

Application of Multivariate Exploration Analysis of the Vocational High School Accreditation Data in Indonesia

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ABSTRACT : The Ministry of Education and Culture of the Republic of Indonesia in 2015 stated that the educational quality enhancement of Vocational High School (VHS) was carried out by the increasing the percentage of accreditation rankings to minimum of B. Thus, to ensure and control the quality of education, the Government formed an agency called National Accreditation Agency of the School/Madrasah (NAA S/M). In classifying accreditation rank of A, B, C, and NA (not accredited) of vocational program VHS, NAA S/M refers to the National Education Standards (NES). The goals of this research were first, to explore the distribution of school accreditation rankings across province in Indonesia by correspondence analysis. Second, to explore the correlation between accreditation constituent variables, the distribution and characteristic of provinces based on the variables by biplot analysis. Third, to cluster the province based on the accreditation constituent variables by cluster analysis. The results of correspondence analysis showed that the ranking of accreditation was closely related to the provinces so that each province tend to be dominated by the different accreditation rankings. Biplot analysis showed that every province in Indonesia had different characteristics based on accreditation constituent variables and divided into three groups. Similar as biplot analysis, the provinces in Indonesia based on the cluster analysis were divided into three groups: provinces with excellent, very good, and good on all accreditation constituent variables. high standard of based on the cluster analysis. All variables used in the cluster analysis had significantly different mean on each cluster so they tend to influence and determine the results of the clusters.

Keywords: national education standards, correspondence, biplot, and cluster analysis

1. INTRODUCTION

Public policies of the government's program and plans in education are based on the function and purpose of national education which are stated on Pancasila and the Constitution of the Republic of Indonesia in 1945. The purpose of national education is a direction for Indonesian government to develop and arrange the strategies in order to improve the quality of human life, the people's productivity, and the competitiveness in the international market. Furthermore, another goal of national education is to form the character of young generation to continue working and loving their country, Indonesia.

The Ministry of Education and Culture of the Republic of Indonesia (MECRI) in 2015 stated that community increasing of productivity and competitiveness in international market in terms of food security, maritime and tourism can be realized through Vocational High School (VHS). This statement was supported and strengthened by the issuance of the President Instruction of the Republic of Indonesia (PIRI) number 9 in 2016 about revitalizing VHS in order to improve the quality and competitiveness of Indonesia's human resources. To achieve this mission, the Government attempted to improve certification access of graduates and education

quality of VHS (MECRI 2015; PIRINo. 9/2016). The government do efforts in order to increase the percentage of VHS accreditation minimum B (MECRI 2015).

2. RESEARCH METHOD

2.1 Data

This research used data accreditation of VHS of 2014-2015 in Indonesia which was obtained from the National Accreditation Agency of School/Madrasah (NAA S/M). in total there were 8065 VHS skills program spread over 34 provinces. The accreditation rankings are categorized into A, B, C, and NA (not accredited). Constituent variables of accreditation consist of eight standards: content standard (CS), process standard (PS), competency of graduates standard (CGS), teachers and education personnel standard (TES), facilities and infrastructure standard (FIS), management standard (MS), financial standard (FS), and educational assessment standard (EAS). Eight variables are mentioned as 8 NES for section in this paper.

2.2 Methods of Analysis

Procedure to analysis data were following:

1. Conducting descriptive statistics analysis to know a general overview about the characteristics of VHS accreditation of 2014-2015;
2. Conducting association test to find out the relationship between accreditation by the type of school and accreditation by the province. Association test used is the *chi-square* independency test (χ^2) with 5% significance level;
3. Conducting simple correspondence analysis based on association test results to determine the proximity

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- or similarity between the accreditation by the province through the two-dimensional visualization;
4. Conducting biplot analysis to determine characteristics of each province based on eight NES;
 5. Conducting cluster analysis to the province based on eight NES. Euclidean distance is used as a measure of similarity while cluster method used is the Ward method. Ward method used because it tends to produce cluster with a diversity that is relatively small in one cluster and resulting large variance between the clusters.

