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Clustering Administrative City Based On Indicator Livable City in West Java Province

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ABSTRAK

As the population increases every year then a place to live, especially with livable conditions. Cities in the world are trying realizing the city with the concept of a livable city for residents to live comfortably in that city. In Indonesia, planning the city that it can inhabited. Based on the livable city indicators, there are still many cities in Indonesia that have not achieve it. In this case, especially for the cities in West Java Province has a vision as a city comfortable, need to apply the concept of the city livable in realizing the condition of the city. Furthermore, in this study an analysis was carried out to find out which city groups needed prioritized in the realization of a livable city in West Java Province. This study uses cluster analysis of city grouping with various methods in the hierarchical method using R Programming. Finally, this research will produce a group of cities that will be prioritized for accelerating its realization by improving aspects that are still lacking in development according to the indicators of livable city.

***Keywords**: livable city, cluster analysis, hirarchical method.*

I. INTRODUCTION

CITIES are centers of activities, services, and government becomes an attraction for the population to urbanize. Urbanization is one of the urban problems which makes the city the dominant choice for people in the world to live in. Complex city development involving various sectors relate. Linkages between spaces and sectors into an urban system. This condition which dynamic the city development.

Population growth every year increase the need for housing, especially with livable conditions. Cities in the world are trying create a city with a livable city concept so that residents can live comfortably in that city. Likewise in Indonesia planning the city that it can inhabited. Based on the livable city indicators, there are still many cities in Indonesia that have not achieve it. In this case especially for cities in West Java Province has a vision as a city comfortable, need to apply the concept of the city livable in realizing the condition of the city.

This research was conducted based on the research question, namely which city groups need prioritized in the realization of livable city in West Java Province? The grouping is done to make it easier to identify which cities need to be prioritized in accelerating the realization of livable cities. The findings in this study will support the stakeholders to determine priorities for the realization of livable cities in West Java that identified by cluster results

II. LITERATURE REVIEW

A. Livable City

Livable City is a term that describe a comfortable environment and atmosphere of the city as a place to live and work, viewed for various aspects of both physically such as urban facilities, infrastructure, spatial planning, etc. as well as non-physically such as social relations, economic activities, etc. (MLCI IAP, 2017).

The principle of livable city is divided based on several aspects as follows.

a. Availability of basic needs (proper housing, clean water, electricity network, sanitation, food sufficiency, etc.)
b. Availability of public and social facilities (public transportation, parks, health facilities, etc.)
c. Availability of public space as a place to interact between communities
d. Security and safety
e. Community participation in development
f. Support the city's economic, social and cultural functions
g. Environmental quality

D. Hahlweg (1997) suggests that "The City as a Family". A livable city is a city where citizens can have the opportunity to live healthy and easily supported activities transportation such as walking, cycling, availability of public transportation, and others. on the other hand a livable city is a city for everyone to can live comfortably in living, working and recreation (Ifni, 2017).

This concept describes the process of life towards well-being and comfort for city development

B. Livable City Indicator

The livable city concept has indicators from various regions, both at the world and Indonesian levels. According to the Big Dictionary Indonesian Language (KBBI) indicators are something which can be a clue or explanation.

The livable city indicator becomes a hint and rejects measure in assessing a livable city. Indicators of livable cities in Indonesia can be seen from Most Livable city Index (MLCI) from IAP year 2009, 2011, 2014 and 2017. These indicators used to measure the livability of cities in Indonesia.

Cities measured on the MLCI are dominated by major cities deemed important by IAP (MLCI IAP, 2017). Then, how about livable city indicator for medium city size (medium city/ mid-size city) in Indonesia. Size city based on population of course will affect the livable city indicator of a city currently. Maybe there are some indicators that can course is the same as the indicator for big cities. However, the uniqueness of a city is may be able to escape from the indicators that has existed at this time. In addition, the characteristics of each the city is also a determinant in create a livable city.

