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CLUSTERING LOCAL GOVERNMENT FOR OPTIMIZING LOCAL GOVERNMENT FINANCIAL CONDITION ANALYSIS: A CASE STUDY IN INDONESIA

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Abstract: *The outcome of local government financial conditions analysis will be more meaningful and useful if local governments are clustred into several groups with similar characteristics. Clustering local government for analysing financial condition is very crucial for a country, for example Indonesia, which has local governments with significant difference characteristics in social, economic, or demographic. However, clustering local governments hasn't been developed in Indonesia. The main objective of this research is to create a clustering model of local governments in Indonesia in order to maximize comparability among local governments. This study uses combination of Hierarchical Method and K-means Method to cluster local governments. The components of General Allocation Fund are applied as socioeconomic variables to cluster local governments. Those variables are population, area, human development index, construction cost index, regional gross domestic income per capita, local own revenue, tax revenue-sharing, and natural resources revenue-sharing. By using thirty municipal local government and ninety one district local governments in Java and Bali as samples, this study obtaines five clusters of municipal local governments and three clusters of district local governments with similar characteristics. Among five clusters formed in the group of municipal local governments, two of them only consist one local government. Therefore, they are not considered as cluster. The most significant factor which makes the difference between clusters is tax sharing-revenue.*

Keywords*: clustering, financial condition, hierarchical methods, k-means, local government, Indonesia.*

1. INTRODUCTION

1.1. Research Background

Several researchers have developed measurement models with a range of indicators to assess financial conditions of local governments[1] (see Kloha *et al.*, 2005; Zafra-Gómez *et al.*, 2009a, 2009b; Carmeli, A., 2002; Cabaleiro *et al.*, 2013; Ritonga, IT, 2014). Nonetheless, Zafra-Gómez *et al.* (2009b) expressed criticism regarding the measurement models. One of the main problems in assessing local government financial conditions is the issue of comparability. That is, in many cases, the

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measured values for local governments are different or not comparable because their environment are significantly different. For example, financial condition of City of Surabaya (the biggest city in East Java) cannot be compared with of City of Magelang (a small city in Central Java) because the complexity and the environment between those cities are significantly different. Some researchers such as Ammons *et al.*, (2001); De Lancer and Holzer (2001); Folz (2004) have highlighted the difficulty of making comparisons between the performance of different local governments in the nature, scope, and quality of service; and to find partners who implement performance measurement benchmarking truly comparable, reliable, and useful for decision making.

According to Wang *et al.* (2007) and Zafra-Gómez *et al.* (2009a, 2009b), there are social factors, economics, and demographics that affect the financial condition of a local government. Environmental factors are considered to be the main external constraints that affect financial performance. Services provided by a local government depend on the needs and socioeconomic characteristics of the population and thus reflected in the financial condition of local governments (Zafra-Gómez *et al.*, 2009b). Further Zafra-Gómez *et al.* (2009b) states that when these factors are not considered in the measurement of indicators of financial condition of local governments, it will be difficult to make comparisons between the local government's financial conditions. However, further Zafra-Gómez *et al.* (2009b) explained that there is some debate in the literature about how the socioeconomic variables must be addressed. Some authors consider that the socio-economic environment is simply another factor to be taken into account in the financial condition, while Wang *et al.* (2007) argues that socioeconomic factors affect local finances but does not have to be included as an additional factor in the financial condition.

Referring to the research of Zafra-Gómez *et al.* (2009a, 2009b), if the local authorities are grouped according to the factors affecting social and economic provision of their public service, financial condition evaluation results will be made much more effective, can facilitate decision-making by the legislature and local government. In their research, Zafra-Gómez *et al.* (2009a, 2009b) apply cluster analysis to classify local government into groups with similar socioeconomic characteristics. The analysis uses a group of socioeconomic variables that have been based on the regulations in Spain, are influential in determining the level of services to be provided by the government. Zafra-Gómez *et al.* (2009b) added that the financial condition of the measurement models using cluster analysis can be applied in other countries to consider the socioeconomic variables that are relevant in each country.

1.2. Research Problem

Research background section above has shown that outcome of analyzing financial condition of local governments will be more meaningful and useful if local

governments are clustered into similar groups. However, until now there has been no clustering of local governments in Indonesia. To the best of authors' knowledge, in Indonesia, there has been no research to develop a model clustering local governments in order to optimize analyzing the financial condition of local governments. In addition, there is still limited research in worldwide discussing how to cluster local government. Based on this situation, the research problem raised by this study is "how to cluster local governments for optimizing local government financial condition analysis; and what is the local government clusters formed based on the socioeconomic variables"?