3. RESULT AND DISCUSSION

3.1 Descriptive Analysis

Results of accreditation issued by NAA S/M in 2014-2015 showed that from 8065 of VHS skills program in Indonesia spread over 34 provinces consisted of 3389 public schools and 4676 private schools. Figure 1 show the distribution of high vocational schools which have been achieved accreditation between public schools and private schools. Mostly high vocational schools for both schools pass the accreditation process. Only a few high vocational schools did not pass the accreditation process. Quality of public schools were better than quality of private schools. It is showed by the percentage of high vocational schools which achieved ranking A in public schools (54.97%) was higher than in private schools (35.46%)

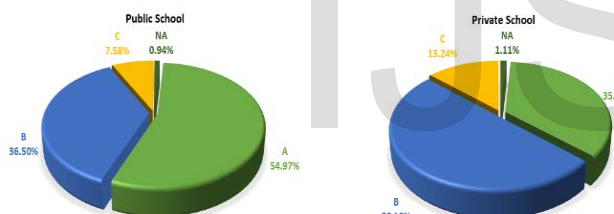


Figure 1 Distribution of accreditation results based on types of schools

The bar chart in Figure 2 showed the distribution of the results of VHS skills program accreditation in Indonesia by province. From 34 provinces in Indonesia, most of high vocational schools have been pass the accreditation process. All high vocational schools in three provinces (province of North Kalimantan, Bali and Maluku) got ranking A and B. It was surprising that all high vocational schools in North Kalimantan Province got ranking A. It was probably because there were only six schools which submitted the accreditation process and North Kalimantan province is a new province. Before 2012, North Kalimantan Province was belong to East Kalimantan Province.

West Sulawesi province and Southeast Sulawesi province were the provinces which low quality of high vocational schools. It is showed by none of high vocational schools in West Sulawesi got ranking A. Southeast Sulawesi province was worse than West Sulawesi province because the highest ranking of high vocational schools was only C. Another condition was the percentage of high vocational schools did not pass the accreditation process was the highest compared to other

provinces (18.18%). In general, the quality of high vocational schools were variation between provinces in Indonesia.

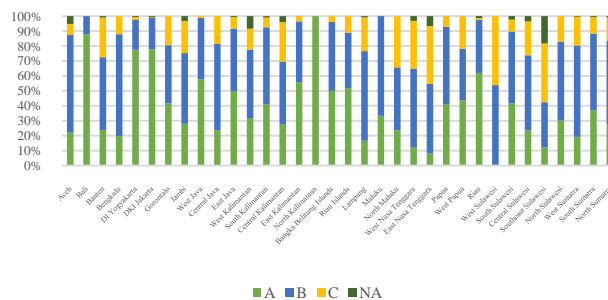


Figure 2 Distribution of the results of the accreditation rankings based on province

The accreditation raking is based on eight NES. The expected value of each NES have to at least 71. Figure 3 shows that the mean value of eighth NES VHS in Indonesia by 2014-2015 greater than 71. The distribution scores which were achieved by high vocational schools were variation. The highest mean of eight NES was financing standard (FS) while the lowest was educators and educational personnel standard (TES).

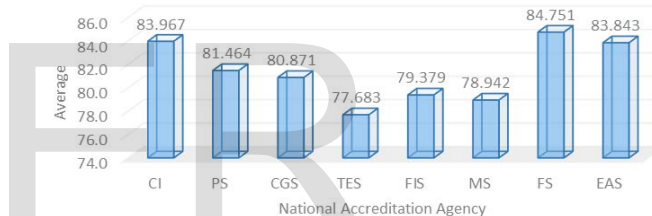


Figure 3 Mean value of eight NES VHS in Indonesia in 2014-2015

3.2 Correspondence Analysis

As mentioned before that the distribution of accreditation rankings were different among province. It was strengthened by the *chi-square* independency test (χ^2) between accreditation rankings and provinces. The *chi-square* value of 1837.65 (p -value = 0.00000). It was significant at the significance level 5%. To determine the proximity between categories of variables then conducted the correspondence analysis with graphical visualization of accreditation ranking against the provinces.