A livable city needs indicators which can be a measure in reach a livable city. The indicators of a livable city are as follows (Kristarani et al., 2017).

Tabel I
Indicator Of Livable City

Code	Indicators
Infrastructure	
A1	Public Transport
A2	Road Condition
A3	Medical Facilities
A4	Educational Facilities
A5	Electrical Distribution
A6	Availability of Clean Water
A7	Public Internet Access Service
Economic	
B1	Working Residents
B2	Living Cost
Environment	
C1	Green Open Space
C2	Air Quality Index
Social	
D1	Recreational Facilities
D2	Crimes

Source: General livable city indicators, 2017

III. METHOD AND DATA

Several methods that have developed and are often used are cluster analysis which is a multivariate technique and has the main objective of grouping objects based on their characteristics, grouping with two or more objects that have the closest similarity. Then forwarded to other objects and so on until the cluster will form a kind of 'tree' where there is a clear level (hierarchy) between objects, from the most similar to the least similar. Tools that help to clarify this hierarchical process are called “dendograms”. Another method that is continuous with clusters is mapping with the aim of grouping a collection of areas related to several geographical locations including highlands, mountains, resources and population potential that affect socio-cultural characteristics that have special characteristics in the use of the right scale (S et al., 2016).

In hierarchical cluster analysis, there are several distance matrix methods (Haumahu & Nanlohy, 2020), including:

a. Average method

The basis is the average distance between observations. grouping starts from the middle or pairs of observations with the closest distance to the average distance.

b. Complete Method

Also called the farthest neighbor approach. The basis is the maximum distance. In this method, all objects in a cluster are associated with each other at a maximum distance or with minimum similarity.

c. Single Method

This method is based on the minimum distance. Starting with two objects separated by the shortest distance then both will be placed in the first cluster, and so on. This method is also known as the nearest neighbor approach.

d. Ward's method

In this method the distance between two clusters is the sum of the squares between the two clusters for all variables. This method tends to be used to combine clusters with a small number.

e. Centroid Method

The distance between two clusters is the distance between the cluster's centroids. The cluster centroid is the mean value of the observations on the variables in a set of cluster variables. The advantage is that outliers have little effect when compared to other methods.

This analysis uses secondary data in 2019 with the variable according to the livable city indicator. Analysis method using analysis cluster (hierarchical method) with R programming. Analysis stages:

- Raw data input containing objects and variables, in this case the objects are cities in West Java and the variables are 13 variables based on liveable city indicators
- Input data with NA data that is a missing value filled with the average for each variable
- The measurement of similarity between objects is in this case between nine cities, namely Bogor, Sukabumi, Bandung, Cirebon, Bekasi, Depok, Cimahi, Tasikmalaya and Banjar. This measurement can be carried out in two stages, namely 1) measuring the distance with Euclidean or mahalanhois, but because the size of each variable is the same, it can use the Euclidean distance; and 2) the correlation coefficient to determine the relationship between objects with a value if it is close to one then the object is more similar
- Multicollinearity test on 13 variables based on the livable city indicator
- Standardization of data by method scaling
- Perform cluster analysis with five methods that exist in the hierarchical method. Determine the selected method that has the highest copenatic correlation or which is close to 1 between the average method, complete method, simple method, ward's method or centroid method.
- Determining clusters with dendogram
- Showing results for cluster cities
- Setting city group priorities in accelerating the embodiment of the livable city

The table at below show the input data from 13 variables for 9 cities in West Java that have been filled in first in the empty data with the average value for each variable.

