria	Sub-criteria	Weight
Relevance	1. Competence of graduates	0.383
	2. The quality of graduates	0.760
	3. Curriculum Compliance	0.693
	4. The waiting period for graduates	0.560
	5. Collaboration with universities	0.711

Academic Atmosphere	1. A healthy relationship between PT and lecturer	0.884
	2. Interaction between lecturers and students	0.820
	3. High student activities	0.834
	4. The discipline of the academic community	0.841
Internal Management	1. Performance improvement training	0.741
	2. Reliable management system	0.804
	3. Decision making is fast and efficient	0.768
	4. A good bureaucratic system	0.740
	5. Effective and efficient use of resources	0.756
Sustainability	1. Sources of income other than student funds	0.721
	2. Good management reputation	0.848
	3. Quality lecturers	0.855
	4. Strategic resource investment	0.766
Efficiency & Productivity	1. Study period on time	0.689
	2. Low dropout rate	0.625
	3. Strict selection system	0.700
	4. Ratio of lecturers according to criteria	0.685
	5. Financing efficiency	0.822
	6. High physical utility	0.789
Leadership	1. Good leader selection	0.848
	2. Quality leaders	0.854
	3. Innovative leaders	0.915
	4. Leader's reputation	0.786
	5. Evaluate the performance of the leader	0.879
Access & Equity	1. Complete learning resources	0.680
	2. Manicured learning resources	0.795
	3. Optimizing the use of learning resources	0.739
	4. Student diversity	0.741
	5. Student facilities outside the area	0.491

The results of the analysis from the smartPLS application will be used as a reference for determining the weight in the Analytical Hierarchy Process (AHP) method. The hierarchy arrangement for this research consists of hierarchy I in the form of goals/goals in this study the main objective is Competitiveness Strategy, hierarchy II consists of RAISE ++ criteria, namely Relevance, academic atmosphere, internal management, sustainability, efficiency and productivity, leadership and access and equity. and hierarchy III is an alternative strategy obtained from the results of filling out the questionnaire by the respondent, namely as many as 18 alternatives. The alternatives were the quality of human resources, the quality of infrastructure, institutional cooperation, quality of academic services, student selection systems, scholarship programs, curriculum, accreditation value, training/workshops for students, graduate quality, investment in HR, students graduated on time, leadership, quality of PT management, online-based information systems, conducive academic activities, tri dharma of higher education, and quality control and evaluation.

The 18 alternatives were calculated using the AHP method. AHP method was used to determine the ranking of alternatives. The results of the alternative analysis were based on the goals set can be seen in 3 analysis results, namely synthesis analysis, Performance Sensitivity, and Dynamic Sensitivity.

The results of this analysis were the best alternative recommendations that occupied the strategy of higher education competitiveness by the priorities set previously. The results of the synthesis analysis, Performance Sensitivity and Dynamic Sensitivity was seen in table 3.



Table 3. Result of Sensitivity Performance and Dynamic Sensitivity

Alternative	Synthesis Analysis	Dynamic Sensitivity
Management Quality of higher education	0.112	11.2%
Leadership	0.112	11.2%
Quality of HR	0.097	9.7%
Quality control and evaluation	0.092	9.2%
HR investment	0.065	6.5%
Conducive academic activities	0.062	6.2%
Academic service quality	0.055	5.5%
Tridarma College	0.053	5.3%
Accreditation score	0.048	4.8%
Institutional collaboration	0.043	4.3%
Quality of infrastructure	0.040	4.0%
Quality of graduates	0.036	3.6%
Online based information system	0.034	3.4%
Curriculum	0.032	3.2%
Students graduate on time	0.032	3.2%
Student selection system	0.030	3.0%
Scholarship program	0.030	3.0%
Training / workshops for students	0.026	2.6%

Based on the results of the research above, the analysis of the research results of this study was:

a. The priority criteria for improving the competitiveness of higher education institutions based on RAISE ++ were:

- Relevance analysis, had a percentage of 8.1% which shows that according to respondents the relevance criterion became the 4<sup>th</sup> priority with a weight of 0.081.
- Academic Atmosphere Analysis, had a percentage of 3.0% which showed that according to respondents the Academic Atmosphere criterion became the 7<sup>th</sup> priority or the last priority with a weight of 0.030.
- Internal Management Analysis, had a percentage of 13.8% which showed that according to respondents the Internal Management criterion became the 3<sup>rd</sup> priority with a weight of 0.138.
- Sustainability Analysis, had a percentage of 41% which showed that according to respondents Sustainability criteria became the 1<sup>st</sup> priority with a weight of 0.415.