Figure 4 shows that a plot of accreditation correspondence analysis by the provinces. Total variation was explained by the graph was 91.85%, 78.06% in the first dimension and 13.79% in the second dimension. The accreditation rating NA tend to be more prevalent in Southeast Sulawesi province (30), West Kalimantan (12) and East Nusa Tenggara (23). The accreditation ranking of C tend to be more prevalent in the province of West Sulawesi (27), Southeast Sulawesi (30), and East Nusa Tenggara (23). The accreditation ranking of A tend to be dominated by the province of North Kalimantan (16), Bali (2), DKI Jakarta (5), DI Yogyakarta (6), and Riau (26) while the accreditation ranking of B tends to be dominated in all provinces in Indonesia. The results of the correspondence analysis was quite similar as

descriptions of Figure 2. The name of provinces and the codes can be seen in Table 1.

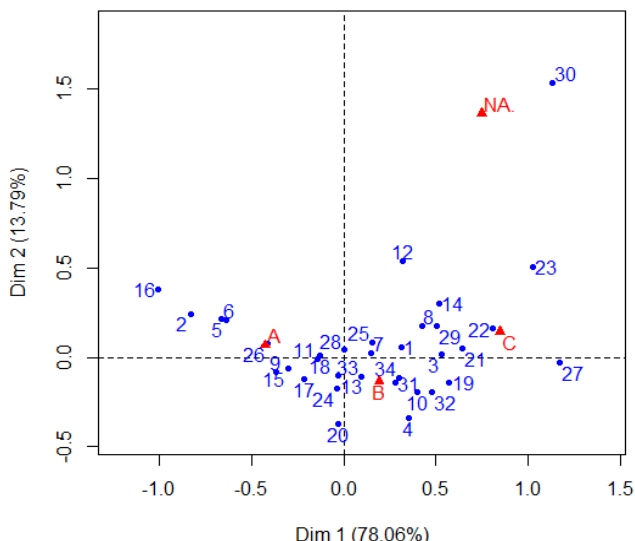


Figure 4 Plot of accreditation correspondence by province

Table 1 Province name list

Label	Provinsi	Label	Provinsi
1	Aceh	18	Riau Islands
2	Bali	19	Lampung
3	Banten	20	Maluku
4	Bengkulu	21	North Maluku
5	DI Yogyakarta	22	West Nusa Tenggara
6	DKI Jakarta	23	East Nusa Tenggara
7	Gorontalo	24	Papua
8	Jambi	25	West Papua
9	West Java	26	Riau
10	Central Java	27	West Sulawesi
11	East Java	28	South Sulawesi
12	West Kalimantan	29	Central Sulawesi
13	South Kalimantan	30	Southeast Sulawesi
14	Kalimantan	31	North Sulawesi
15	East Kalimantan	32	West Sumatra
16	North Kalimantan	33	South Sumatra
17	Bangka Belitung Islands	34	North Sumatra

3.3 Biplot Analysis

Figure 5 shows the results of the biplot analysis of province based on eight NES. Total variation explained by the biplot was 95.6% consisted of 92.8% of the first dimension and 2.8% in the second dimension. Based on the total variation of biplot, information presented by the biplot was already able to explain the characteristics of each province in accordance to the real condition.

The largest variation among the provinces was in variabel teachers and educational personnel standard (TES). The variation between province was also large on management standard (MS) and financial standard (FS). Variable educational assessment standard (EAS) was quite standard between provinces because this variable had the smallest variation compared to other variables.

