

Grouping of Universities in Indonesia Based on Data Base of Higher Education

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Abstract- This study aims to group universities in Indonesia based on a various quality variables of universities that had been documented in the Data Base of Higher Education (PD Dikti) in order to develop the implementation of higher education in Indonesia. Variables that had been documented in PD Dikti among other is the quality variable of higher education, that are the number of students, the ratio of the average GPA to maximum GPA, the number of department, the average number of students per department, the ratio of lecturer to student, the ratio of tenured lecturer to total lecturer, the ratio of associate professor to professor, the ratio of certified lecturer, the ratio of lecturer titled master degree, the ratio of lecturer titled doctorate degree. These variables were obtained from data of higher education implementation that consist of institution data, department, student, and lecturer. By using a cluster analysis, this study showed that universities in Indonesia were formed into two groups. The first group consisted of universities with characteristics whose all factor values were above the average from the group formed that most members of this group were state universities and the second group consisted of universities with the characteristic factor where all factor values were low that some members of this group were private universities.

Index Terms- university, higher education, data base of higher education, cluster analysis

I. INTRODUCTION

Higher education has a strategic role in educating the intellectual life of the nation and bringing science and technology forward as well as the sustainable empowerment of the Indonesian nation. In attempting to realize this role, the implementation of the higher education in Indonesia faces challenges, in terms of policy, implementation, monitoring, and evaluation. These challenges include issues related to access, quality, budget and finance, relevance, governance of universities and other issues. These challenges that are related to higher education must be overcome immediately to make the future of nation development better. Higher education is expected to contribute in addressing the needs of national technology, creating jobs with technological base, creating qualified human resources, and developing economic. There is a positive causal relationship between higher education and economic growth, as well as between higher education and the level of employment (Morote, 2001). According to Keller (2010) and Shin (2012) in their research, it is stated that higher education plays an important

role in economic growth and regional development in a global context, particularly in developing countries. Therefore, serious efforts are needed to face the challenges in the implementation of the higher education.

The government, in implementing higher education, has an responsibility to organize, plan, supervise, monitor, and evaluate as well as to develop and organize the implementation of the program, level and type of higher education to achieve the goal of higher education. This charge is not effortless; for the reason that the number of university in Indonesia keeps growing.

Table 1 The development of number of university and department

Year	2012	2013	2014	2015
Universities	3.170	3.189	3.280	3.246
Departments	17.206	17.503	18.882	19.373

Source: Higher Education Database

Until 2015, there are 3,246 universities in Indonesia under the charge of the Ministry of Research, Technology and Higher Education. This number of universities will certainly continue to grow in the future, particularly as the public interest to participate in higher education is very high and the number of college-age population is growing. Based on data from academic year of 2014/2015, the number of department in the scope of Ministry of Research, Technology and Higher Education of the Republic of Indonesia is 19,373 managed by 3,246 higher educations. It consists of 6,101 (31.4%) departments managed by state universities and 13,272 (68.6%) managed by private universities. The data indicates that the ratio between departments and group of state universities is 1:45, while the group of private universities is 1:4. This means, on average, that a state university manages 45 departments while a private university manages 4 departments. Referring to some of the overview above, it will provide opportunities to the growth and development of higher education; in that case the quality of existing universities must be improved so that they have a competitive advantage (Rosalin, 2010).

Demands for quality and relevance of higher education, the availability and equal access to higher education is increasing. In order to implement excellent higher education, the government runs the Quality Assurance System of Higher Education (SPM Dikti). Law No. 12 of 2012 on Higher Education (UU Dikti) integrates Quality Assurance of Higher Education, which consists of Internal Quality Assurance System (SPMI), External Quality Assurance System (SPME) or accreditation, and

Database of Higher Education (PD Dikti), In Article 79 paragraph (2) of the Law of Higher Education stipulates that the government develop an information management system of higher education. With this rule, it is necessary to have a good management in Database of Higher Education so that data and information about higher education in Indonesia can always be provided as part of the implementation of excellent higher education. Database of Higher Education aims to provide information precise and accurate for decision making in higher education institutions on program development, planning, monitoring, evaluation and other management purposes.

Data and information of higher education by universities is an important part of the Database of Higher Education. Data and information reported can be used for the periodical evaluation of universities and departments (Muchlis, 2008). The implementation of higher education by the government requires data and information for making decision and projecting the development needs of higher education. This study aimed to group universities based on various quality variables of universities that had been documented in Database of Higher Education with the purpose of the development of the implementation higher education in Indonesia.