The statement agreed with research conducted by [4] stating that the strategy to achieve PTS excellence in Semarang should not only be on the quality aspect of the service production process alone but it was on the more specific service design aspects, marketing aspects, aspects of source management activities human power, the form of infrastructure (physical building) and technological development.

Research conducted by [5] stated that the mapping model of competitive and sustainable competitive advantage based on the performance of private higher education that was realized through various program activities was enhanced through program activities: improving relevance, improving academic atmosphere, improving sustainability, improving efficiency and improving productivity, improving leadership, and improving access and equity.

- Efficiency & Productivity Analysis, had a percentage of 7% which showed that according to respondents the Efficiency & Productivity criterion became the 5<sup>th</sup> priority with a weight of 0.070.
- Access & Equity analysis, had a percentage of 3.9% which showed that according to respondents the Access & Equity criterion became the 6<sup>th</sup> priority with a weight of 0.039.

- Leadership Analysis, had a percentage of 22% which showed that according to respondents Leadership criteria became the second priority with a weight of 0.226.  
The statement, in agreement with the first, research conducted by [6] stated that the determination of personnel who considered the competence, knowledge, experience, and personnel attributes were able to influence the performance and role of operational, organizational, and public leadership.  
Secondly, research conducted by [7] stated that the results obtained that the aspects of leadership as a driving force to drive the competitiveness strengths of higher education in order to win the Competition Areas so it was able to obtain the expected Competition Results in terms of adequate quality and quantity of students, adequate income, social and cultural respect for the organization and good image.  
Third, according to [8] revealed in the context of education management itself, the existence of a leader was mandatory. A leader was fully responsible for every success and failure experienced by educational institutions in the application of every detail of work planning that had been made.
- b. The alternatives of higher education competitiveness strategies that must be based on the highest score were Management Quality of higher education with a weight of 0.111, Leadership with a weight of 0.109, HR Quality with a weight of 0.098, Quality control and evaluation with a weight of 0.091, HR Investment with a weight of 0.064, conducive academic activities with a weight of 0.064, Academic service quality with a weight of 0.054, Tri dharma higher education with a weight of 0.053, Accreditation value with a weight of 0.048, Institutional cooperation with a weight of 0.042, Quality of infrastructure facilities with a weight of 0.041, Quality of graduates with a weight of 0.037, Online-based information system with a weight of 0.035, Curriculum with a weight of 0.033, Students graduating on time with a weight of 0.033, Student selection system with a weight of 0.030, Scholarship programs with a weight of 0.029, and Training/workshops for students with a weight of 0.028.

In terms of people and structures involved in QM, it was clear that in most responding institutions, the university leadership (head of the institution and/or the vice-rector) played an important role, followed by collegial structures such as a quality committee and the university senate [9].

Strategic leadership was very important to able to achieve high-performance study program. Dimensions of strategic leadership consisted of driving the strategic management process as a strategist, as agents of change, and the ability to create a vision as a visionary leader. The dimensions as a component of strategic leadership were interlinked to form a variable construct of strategic leadership [10].

Human resources were a core determinant of quality in higher education and research. Universities must therefore work to enhance their human potential, both qualitatively and quantitatively, by attracting, developing, and keeping talent in the teaching/research career [10]. The quality of human resources i.e., lecturers were the highest [11].

Higher education that applied quality control and evaluation improved the quality of higher education gradually so that it increased competitiveness [12].

It was concluded the findings of this study stated that the alternative of strategies that needed to be considered in the strategy higher education competitiveness was the quality of higher education management, leadership, quality of the human resources, and the quality of control and evaluation, and, investment human resources good.

- c. Higher education competitiveness was determined by the sustainability of higher education that had qualified lecturers/quality human resources and improved strategies in terms of the quality of higher education management. According to [13] that the management of the college, a quality leader was able to improve the quality of higher education.

## B. CONCLUSIONS

Based on the results and analysis of the above research, the conclusion of this study is:

- a. Priority criteria for improving the competitiveness of higher education based on RAISE ++ are 1st priority sustainability criteria, 2nd priority leadership criteria, 3rd priority Internal Management criteria, 4th priority relevance criteria, 5th priority Efficiency & Productivity criteria, the 6th priority Access & Equity criterion, and the 7th or last priority Academic Atmosphere criterion.
- b. The alternatives of higher education competitiveness strategies that must be considered based on the 5 (five) highest weights are the quality of higher education management, leadership, human resource quality, quality control and evaluation, and good HR investment. These alternatives are a recommendation for higher education in reminding the competitiveness strategy of higher education.
- c. Higher education competitiveness is determined by the sustainability of higher education that qualified lecturers/quality human resources and improved strategies in terms of the quality of higher education management.

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