Four other variables had similar variation: process standard (PS), content standard (CS), competence of graduates standard (CGS), as well as facilities and infrastructure standard (FIS).

Biplot analysis is to see the correlation between variables. If the angle between two variables less than 90° , it means the correlation between two variables is positive. Viceversa, the correlation is negative. If the angle between two variables is same as 90° , it means that no correlation between two variables. The strong correlations were correlation between the variables competence of graduates standard (CGS), with the management standard (MS), a process standard (PS) with facilities and infrastructure standard (FIS). The weak correlation established between the independent teachers and education personnel standard (TES) with financial standard (FS).

Figure 5 shows that the province of Bali (2), North Kalimantan (16), DI Yogyakarta (5), and DKI Jakarta (6) had the same characteristics and value of an mean of eight NES's most high for all variables while the province of Southeast Sulawesi (30), East Nusa Tenggara (23), West Sulawesi (27), West Nusa Tenggara (22), West Kalimantan (12), and North Maluku (21) had the same characteristics and low mean of eight NES or far below the mean value.

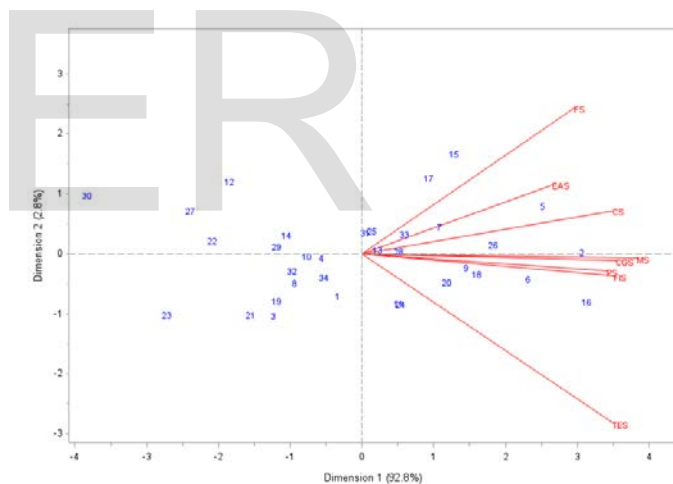


Figure 5 Biplot of provinces based on eight NES

3.4 Cluster Analysis

Cluster Analysis in this research aimed to clustering the provinces in Indonesia into several clusters which have the same characteristics based on eight NES. Clustering of the provinces carried out using the method of hierarchical with the link method was Ward method. Euclidian distance was used to measure the similarity between provinces. The hierarchical cluster is an agglomerative approach, The process is starting from a single cluster which has the smallest distance based on the link method and successively merge of other clusters until all clusters become a single cluster. The output of the hierarchical method is dendrogram. The next process is evaluation how many cluster can be drawn from the dendrogram. Usually, it is subjective by the researcher. In this paper, the choice how many cluster based on *pseudo-F* statistical and *R-square*. Figure 6 shows that the dendrogram cuts set is the clusters which

generated high statistics value of *pseudo-F* and *R-square* i.e. 291.30 and 94.95% with the number of clusters was 3.