1.3. Research Objective

This study aims to:

1. develop a model to cluster local governments in Indonesia for optimizing local government financial condition analysis; and
2. apply the model to find clusters of local government in Indonesia.

2. LITERATURE REVIEW

2.1. Cluster Analysis

Cluster analysis is the process of classifying a group of objects into one particular cluster so that the objects in the cluster are similar to each other, objects that have no resemblance incorporated into other clusters (Park *et al.*, 2009). Hair *et al.*, (2010) state that cluster analysis is a tool for exploratory data analysis of observed data set (i.e. people, objects, events, brand, company) into a taxonomy, a group, or meaningful clusters, which maximizes the similarity of cases within each cluster while maximizing the differences between groups were initially not known. Cluster analysis seeks to divide a set of objects into a small number of relatively homogeneous groups on the basis of their similarity on variables. Hair *et al.* (2010) states that the primary goal of cluster analysis is to define the data structure by placing the most similar observations into groups. Goodness of cluster depends on the similarity (homogeneity) between members of a cluster (within-cluster) and the inter-cluster differences (heterogeneity) which is measured by the proximity between objects (Santoso, 2012).

2.2. Previous Studies Related to Clustering Local Government

To the best of authors' knowledge, there is very little research related to the clustering of local government. McAdam and O'Neill (2002) using cluster approach to benchmark local governments in England. The purpose of their study was to measure the effectiveness of the best value in a similar group of service providers. A local government can be compared to the best practices that are in the same

cluster by using the key measurement indicators. They conclude that the cluster approach is more advantageous in terms of comparing the services of a local government to the best practice.

Furthermore, Zafra-Gómez *et al.* (2009a) developed a model to measure the financial condition of local governments in order to evaluate the quality of services provided by local government. They suggested that one of the main issues that need to be considered in evaluating the financial condition of local governments is related to socioeconomic variables. They developed a methodology that presents a new treatment of the socioeconomic variables so that financial factors and socioeconomic can be integrated. Effects of socioeconomic environment which is reflected in the financial condition of a local government are minimized by forming clusters of local governments with similar socioeconomic characteristics. As a result, the evaluation will be meaningful and useful for decision making.

In classifying local government, Zafra-Gómez *et al.* (2009b) using a group of variables used by the Spanish government to make policies related to the estimation of local government spending and allocation of funds to local governments. The criteria used in their study is income per capita, registered unemployment, industry, trade, tourism, population, net migration rate, and housing per capita. In forming a homogeneous group of local governments, Zafra-Gómez *et al.* (2009b) started to classify local governments based on population. Then, within each category is grouped using a two-phase clusters method and k-mean clusters to form groups as homogeneous as possible. By applying iterative process to combine the two procedures, then they obtained a total of 25 clusters that have minimal environmental impact. Each cluster has social and economic characteristics that are similar. The next step in their research is to evaluate the financial indicators in each group that have similar socioeconomic characteristics.

2.3. Socioeconomic Variables In the Context of Local Government in Indonesia

Hair *et al.* (2010) assert that researchers must effectively limit the variables selected for use in the cluster formation. Clusters obtained reflect the inherent structure of the data and can only be defined by variables. Thus, selecting variables to be included in the cluster must be done with consideration of theoretical, conceptual, and practice.

In their research, Zafra-Gómez *et al.* (2009b) utilized variables that are used to estimate the spending policies of local governments and to allocate funds to local governments in clustering local governments. In addition, Zafra-Gómez *et al.* (2009b) suggests that the variables used should be adapted to the regulations or the relevant legislation in each country. In the context of Indonesia, author argues that variables composing formula of General Allocation Fund (GAF) are suitable to cluster local government because the formula accommodates complexity of local government financial condition. In addition, the variables in formula have been

accepted appropriately by all local governments in Indonesia since the first time it was implemented in early of fiscal decentralization era (i.e. fiscal year 1999). Therefore, in the context of Indonesia, this study uses variables composing the calculation of the GAF.