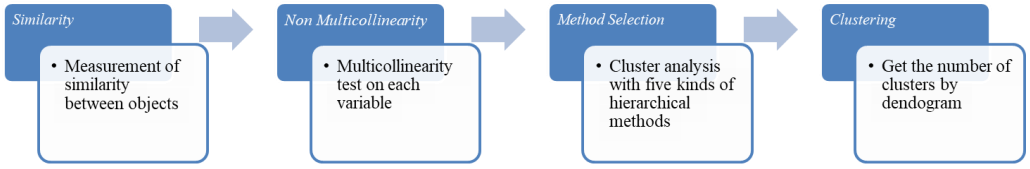

Figure 1. Kramework Of Analysis

Tabel II
Input Data

City	A1	A2	A3	A4	A5	A6	A7	B1	B2	C1	C2	D1	D2
Bogor	8300	76,59	19	3	2384271	52808	5	486867	4472462	183,99	12	8	725
Sukabumi	984	45,15	6	3	1044906	12270	5	140827	3838217	267,20	62	2	441
Bandung	5737	23,05	26	8	2730405	39350	11	1183193	5630382	2032,21	21	11	2276
Cirebon	1624	73,80	9	2	1354937	27688	5	138667	3606736	388,54	0	2	601
Bekasi	2207	90,43	26	7	1884160	12981	6	1383287	5770710	10,46	24	8	2934
Depok	3651	78,17	18	6	1656948	22925	5	1112358	6330690	64,66	58	7	1263
Cimahi	1691	49,89	5	2	1355030	27425	5	272553	4754492	37,21	29	6	317
Tasikmalaya	358	15,05	7	4	1215565	7468	5	301081	3632249	802,30	25	11	322
Banjar	3069	75,98	3	2	1703277	3414	4	88846	4754492	3661,57	25	1	127

Source: Statistic Agency; Departement of Transportation; Regional Government of West Java; and Ministry of Environment and Forestry Indonesia, 2019

Notation
A1 : Public Transport
A2 : Road Condition
A3 : Medical Facilities
A4 : Educational Facilities
A5 : Electrical Distribution
A6 : Availability of Clean Water
A7 : Public Internet Access Service
B1 : Working Residents
B2 : Living Cost
C1 : Green Open Space
C2 : Air Quality Index
D1 : Recreational Facilities
D2 : Crimes

IV. RRSULT AND DISCUSSION

In the initial input data, visualization of variables and research objects is carried out. It is found that the point distribution forms groups as follows.

It can be seen that there are groupings of points that can be used as initial cluster estimates, namely in two groups at the top and bottom points on the graph.

In the early stages of the analysis, the input data was tested for multicollinearity on 13 variables based on the indicators of livable cities and standardized data using the scaling method. It is known that there is no multicollinearity between variables which is indicated by a value not close to 1 or can be called strongly correlated. Furthermore, clustering analysis was carried out on five hierarchical methods to choose the best method in this study. After knowing each cluster member formed from 5 methods, then choosing the best cluster method by looking at the cophenetic coefficient values as follows.

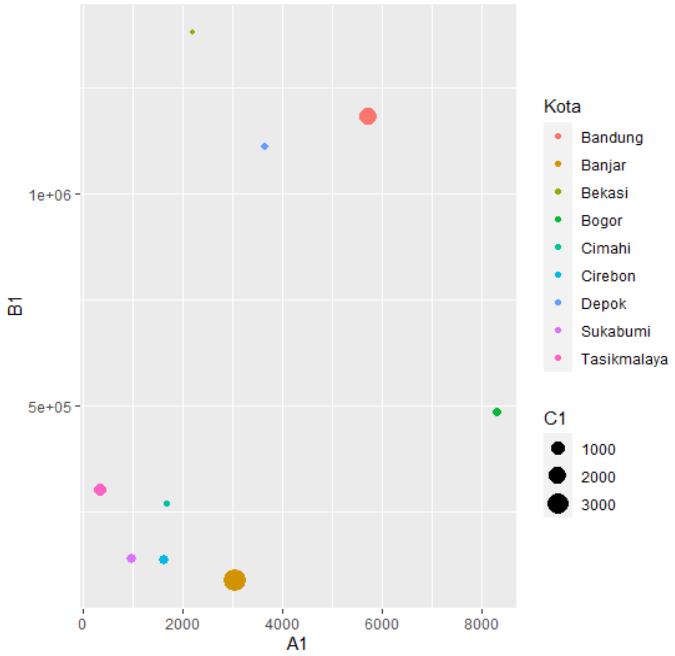

Figure 2. Visualization Of Input Data

Tabel III
Corelation Copenhatic

Method	Correlation
Average	0.817981
Complete	0.800632
Single	0.663824
Ward	0.718371
Centroid	0.619351

