The model for determining location of export coffee’s warehouse distribution in West Java

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Abstract. The objective of this article is to design a solution to coffee supply chain improvement by warehouse distribution center determination of exported coffee in West Java. Determining the distribution warehouse center requires three stages: determining clusters, determining warehouse’s location of each cluster, and determining warehouse’ center; sequentially, each of them has 6, 14, and 5 steps. Several methods used in conducting those stages are Clustering Method (or well-known as Agglomerative Clustering for determining clusters), Model Optimization (P-Median Method) for determining warehouse location in each cluster, and Location Theory for determining the export warehouse center. The first stage results in classifying West Java into 4 clusters. Cluster I consists of 3 Districts and 1 City. Cluster II consists of 4 Districts. Cluster III consists of 4 Districts. Cluster IV consists of 3 Districts and 3 Cities. Furthermore, in determining warehouse’s location of each cluster, central of warehouse distribution at cluster I is located in Bogor District, Cluster II is located in West Bandung District, Cluster III is located in Kuningan District, and Cluster IV is located in Tasikmalaya District. At the final stage of determining warehouse center, Cirebon is selected to be the center of coffee export warehouse in West Java. This study could abridge inefficient coffee supply chain in order to increase the selling price of coffee among farmers, which could increase their profit and prosperity.

1. Introduction
West Java is one of potential coffee producers in the development of coffee plants as it has quite extensive plantation area and is able to provide the needs of coffee exporters which increase every year. Defines export as shipping of goods and services out of the country of origin in which the seller of the goods is referred to as the exporter who is based in the country of import whereas buyer is referred to as an importer [1]. Export is a function of international trade whereby goods produced in one country are shipped to another country for future sale or trade and the sale of such goods adds to the producing nation's gross output [2].

Based on a data from Badan Pusat Statistik (BPS), currently, plantation area in West Java reaches 494,900 hectares or 13.28 percent of the total area in West Java Province. According to the Head of West Java Plantation Department, the area of coffee plantations in West Java continued to increase, in 2008 the area reached 26,000 hectares, while in 2015 it increased to 32,558 hectares and the production yield was 17,461 tons spread in 18 districts / cities throughout West Java. West Java coffee export needs from 2012 to September 2015, the export value of processed coffee products reached US $ 7.09 million with a volume of 150 tons. Whereas, the volume of exporting roasted and green bean coffee at the same
time reaches US$ 1.3 million [3]. In addition to exporting roasted and green bean coffee, Indonesia can also export coffee powder or instant coffees. Over the last decade, the international trade in instant coffees has grown at a faster rate than trade in both green beans and roasted coffees, and there has been a trend towards the production of instant coffees within producing countries [4].

Nguyen does coffee research that focuses on analyzing and defining the factors that have influence on the sustainable export coffee supply chain, from that to propose proper solutions for improving this supply chain of coffee for export of Vietnam [5].

Whereas, Hong does coffee research that focuses on identifying factors of export price fluctuation in agricultural products is necessary to equip decision makers and producers with bases and tools in forecasting price fluctuation and then suggesting solutions for risk mitigation [6]. This research integrated quantitative and qualitative methods to analyze and measure effects of some major factors on export price of Vietnamese coffee.

This study focuses on determining the locations for coffee export warehouse in West Java in which the distribution warehouses are classified into some clusters with considering the variables and factors which contribute in the determination. Moreover, the study could make the coffee supply chain in West Java more efficient to increase the selling price of coffee among farmers in the province as well as improve their prosperity. Efficient supply chain plays very important role for development and contemporary issue for agriculture therefore; government action must address the issue of infrastructure development to achieve the objective of food security for all [7].

According to the result from surveys and interviews in several areas in West Java, coffee distribution in the province consists of several parties forming the supply chain, which are farmers, farm community, cooperatives, domestic distributors, collectors, domestic markets, foreign markets, exporters, coffee industries, and consumer. The West Java coffee business process flow chart is relatively shown in Figure 1. However, the current issue is that most of coffee farmer group producers and their organizations are not capable enough of using foreign languages, and it hampers communication and negotiations, and also campaigns for products owned, that effects consumers cannot get information directly from producers because of the long chain in marketing coffee and the lack of producers to communicate their products [8].

According to the Head of Indonesian Coffee Exporters Association, trade chain at the local level is currently too complicated, it makes the selling price of coffee at farmer level less promising [9]. Therefore, it is necessary to improve coffee distribution channels in West Java. West Java needs to have an export gate directly since the direct export to the international level makes the selling price of coffee increase. So far, before going to the destination countries, the export of West Java coffee beans will be through Semarang, Medan and Surabaya.

The concept of ‘upgrading’ has been particularly important as a policy tool adopted by development agencies and governments applying a value chains for development approach [10]. Gereffi described ‘upgrading’ as a process of moving into more profitable or technologically sophisticated economic niches and explains how participation in a chain is often a necessary step that puts firms and economies on potentially dynamic learning curves [11]. This idea draws primarily on the experiences of the high

![Figure 1. Marketing coffee chart.](image-url)
performing Asian economies, whose rapid economic development in the late 20th century was made possible through specific articulations of global chains and the off-shoring of US and European manufacturing. Under this explanation, East Asian firms evolved from simple equipment assembling through to component suppliers to foreign multinationals, and then ultimately developed capacity to design, manufacture and brand their own goods for export [12].