II. RESEARCH METHOD

The data used in this research was secondary data obtained from the data and information of higher education implementation, academic year of 2014/2015 that has been reported in the Data Base of Higher Education (PD Dikti). From the data report in the Data Base of Higher Education, data related to institutions, students and lecturers were collected from 2,993 universities in Indonesia that had reported their data. From the data it was obtained 10 quality variables of universities, that are the number of students, the average ratio of GPA to the maximum GPA, the number of department, the average number of students per department, the ratio of lecturer to student, the ratio of tenured lecturer to total lecturer, the ratio of associate professor and professor, the ratio of certified lecturer, the ratio of lecturer titled master degree, the ratio of lecturer titled doctorate degree.

Data processing was performed using factor analysis and cluster analysis. Factor analysis is an interdependence technique that aims to define the structure that exists between variables in an analysis, so that data reduction can be performed and these variables can be grouped into a few factors (Santoso, 2010). The process of factor analysis attempted to find an interrelationship between a number of variables that are mutually independent, so that one or fewer variables, than the initial number of variables, can be made.

Cluster analysis were used to classify objects or cases into relatively homogeneous groups called clusters. Objects or cases in each group tend to be similar each other and differ greatly (not the same) with the object of other clusters (Santoso, 2010). The procedure of cluster formation is divided into 2, that are hierarchy and non-hierarchy. The formation of hierarchy cluster has the quality as the development of a hierarchy or branched tree-like structure. Hierarchy method can be agglomerative or divisive. Agglomerative method consists of linkage method, variance methods, and the centroid method. Linkage method consists of a

single linkage, complete linkage and average linkage. Non-hierarchy method is often called K-means method. Cluster analysis used in this study was K-means with data processing done and supported by SPSS software.

III. RESULTS AND DISCUSSION

Factor analysis

Test tool of KMO and Bartlett's test of sphericity was used as an initial test whether the existing data can be parsed into a factor. The figure of KMO and Bartlett's test was above 0.5 with a significance of less than 0.5 indicating that the existing variables and samples could be analyzed by factor analysis. Here is the result of KMO and Bartlett's test of sphericity.

Table 2 KMO and Bartlett's test.

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		0,6633
Bartlett's Test of Sphericity	Approx. Chi-Square	7966,680
	df	45
	Sig.	0,000

KMO / Kaiser-Meyer-Olkin Measure of Sampling Adequacy showed the adequacy of data used in the study, and how beneficial the data in the study. If the number is above 0.5, then the data is considered to be quite beneficial for use in the study. On the table, the value of KMO was sufficiently high at 0.663. This means the data was sufficiently effective to be used in the study. While Bartlett's Test of Sphericity showed the significance index of 0.000 or was under 0.05, so it can be said that the factor analysis was sufficiently effective to be used. As a result, the available variables and data could already be analyzed by factor analysis.

The next stage is to determine the number of factors. In determining the number of factors formed, one of them is determined by eigenvalue. The number of factors that are formed optimally is when eigenvalue was more than one. For more details, it can be seen in the table below.

Table 3 Value of Eigenvalue

Component	Initial Eigenvalues		
	Total	% of Variance	Cumulative %
1	3,053	30,529	30,529
2	1,361	13,613	44,142
3	1,176	11,757	55,899
4	1,045	10,449	66,348
5	1,016	10,160	76,508
6	0,873	8,735	85,243
7	0,505	5,050	90,292
8	0,447	4,470	94,762
9	0,287	2,868	97,631
10	0,237	2,369	100,000

On the table, it is shown that Eigenvalues on quality variables of higher education was on the component / factor of 5, so that the factors that had been formed were 5. Cumulatively, the five factors formed can explain the variety of factors of

76.508% of the total variance. Based on the eigenvalue, it was obtained 5 factors that have the highest value. Then from 10 variables that were obtained, it was formed into five factors used to determine the factors that affect the quality of higher education.

After determining the number of factors that will be formed, the next step was to determine which variables that were included in these factors.