Cluster Dendrogram

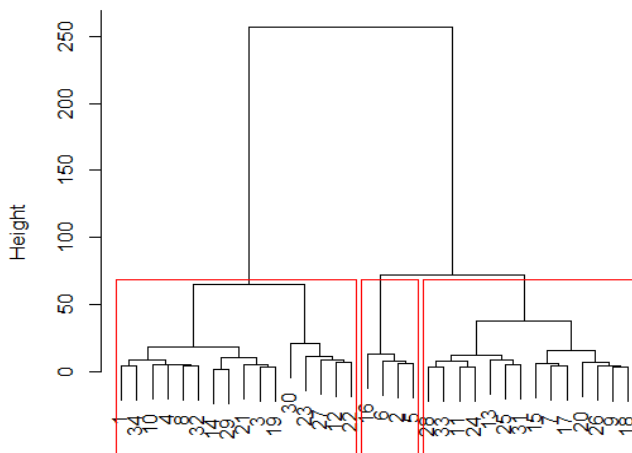


Figure 6 Dendrogram of cluster analysis results of province based on eight NES

Table 2 Provincial clusters based on cluster analysis

Cluster	Province
1	Aceh, North Sumatra, Central Java, Bengkulu, Jambi, West Sumatra, Central Kalimantan, Central Sulawesi, North Maluku, Banten, Lampung, Southeast Sulawesi, East Nusa Tenggara, West Sulawesi, West Kalimantan, and West Nusa Tenggara.
2	South Sulawesi, South Sumatra, East Java, Papua, South Kalimantan, West Papua, North Sulawesi, East Kalimantan, Gorontalo, Bangka Belitung Islands, Maluku, Riau, West Java, and Riau Islands.
3	North Kalimantan, DKI Jakarta, Bali, and DI Yogyakarta



Figure 7 Cluster analysis results map of province in Indonesia

To know the variables that determine the results of the cluster on every cluster then conducted an analysis of variance of the eight NES with a significant level of

5%. Table 3 shows that the number of clusters as much as 3 *p-value* less than 0.05 means that the variables for each of the clusters had different mean value from each other so that each variables tends to influence and determine the results of clusters.

Table 3 Results of analysis of variance and mean of the clusters

Variables	Analysis of Variance		Mean of Clusters		
	F	<i>p-value</i>	1	2	3
CS	54.24	<.0001*	77.7442	86.1126	92.4669
PS	55.56	<.0001*	75.2609	83.4235	89.4450
CGS	61.57	<.0001*	74.5534	82.7711	89.7454
TES	27.75	<.0001*	71.1464	78.2480	85.7429
FIS	48.81	<.0001*	73.3732	81.0845	88.3523
MS	47.91	<.0001*	71.1058	80.0106	87.0817
FS	43.69	<.0001*	79.7568	87.1570	92.3204
EAS	53.29	<.0001*	79.4817	85.7829	90.8234

The characteristics of each cluster can be seen from Table 3. Cluster 1 tend to have value of mean of each variable was below the mean of other two clusters. Cluster 2 had a value of mean close to the highest, it means the provinces which were in this clusters tend to have mean value close to mean value of Cluster 3. Cluster 3 was the cluster which had the highest mean of eight NES.

4. CONCLUSIONS

Based on the results of this research, it can be concluded that:

1. There are association between the accreditation A, B, C and NA with the provinces and the type of school at 5% significant level. The accreditation rating NA tend to be more prevalent in Southeast Sulawesi province (30), West Kalimantan (12) and East Nusa Tenggara (23). The accreditation ranking of C tend to be more prevalent in the province of West Sulawesi (27), Southeast Sulawesi (30), and East Nusa Tenggara (23). The accreditation ranking of A tend to be dominated by the province of North Kalimantan (16), Bali (2), DKI Jakarta (5), DI Yogyakarta (6), and Riau (26) while the accreditation ranking of B tends to be dominated in all provinces in Indonesia;
2. The correlation between variables had a positive correlation. The strongest correlation was the correlation between the variables competence of graduates standard (CGS), with the management standard (MS), a process standard (PS) with facilities and infrastructure standard (FIS);
3. The value of an mean of eight NES's is highest in the province of Bali (2), North Kalimantan (16), DI Yogyakarta (5), DKI Jakarta (6) and Riau (26);
4. The number of cluster produced by the dendrogram cuts with attention to the value of the *pseudo-F* statistical and *R-square* is highest value was three cluster. Provinces in cluster 1 belong to provinces with good in all variables, provinces in cluster 2 belong to provinces with very good in all variables, and provinces in cluster 3 belong to provinces with excellent in all variables.

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