GAF is one of the central government transfers of fund to local governments. GAF is intended for inter-local government equalization of financial ability to fund the needs of local governments in the implementation of decentralization. GAF is allocated based on the fiscal gap, namely the difference between fiscal needs and fiscal capacity. Fiscal needs of local governments are the need to carry out basic public services. Fiscal needs are measured based on number of population, area, construction cost index, gross regional domestic product (GDP) per capita, and human development index. Fiscal capacity is determined using variables of local-owned revenues, tax sharing revenue and natural resources revenue-sharing.

In addition, in his study, Ritonga (2012b) argues that there are six variables that affecting local governments' financial conditions in Indonesia, which are financial efficiency, cost of services and goods, population, revenue-base, population density, age profile of community, and wealth of community. He uses the framework of supply and demand to determine those variables. All the variables are almost the same with those in the GAF formula. Therefore, the socioeconomic variables used to cluster local government in Indonesia are number of population, area, construction cost index, gross regional domestic product (GDP) per capita, and human development index, local-owned revenues, tax sharing-revenue, and natural resources revenue-sharing.

3. RESEARCH METHOD

3.1. Data

Municipal local governments and district local governments located in Java and Bali are the objects observed in this study. Socioeconomic data used to classify the local governments are data of year 2010 because in that year the Central Statistics Agency conducted census. Thus, population data for each local government are available and reliable. The socioeconomic data of 121 local governments are taken consisting of 30 municipal local governments and 91 district local governments. This number is satisfying the first assumption of cluster analysis, which is sample representativeness. Therefore, data already represents the number of actual population structure. All the data is sourced from the Central Statistics Agency and the Ministry of Finance.

3.2. Operational Definition of Variables

The process of cluster formation is done by using eight variables: total population; area; human development index; construction cost index; GDP per capita; local

own revenue; tax sharing revenue; natural resources sharing revenue. Table 1 below describes details of definition and measurement of socioeconomic variables.

Table 1
Definition and Measurement of Socioeconomic Variables

Variable	*Definition and Measurement*
Population (P)	Number of residents living in a district/municipal area when the population census 2010 was undertaken.
Area (A)	Jurisdiction area of district or municipal in kilometre square (km^2).
Human Development Index (HDI)	Human development index is an index to measure and rank local government level of social and economic development. Central Agency of Statistics of Republic of Indonesia counts this index by some variables: life expectancy, literacy rate, length of study, and purchasing power.
Construction Cost Index (CCI)	Construction cost index is the ratio of the construction price towards the referenced city.
Gross Regional Domestic Product per Capita Index (GDPI)	The level of gross regional domestic product per capita at current prices.
Local Own Revenue (LOR)	Local own revenue is derived from economic activities in the area of local government itself. Local own revenue consists of local taxes, surcharges, income from local government wealth management, and other legitimate local government revenues.
Tax Sharing Revenue (TSR)	Tax sharing revenue is revenue sourced from central government allocated to a local government with regard to the tax contained in the local government area.
Natural Resources Sharing Revenue (NRSR)	Natural resources sharing revenue is revenue sourced from central government allocated to local government with regard to the natural resources contained in the local government area.

All the data is standardized or transformed to z-score. Standardization is needed because the collected data have different unit. Variables will be saved in standardized values. These values will be used as a basis for next analysis process.

Using standardized value, outliers in the data groups can be detected. In this study, outlier data are remained in use because the data are part of the population that does have an extreme value and represents a valid and relevant group. In addition, Square Euclidean distance is chosen as the similarity measure. This measurement is a part of cluster formation process in hierarchical method.

3.3. Cluster Method

This study uses a combined method, which is the method of hierarchical and non-hierarchical methods (K-mean Cluster). This combination is chosen because of the unknown number of clusters that will appear in the sample. In addition, this method is chosen in order to get optimal results. Sequence analyses of the two phases are as follows.

1. Hierarchical cluster analysis is performed using Ward's Method, and by applying the Square Euclidean Distance as a measure of distance or similarity. This selection helps to determine the optimal number of clusters of the sample.
2. The next step is to repeat the hierarchical cluster analysis with the K-mean Cluster based on the number of clusters that have been formed from the previous stage. Interpretation and validation process is done by using the output of K-means clustering method.

4. RESULTS

4.1. Testing Assumptions of Cluster Analysis

After the first assumption, i.e. data representativeness, is satisfied, then the second assumption that must be fulfilled is that no multicollinearity. Multicollinearity test aims to examine the correlation among variables utilized for clustering. The existence of multicollinearity can be seen from the value of Variance Inflation Factor (VIF) or the value of tolerance. Table 2 below shows the test results of multicollinearity tests.