Source: Author, 2021

Based on the value of the cophenetic coefficient above, the best method can be obtained from the highest correlation value. From the table above, it can be seen that the best method used is the average method, because it has the highest correlation value of 0.817981.

The results of the cluster using the average method in a hierarchical cluster analysis show groups of cities in West Java based on liveable city indicators.

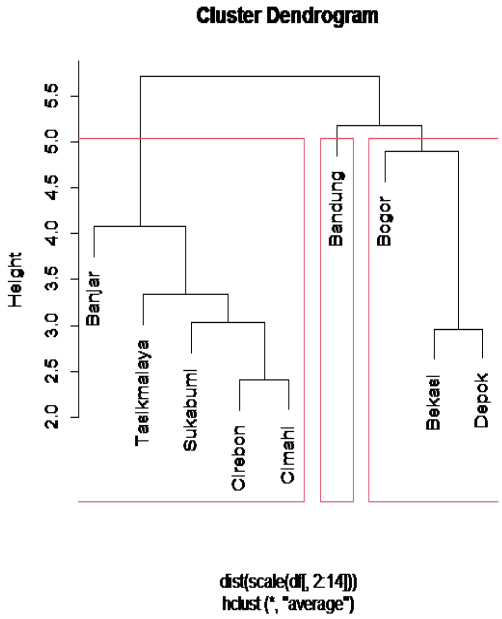

Figure 3. DENDOGRAM

Based on the dendogram above, it can be seen that the average method produces 3 clusters with members:

- Bandung City in Cluster I
- Depok City, Bekasi City and Bogor City in Cluster II
- Banjar City, Tasikmalaya City, Sukabumi City, Cirebon City and Cimahi City in Cluster III

Source: jabarprov.go.id,2021

Figure 4. Clustering Cities In West Java

In determining priorities for the realization of livable cities in cities in West Java identified by cluster results. The city of Bandung which is included in the first cluster which can be prioritized for acceleration the embodiment of a livable city. After that there is Bogor City, Bekasi City and Depok City which included in the second cluster can also prioritized but by maximizing variables that are still not high, such as improvement of internet access facilities and infrastructure rights, employment opportunities, expansion of green open space and recreation areas.

V. CONCLUSION

In this study, in cities in West Java Province, having a vision as a comfortable city, it is necessary to apply the concept of a livable city in realizing the conditions of the city. The results were found based on an analysis to find out which city groups need to be prioritized in the realization of livable cities in West Java Province. This research uses cluster analysis where the average method is chosen in the hierarchical method because it has the highest correlation compared to the other four methods. Cluster analysis shows that there are three groups of cities in West Java based on livable city indicators. It was found that the first group is Bandung City and the second group is Depok City, Bekasi City and Bogor City which will be prioritized for accelerating its realization by improving aspects that are still lacking in development in accordance with liveable city indicators.