Table 4 The Value of Loading Faktor with Varimax Rotation

	Component				
	1	2	3	4	5
The number of student	0,367	0,830	0,024	0,075	0,070
The average ratio of GPA to the maximum GPA	0,000	-0,109	0,030	0,833	-0,156
The number of department	0,728	0,311	0,053	0,267	0,199
The average number of students per department	-0,066	0,846	0,094	-0,196	-0,177
The ratio of lecturer to student	-0,012	-0,094	-0,004	-0,150	0,891
The ratio of tenured lecturer to total lecturer	-0,020	0,128	0,835	0,235	0,169
The ratio of associate professor and professor	0,874	0,038	0,038	-0,065	-0,059
The ratio of certified lecturer	0,763	-0,091	0,080	-0,294	-0,212
The ratio of lecturer titled master degree	0,266	-0,015	0,752	-0,252	-0,231
The ratio of lecturer titled doctorate degree	0,784	0,151	0,114	0,097	0,062

Therefore the variables have been reduced to 5 factors with the following details:

Table 5 Grouping variables

Factors	Variables	Loading Value
Factor 1	The number of department	0,728
	The ratio of associate professor and professor	0,874
	The ratio of certified lecturer	0,763
	The ratio of lecturer titled doctorate degree	0,784
Factor 2	The number of student	0,830
	The average number of students per department	0,846
Factor 3	The ratio of tenured lecturer to total lecturer	0,835
	The ratio of lecturer titled master degree	0,752
Factor 4	The average ratio of GPA to the maximum GPA	0,833
Factor 5	The ratio of lecturer to student	0,891

Factor 1 consisted of 4 variables where the variable of ratio of associate professor and professor was the primary identifier because it had the largest loading value (0.874). Factor 2 consisted of 2 variables where the variable of average number of students per department was the primary identifier because it had the largest loading value (0.846). Factor 3 consisted of 2 variables where the variable of ratio of lecturer to total lecturer was the primary identifier because it had the largest

loading value (0.835). Factor 4 consisted of 1 variable, that was the ratio of the average GPA to the maximum GPA with loading value (0,833). Factor 5 consisted of 1 variable, that was the ratio of lecturer to student with loading value (0.891).

Cluster analysis

Clustering process is performed to classify universities based on characteristics similarity. The process begins by determining the number of clusters selected. This method is to classify by initially determining the desired number of clusters (two clusters, clusters or the others). After the number of cluster is determined, then the cluster process is performed without following hierarchy process (Santoso, 2010). This method is commonly called K-Means Cluster.

In this study, the number of clusters was determined, that was 2 clusters. After 2 stages of iteration, the final cluster results were obtained as the following table.

Table 5 Final Cluster Center

Factor	Cluster	
	1	2
Factor 1	4,25442	-,07522
Factor 2	2,22055	-,03926
Factor 3	,04419	-,00078
Factor 4	1,56770	-,02772
Factor 5	3,03952	-,05374

The universities grouping based on similar characteristics are as follows.

- Group 1 consisted of universities whose all value factors were above the average of the group formed. There were 52 universities in this cluster.
- Group 2 consisted of universities whose all value factors were low. There were 2,941 universities in this cluster.

From the results of university grouping, if cross-tabulation with the type of university is performed then it will produce the following table.

Table 7 Results of grouping based on type of university

		Cluster Number		Total
		1	2	
State Universities	Count	44	69	113
	% within Cluster Number of Case	84,6%	2,3%	3,8%
	% of Total	1,5%	2,3%	3,8%
Private Universities	Count	8	2872	2880
	% within Cluster Number of Case	15,4%	97,7%	96,2%
	% of Total	0,3%	96,0%	96,2%
Total	Count	52	2941	2993

From Table 7, it is shown that from the total universities, in the first group were mostly state universities, and in the second group were mostly private universities.

After that, the validity of the group was performed. The validation of the group formed was performed by using Analysis of Variance (ANOVA) to determine whether or not there was difference/ influence on clusters formed. ANOVA F-test showed

that the factors 1, 2, 4 and 5 had p-value <0.05, it means that each factor had a significant difference between cluster 1 and cluster 2, while on the factor 3, p-value was larger than 0.05 which means that both clusters were relatively the same or factor 3 between cluster 1 was not significantly different with factor 2 in the cluster 2.

Table 7 Final Cluster Center

Factor	Cluster		Error		F	Sig.
	Mean Square	df	Mean Square	df		
Factor 1	957,848	1,000	0,680	2991,000	1408,412	0,000
Factor 2	260,937	1,000	0,913	2991,000	285,772	0,000
Factor 3	0,103	1,000	1,000	2991,000	0,103	0,748
Factor 4	130,059	1,000	0,957	2991,000	135,924	0,000
Factor 5	488,906	1,000	0,837	2991,000	584,205	0,000

IV. CONCLUSION

The grouping of universities in Indonesia based on the quality variable of higher educations that had been documented in the Data Base of Higher Education resulted 2 groups. The first group consisted of universities with characteristic whose all factor values were above the average of the group formed that some members of this group were state universities and the second group consisted of universities with factor characteristic whose all factor values were low that most members of this group were private universities.

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