Table 2
Multicollinearity Test

Variable	*Municipal Local Government*			*District Local Government*		
	R square	*VIF*	*Tolerance*	*R square*	*VIF*	*Tolerance*
P	0.934	15.15152	0.066	0.702	3.355705	0.298
A	0.676	3.08642	0.324	0.447	1.808318	0.553
HDI	0.32	1.470588	0.68	0.274	1.37741	0.726
CCI	0.369	1.584786	0.631	0.19	1.234568	0.81
GDPI	0.204	1.256281	0.796	0.341	1.517451	0.659
LOR	0.887	8.849558	0.113	0.398	1.66113	0.602
TSR	0.953	21.2766	0.047	0.719	3.558719	0.281
NRSR	0.319	1.468429	0.681	0.274	1.37741	0.726

Table 2 shows that in the group of municipal local government, VIF values for the variable Population Index and Tax Revenue Sharing are more than 10 so that the two variables are not meet the assumption of no multicollinearity. Six other

variables have VIF values less than 10 so that qualifies the multicollinearity test. In addition, in the group of district local governments, VIF values for the entire variable are below 10. Therefore, it can be concluded that all the variables in the group of local governments meet the assumption of no multicollinearity.

According to Goedono (2011), problem of multicollinearity is addressed by removing variables that have the multicollinearity from the model. However, if theoretically these variables should be exist in the model, then these variables can still be used. In this study, authors believe that all variables proposed are important components that should exist in the model, so that authors decide to keep using the correlated variables.

4.2. Cluster Formation

The first step in deriving cluster is to identify number of clusters developed and getting the best initial cluster centers by using hierarchical method. Ward's Error of Sum Square is used as clustering algorithm. This method develops clusters by maximizing homogeneity of each cluster. The sum of squares in clusters is used as the measure of homogeneity. Process of combining objects to several clusters can be defined by looking at agglomeration coefficient. By counting transition stages in each coefficient, the number of clusters can be determined based on the highest changes. Coefficient change indicates how much heterogeneity increases when the process change from one stage to another (Hair *et al.*, 2010). Table 3 below reports the agglomeration schedule of municipal local government group and district local government group.

Table 3
Agglomeration Schedule

Number of Cluster	*Municipal Local Government*			*District Local Government*		
	Coefficient	*Difference*	*Proportionate Increase*	*Coefficient*	*Difference*	*Proportionate Increase*
6	76.789	14.471	16%	297.361	49.463	14%
5	91.260	22.808	20%	346.824	50.722	13%
4	114.068	24.644	18%	397.546	56.704	12%
3	138.712	27.929	17%	454.250	95.700	17%
2	166.641	65.359	28%	549.950	170.050	24%
1	232.000	0.000		720.000	0.000	

According to Table 3 for group of municipal local government, high coefficient changes occur at the transition from one-cluster solution to two-cluster solution (232.000 – 166.641 = 65.359 or 28%) until from four-cluster solution to five-cluster

solution, which is 20%. Hence, five-cluster solution is selected for analysis because it still has high level of error decrease. For group of district local government data, high coefficient change occurred up to transition from two-cluster solution to three-cluster solution, i.e. 17%. Therefor, three-cluster solution is selected for analysis because it still has high level of error decrease.

Further, mean value of each variable in five-cluster (municipal local government) and mean value of each variable in three-cluster (district local government) will be used as initial cluster centers in non-hierarchical method or K-means method. Table 4 below shows the initial cluster centers for municipal local government and district local government.

Table 4
Initial Cluster Centers

	Cluster – Municipal Local Government					*Cluster – District Local Government*		
	1	*2*	*3*	*4*	*5*	*1*	*2*	*3*
Zscore(P)	1.17344	-.27156	-.62001	-.62305	2.64158	1.32375	.36312	-.44449
Zscore(A)	.93013	.02494	-.66479	-.54506	2.47695	-.06487	.96368	-.45078
Zscore(HDI)	.29944	-.72663	.20628	.26307	.77224	.60811	-1.04250	.37807
Zscore(CCI)	.34633	.51552	-.33254	-.55629	-1.66920	.24691	.02228	-.06102
Zscore(GDPI)	.00055	-.25006	-.29890	4.73997	1.14236	2.06177	-.22463	-.31183
Zscore(LOR)	.54990	-.37482	-.36989	-.33507	4.29292	1.68808	-.17070	-.26168
Zscore(TSR)	.95265	-.42357	-.51967	-.25918	3.73491	1.99028	.01382	-.41208
Zscore(NRSR)	-.02991	.98993	-.56155	-.20496	-.20496	.58431	.43277	-.32740