ATTACHMENT

```
> glimpse(df)
Rows: 9
Columns: 14
$ Kota <chr> "Bogor", "Sukabumi", "Bandung", "Cirebon", "Bekasi", "Depok", "Ci~
$ A1   <dbl> 8300, 984, 5737, 1624, 2207, 3651, 1691, 358, 3069
$ A2   <dbl> 76.59288, 45.15216, 23.04991, 73.79679, 90.43498, 78.16709, 49.89~
$ A3   <dbl> 19, 6, 26, 9, 26, 18, 5, 7, 3
$ A4   <dbl> 3, 3, 8, 2, 7, 6, 2, 4, 2
$ A5   <dbl> 2384271, 1044906, 2730405, 1354937, 1884160, 1656948, 1355030, 12~
$ A6   <dbl> 52808, 12270, 39350, 27688, 12981, 22925, 27425, 7468, 3414
$ A7   <dbl> 5, 5, 11, 5, 6, 5, 5, 5, 4
$ B1   <dbl> 486867, 140827, 1183193, 138667, 1383287, 1112358, 272553, 301081~
$ B2   <dbl> 4472462, 3838217, 5630382, 3606736, 5770710, 6330690, 4754492, 36~
$ C1   <dbl> 183.99, 267.20, 2032.21, 388.54, 10.46, 64.66, 37.21, 802.30, 366~
$ C2   <dbl> 12, 62, 21, 0, 24, 58, 29, 25, 25
$ D1   <dbl> 8, 2, 11, 2, 8, 7, 6, 11, 1
$ D2   <dbl> 725, 441, 2276, 601, 2934, 1263, 317, 322, 127
```

Attachment 1 Data Frame

```
> summary(df)
     Kota                A1              A2              A3
 Length:9           Min.   : 358   Min.   :15.05   Min.   : 3.00
 Class :character   1st Qu.:1624   1st Qu.:45.15   1st Qu.: 6.00
 Mode  :character   Median :2207   Median :73.80   Median : 9.00
                    Mean   :3069   Mean   :58.68   Mean   :13.22
                    3rd Qu.:3651   3rd Qu.:76.59   3rd Qu.:19.00
                    Max.   :8300   Max.   :90.43   Max.   :26.00
       A4              A5                A6              A7
 Min.   :2.000   Min.   :1044906   Min.   : 3414   Min.   : 4.000
 1st Qu.:2.000   1st Qu.:1354937   1st Qu.:12270   1st Qu.: 5.000
 Median :3.000   Median :1656948   Median :22925   Median : 5.000
 Mean   :4.111   Mean   :1703278   Mean   :22925   Mean   : 5.667
 3rd Qu.:6.000   3rd Qu.:1884160   3rd Qu.:27688   3rd Qu.: 5.000
 Max.   :8.000   Max.   :2730405   Max.   :52808   Max.   :11.000
       B1                B2              C1              C2
 Min.   :  88846   Min.   :3606736   Min.   :  10.46   Min.   : 0.00
 1st Qu.: 140827   1st Qu.:3838217   1st Qu.:  64.66   1st Qu.:21.00
 Median : 301081   Median :4754492   Median : 267.20   Median :25.00
 Mean   : 567520   Mean   :4754492   Mean   : 827.57   Mean   :28.44
 3rd Qu.:1112358   3rd Qu.:5630382   3rd Qu.: 802.30   3rd Qu.:29.00
 Max.   :1383287   Max.   :6330690   Max.   :3661.57   Max.   :62.00
       D1              D2
 Min.   : 1.000   Min.   : 127
 1st Qu.: 2.000   1st Qu.: 322
 Median : 7.000   Median : 601
 Mean   : 6.222   Mean   :1001
 3rd Qu.: 8.000   3rd Qu.:1263
 Max.   :11.000   Max.   :2934
```

Attachment 2 Descriptive Statistic

```
Call:
hclust(d = dist(scale(df[, 2:14])), method = "ave")

Cluster method   : average
Distance         : euclidean
Number of objects: 9
```

Attachment 3 Scaling and Clustering (Average Method)

```
> d1=dist(df[,2:14]) #korelasi chophenetic
> hc = hclust(d1,"ave")
> d2 = cophenetic(hc)
> corave = cor (d1,d2)
> corave
[1] 0.8817981
```

Attachment 4 Chopenetic Correlation (Average Method)

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