The second step is that to rearrange and smoothen results of hierarchical method by using non-hierarchical method. Process of grouping object using K-means method begins with inserting desired numbers of clusters, which are 5 clusters for municipal local government and 3 clusters for district local government, as well as mean value of each variabel in Table 4. After object allocation process for each cluster is finalised, all 30 municipal local governments are fully mapped into five clusters. Cluster 1 has 6 municipals, cluster 2 has 8 municipals, cluster 3 has 14 municipals, cluster 4 and 5 has 1 municipal each. All 91 district local government are mapped into three clusters. Cluster 1 has 9 districtss, cluster 2 has 26 districts, while cluster 3 has 56 districts.

4.3. Validating the Clusters

Validation process is done by looking at the differences of each cluster based on the given criteria. This can be seen from the output of ANOVA test in Table 6 below.

Table 5
Final Cluster Centers

Variables	*Municipal Local Government*					*District Local Government*		
	1	*2*	*3*	*4*	*5*	*1*	*2*	*3*
P	1,853,625	536,434	277,241	267,435	2,765,908	2,315,361	1,464,692	886,039
A	208.25	117.56	60.84	63.40	350.54	1,415.14	2,322.50	1,035.31
HDI	76.53	74.34	76.11	76.28	77.28	73.14	67.49	71.90
CCI	85.46	85.61	83.95	83.49	81.29	85.74	85.88	85.35
GDPI	21,138	20,337	23,071	212,439	73,941	28,016	11,176	10,330
LOR	261,737,538	85,812,587	91,207,008	92,690,243	893,437,168	339,006,395	82,761,031	73,011,016
TSR	303,868,512	60,898,024	52,631,129	87,212,729	726,559,911	243,499,814	85,860,121	52,397,706
NRSR	9,144,103	15,805,324	3,528,813	6,536,131	6,536,131	26,972,586	22,260,182	4,831,185

Table 6
ANOVA test

Variables	*Municipal Local Governments*		*District Local Government*	
	F	*Sig.*	*F*	*Sig.*
P	49.980	.000	32.256	.000
A	8.573	.000	29.257	.000
HDI	1.708	0.180	39.586	.000
CCI	2.316	0.085	0.452	.638
GDPI	39.480	.000	31.026	.000
LOR	28.548	.000	40.368	.000
TSR	50.365	.000	74.264	.000
NRSR	5.039	0.004	9.590	.000

Table 6 shows that in general there are significant different characteristics of each cluster. The most significant factors which makes the difference between clusters is tax sharing-revenue, either for municipal or district local government. However, there are two variables (i.e human development index and construction cost index) for group of municipal local government and one variable (i.e construction cost index) for group of district local government that do not significantly difference between each cluster since their significance values are greater than 0.05. These findings indicate that human development index and construction cost index are not much different among municipal local governments in Java and Bali, while construction cost index is not significantly different among district local governments in Java and Bali. Those variables could not be used as differentiating factors among the formed clusters.

The greater the F value, the greater the difference among the formed clusters. Table 6 shows that in the group of municipal local government the three largest F values are 50.365 (tax sharing revenue), 49.980 (population) and followed by gross regional domestic product per capita with F value of 39.480. In the group of district local government the highest differences level found in tax sharing revenue with

F value of 74.264, followed by local own revenue with F value of 40.368 and then human development index with F value of 39.586.

4.4. Interpretation and Profiling the Clusters

Interpretation process involves accurately naming and assigning a label to each cluster to describe its characteristics. Interpretation can be done by looking at final cluster centers resulting from K-means method. The last stage is profiling the formed clusters. This stage involves describing the nature or profile of each cluster.

Table 5 shows final cluster centers or mean value of each variable in each cluster. This cluster centers have been converted to the original value.

By looking at the final cluster centers output provided in Table 5, characteristics of groups of municipal local governments and district local governments can be described below.

Clusters of Municipal Local Governments

In the group of municipal local governments, there are five clusters formed. The description of each clusters are as follows.

1. Cluster 1 (Cluster of Big-Prosperous-Metropolitan Cities)

Cluster 1 consists of municipals whose population, area, local own revenues, and tax sharing revenue are the biggest compare to other clusters. This cluster does not have a variable that lie in the lowest rank. This cluster consists of six members; those are Bandung (i.e the capital city of West Java Province), Bekasi, Depok, Tangerang, Tangerang Selatan, and Semarang (i.e. the capital city of Central Java Province). Municipals in this cluster are mostly cities in the territory around the capital of Indonesia, Jakarta, and are often called the metropolitan area. All these cities are among the most developed cities in Java. All these cities have well-developed economic activities as indicated by high local own revenue and tax-sharing revenue. In addition, this cluster has high numbers – higher than average- of population and area. Based-on those characteristics, authors name the cluster as *Big-Prosperous-Metropolitan Cities*.

2. Cluster 2 (Cluster of Less-Prosperous Cities)

Cluster 2 has the highest value natural resources-sharing revenue, whilst has the lowest value of local own revenue, and gross regional domestic product per capita among clusters. Cluster 2 consists of eight members; those are Bogor, Cirebon, Sukabumi, Cimahi, Tasikmalaya, Banjar, Serang, and Malang. Generally, the cities in this cluster –except Cimahi- are located far from major cities. Most of the members of this cluster are located in the western of Java, except Malang. Based-on those characteristics, authors name the cluster as *Less-Prosperous Cities*.

3. Cluster 3 (Cluster of Small-Prosperous Cities)

Cluster 3 consists of 14 members: Cilegon, Magelang, Pekalongan, Salatiga, Surakarta, Tegal, Yogyakarta, Blitar, Madiun, Mojokerto, Pasuruan, Probolinggo, Batu, and Denpasar. The majority cities in this cluster are in the region of Central Java and East Java. Members of this cluster are spread evenly across Java and Bali. Most of cities generate their economy from tourism activities and trading. The main attributes of Cluster 3 are small area and low natural resources-sharing revenue. Compare to Cluster 2, the population density (i.e population divided by area) of Cluster 3 is slightly similar, but Cluster 2 is significantly higher in gross domestic product per capita and local own revenue. Based-on those characteristics, authors name the cluster as *Small-Prosperous Cities*.

4. Cluster 4

Cluster 4 consists of only one member, Local Government of Kediri. The most significant characteristic is the highest gross regional domestic product per capita compared to other clusters and far exceeds the average of the population. This variable causes Kediri as "an outlier" separated as different cluster. Authors believe that if this variable is ignored, Kediri will be placed in Cluster 3 because it has similar characteristic with those local governments in Cluster 3.

Kediri is a major trading center for Indonesian sugar and tobacco industry. Gudang Garam, a cigarette manufacturer, has been become the economic pillar for the majority of Kediri's citizens. The company contributes a relatively large tax and charges to the Local Government of Kediri, as a result it has higher local own revenue and tax-sharing revenue compared to Cluster 2 and Cluster 3.

5. Cluster 5

Cluster 5 has only one member, Local Government of Surabaya. Almost all variable values far exceed other clusters. Number of population, area, amount of local own revenue and tax sharing revenue of this city is the largest compared to other cities. Surabaya, the second metropolitan city in Indonesia after Jakarta, certainly has potential taxes and fees considering the trade, manufacturing, and services grown substantially which is certainly boost local own revenues. This city has been became a center of business, trade, industry, and education in eastern Indonesia.

Because Cluster 4 and Cluster 5 only consist of one local government, then authors argue they cannot be classified as cluster. As a consequence, authors do not put name on those "clusters". The local government in those "clusters" should be treated differently when analyzing their financial condition. Therefore, actually there are three clusters found for municipal local governments.

Clusters of District Local Governments

In the group of district local governments, there are three clusters formed. The description of each clusters are as follows.

1. Cluster 1 (Cluster of Dense-Prosperous-Urban Districts)

Cluster 1 consists of nine districts local governments: Bandung, Bekasi, Bogor, Karawang, Tangerang, Cilacap, Gresik, Sidoarjo, and Badung. Most of the districts in this cluster are located surrounding metropolitan areas which become the center of economic activities. The districts in this cluster are mostly quite developed industrial areas or tourist main destination (i.e. Badung in Province of Bali). Compared to other clusters, this cluster has highest number of population, gross regional domestic product per capita, local own revenue, tax sharing-revenue and natural resources sharing-revenue all other clusters. This cluster also has attribute of the most dense population compare to other clusters. Based-on those characteristics, authors name the cluster as *Dense-Prosperous-Urban Districts*.

2. Cluster 2 (Cluster of Less-developed Districts)

Attributes of districts in Cluster 2 are the highest construction cost index, the widest areas, and the lowest index of human development index. From those variables, the most "eye-catching" one from author's point of view is low human development index. Cluster 2 consists of 26 districts: Ciamis, Cianjur, Cirebon, Indramayu, Garut, Subang, Sukabumi, Tasikmalaya, Lebak, Pandeglang, Serang, Brebes, Bangkalan, Banyuwangi, Bojonegoro, Bondowoso, Jember, Lumajang, Malang, Pamekasan, Pasuruan, Probolinggo, Sampang, Situbondo, Sumenep, Tuban. Agriculture sector is dominant in this district's economy. Based-on those characteristics, authors name the cluster as *Less-developed Districts.*

3. Cluster 3 (Cluster of Small-Less-prosperous Districts)

Cluster 3 consists of districts whose values of most of variables are the lowest among all other the clusters. Only variable of human development index that does not lie in the lowest rank. Cluster 3 consists of 56 districts: Kuningan, Majalengka, Purwakarta, Sumedang, Bandung Barat, Banjarnegara, Banyumas, Batang, Blora, Boyolali, Demak, Grobogan, Jepara, Karanganyar, Kebumen, Kendal, Klaten, Kudus, Magelang, Pati, Pekalongan, Pemalang, Purbalingga, Purworejo, Rembang, Semarang, Sragen, Sukoharjo, Tegal, Temanggung, Wonogiri, Wonosobo, Bantul, Gunungkidul, Kulon Progo, Sleman, Blitar, Jombang, Kediri, Lamongan, Madiun, Magetan, Mojokerto, Nganjuk, Ngawi, Pacitan, Ponorogo, Trenggalek, Tulungagung, Jembrana, Bangli, Buleleng, Gianyar, Karangasem, Klungkung, Tabanan. The interesting thing from this cluster is that all local governments in the Province of Yogyakarta, Province of Bali (except Badung) and Province Central

Java became a member of the cluster. The most dominant economic sectors in this cluster is agriculture, which is supported by plantation, farm, and trading sector. Based-on those characteristics, authors name the cluster as *Small-Less-developed Districts.*

4.5. Applying the Results for Analyzing Local Government Financial Condition Analysis

Using Ritonga's model for assessing local government financial condition in Indonesia (Ritonga, 2014), the following table presents the comparison of ranking of municipal local government financial condition using cluster approach and without cluster approach.

Table 6 below shows that the composition of the ranking order of local government financial condition between clustering approach (left-side) and without clustering approach (right-side) is different. These compositional differences lead to different conclusions about the financial conditions among local governments. This fact occurs for each cluster. In Cluster 1 (Cluster of Big-Prosperous-Metropolitan Cities), rank of City of Depok (ranked 3rd) is higher than the rank of City of Tangerang (ranked 4th). However, the rank of City of Depok is lower (i.e. ranked 18th) than the rank of City of Tangerang (rank 14) in the without clustering approach.

The same situation also occurred in Cluster 2 (Cluster of Less-Prosperous Cities) and Cluster 3 (Cluster of Small-Prosperous Cities). In Cluster 3 (Cluster of Small-Prosperous Cities) rank of City of Pasuruan, ranked 19th on without cluster approach, is much higher than City of Surakarta's (ranked 25th). Meanwhile, on the clustering approach, rank of the City of Surakarta (ranked 11th) was significantly higher than the City of Pasuruan's which is ranked in the bottom (ranked 14th).

Authors believe that the ranking produced by the clustering approach is better than the without the clustering approach because local governments in a same cluster will have the same complexity. In turn, those local governments are comparable (i.e apple-to-apple). Thus, doing clustering will optimize the analysis local government financial condition.

5. CONCLUSION AND DISCUSSION

Based on the process of cluster formation, this study finds that there are five clusters for municipal local governments and three clusters for district local governments. The most significant factor which makes difference between clusters –both for municipal and district local government- is tax sharing-revenue.

On the other hand, there are two variables (i.e. human development index and construction cost index) for group of municipal local government and one variable

Table 6
Comparison of Financial Condition: Clustering Approach Versus Without Clustering Approach

Ranking	*Cluster 1*	*FCI*	*Ranking*	*Local Governments*	*FCI*
1	City of Bandung	0.65	1	City of Mojokerto	0.79
2	City of Tangerang Selatan	0.59	2	City of Madiun	0.58
3	City of Depok	0.47	3	City of Blitar	0.55
4	City of Tangerang	0.35	4	City of Bogor	0.53
5	City of Semarang	0.18	5	City of Cilegon	0.53
6	City of Bekasi	0.13	6	City of Bandung	0.51
			7	City of Tangerang Selatan	0.50
Ranking	**Cluster 2**	**FCI**	8	City of Pekalongan	0.49
1	City of Bogor	0.81	9	City of Magelang	0.48
2	City of Banjar	0.34	10	City of Banjar	0.48
3	City of Sukabumi	0.29	11	City of Kediri	0.47
4	City of Malang	0.25	12	City of Probolinggo	0.47
5	City of Tasikmalaya	0.25	13	City of Batu	0.45
6	City of Cirebon	0.22	14	City of Tangerang	0.45
7	City of Cimahi	0.17	15	City of Denpasar	0.44
8	City of Serang	0.12	16	City of Salatiga	0.44
			17	City of Sukabumi	0.42
Ranking	**Cluster 3**	**FCI**	18	City of Depok	0.42
1	City of Mojokerto	0.72	19	City of Pasuruan	0.40
2	City of Blitar	0.41	20	City of Tasikmalaya	0.37
3	City of Madiun	0.39	21	City of Surabaya	0.33
4	City of Cilegon	0.37	22	City of Yogyakarta	0.32
5	City of Denpasar	0.36	23	City of Tegal	0.31
6	City of Magelang	0.30	24	City of Malang	0.28
7	City of Probolinggo	0.30	25	City of Surakarta	0.27
8	City of Salatiga	0.27	26	City of Cirebon	0.27
9	City of Pekalongan	0.24	27	City of Semarang	0.26
10	City of Batu	0.24	28	City of Serang	0.26
11	City of Surakarta	0.17	29	City of Bekasi	0.24
12	City of Tegal	0.17	30	City of Cimahi	0.20
13	City of Yogyakarta	0.15			
14	City of Pasuruan	0.14			

FCI = Financial Condition Index
Cluster 1 (Cluster of Big-Prosperous-Metropolitan Cities)
Cluster 2 (Cluster of Less-Prosperous Cities)
Cluster 3 (Cluster of Small-Prosperous Cities)

(i.e. construction cost index) for group of district local government that do not significantly difference between each cluster. This situation indicates that variables of human developing index and construction cost are not much different among municipal local governments in Java and Bali, while construction cost index is not significantly different among district local governments in Java and Bali. As a result, those variables cannot be used as differentiating factors forming clusters of local governments.

Results of this study are expected to give academic contribution and practical contribution. In the academic side, this research contributes to the development of public sector accounting literature, especially regarding modeling local government clusters as the means to enhance local government financial condition comparability analysis. In the practical side, results of this research benefit the local government and its stakeholders in improving the analysis of the local government's financial condition through cluster approach. Local governments grouped in the same cluster can be used as benchmarking value. This cluster approach helps local governments and their stakeholders to make more effective evaluation and to facilitate the decision making.

In this research, there were some limitations that should be considered for the future researches. First, this research used variables which are contextual toward the condition in Indonesia, so that it could not be generalized for other countries. Second, cluster analysis has high subjectivity in choosing variables and methods of analysis. Using of different method for the same data could present different results in forming the data. This study keeps using outlier data forming clusters, while Ward Method and K-Means Method are sensitive to outlier data (Hair *et al.*, 2010; Rokach and Maimon (2005)). Therefore, future research should retest outcome of this study by using cluster methods that are not sensitive toward outlier data. Third, researchers did not omit or use the measure of distance which could overcome the correlation between variables, so that the reader should be careful in interpreting the results.

Note

1. Financial condition of local government is the financial ability of local government to fulfill its obligations (short-term obligations, long-term obligations, operational obligations, and obligations to provide services to the public), to anticipate the unexpected events, and to execute financial rights efficiently and effectively. Detail explanation of how such definition is conceptualized is explained in Ritonga *et al.* (2012a).

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