Based on the issue of coffee distribution in West Java, it is necessary to design coffee distribution model in West Java and make coffee distribution centers do direct export from West Java. The stage is determining cluster, determining warehouse distribution location per cluster, and determining export center in West Java. Hence, the aim of this study is to design the solution of improving coffee supply chain by determining the center of coffee export distribution warehouse in West Java in order to improve farmers’ prosperity.

2. Research methods
In finishing the research, several methods were arranged to make the research more directed and the aims of the research achieved. The research method shows the flow of research framework which describes research algorithm from the beginning to the end. In outline, there are three stages in determining the center of export distribution warehouse: clustering/areas classification using Clustering Method (agglomerative clustering), warehouse location determination per each cluster and West Java center with the Optimization Model (P-Median Method), and determination of warehouse center by using Location Theory. The process of the research and its methods of collecting data is shown in table 1.

| Research Process | Theories/ Methods | Data | Data Source | Data Collection | Data Output |
|------------------|-------------------|------|-------------|-----------------|-------------|
| Problem identification and critical business process identification | Integration Definition for Function Modeling (IDEF0) | The flow of coffee supply chain in West Java | Farmers, Farm Community, Cooperatives, Coffee Industry, Huller owner | Interviews and designing coffee supply chain using IDEF0 | IDEF0 related to current coffee distribution channels Level 0-2 |
| Determining clusters | Clustering Methods | The distance of inter-cities in Jawa Barat, coffee production in every region. | Badan Pusat Statistik (BPS) West Java | Making distance matrix of inter-regions which creates clusters and making a table of total production | A map of the clusters of coffee in West Java with coffee total production. |
| Determining the location of distribution warehouse center of every cluster | P-Median Method and Logware software | Location coordinates, data of transportation and fixed costs, total production | The World Coordinate Converter (http://twcc.fr/) | Collecting the data of location coordinates, total production and cost to put in software, and conducting research method calculation using P-Median to select the centers of distribution warehouse with the most optimal budget. | Cities/regencies selected to be the centers of coffee distribution warehouse. |
Table 1. Cont.

| Determining export warehouse center in West Java | P-Median Method, Logware software, and Location Theories | The World Coordinate Converter (http://twcc.fr/) and the data of the result of distribution warehouse center determination calculation, Location Theories (Smith, Weber, Losch, Isard, Richardson, Alfred, Liang & Wang, Chen-Tung Chen, Jesuk Ko.) | Conducting P-Median method calculation such as determining distribution warehouse center, and then analyzing some factors which contribute to the determination of the location to get the main factors. | City/Regency selected to be the center of coffee distribution warehouse in West Java, and an analysis on factors which become the variables and sub variables of location determination |
|---|---|---|---|---|
| | P-Median Method, Logware software, and Location Theories | The World Coordinate Converter (http://twcc.fr/) and the data of the result of distribution warehouse center determination calculation, Location Theories (Smith, Weber, Losch, Isard, Richardson, Alfred, Liang & Wang, Chen-Tung Chen, Jesuk Ko.) | Conducting P-Median method calculation such as determining distribution warehouse center, and then analyzing some factors which contribute to the determination of the location to get the main factors. | City/Regency selected to be the center of coffee distribution warehouse in West Java, and an analysis on factors which become the variables and sub variables of location determination |

2.1. Cluster determination

Clustering Method is used for cluster classification. The method considers the distance of every city and regency in West Java. The data needed is the total production which is collected from BPS and the data of the distance of inter-cities/regencies which will be made into matrix form. The data of total production and the result of the matrix are in table 2 and figure 2.

Table 2. The data of total production.

| No. | Cities/Regencies | Total Production (Ton) |
|-----|------------------|------------------------|
| 1   | Sukabumi Regency | 601                    |
| 2   | Sukabumi City    | -                      |
| 3   | Bogor Regency    | 7202                   |
| 4   | Bogor City       | -                      |
| 5   | Depok City       | -                      |
| 6   | Bekasi City      | 1                      |
| 7   | Bekasi Regency   | -                      |
| 8   | Karawang Regency | 215                    |
| 9   | Cianjur Regency  | 265                    |
| 10  | Purwakarta Regency | 178               |
| 11  | West Bandung Regency | 1038             |
| 12  | Bandung Regency  | 6964                   |
| 13  | Bandung City     | -                      |
| 14  | Cimahi City      | -                      |
| 15  | Subang Regency   | 476                    |
| 16  | Sumedang Regency | 673                    |
| 17  | Indramayu Regency | -                   |
| 18  | Majalengka Regency | 231               |
| 19  | Kuningan Regency | 594                    |
| 20  | Cirebon Regency  | -                      |
| 21  | Cirebon City     | -                      |
| 22  | Garut Regency    | 1280                   |
| 23  | Tasikmalaya Regency | 1364            |
| 24  | Tasikmalaya City | 4                      |
| 25  | Pangandaran Regency | 317              |
| 26  | Ciamis City      | 646                    |
| 27  | Banjar City      | 5                      |
The observed locations are cities/regions producing coffee, which are Bogor Regency, Cianjur Regency, Bandung Regency, Garut Regency, Tasikmalaya Regency, Ciamis Regency, Majalengka Regency, Sukabumi Regency, and Subang Regency, West Bandung Regency. The coordinates of the locations can be found using Google Maps application. These coordinates are the Latitude and Longitude of the locations. Then, the data of coordinates are converted into dd mm ss format (degrees, minutes, seconds). This conversion is done by using the World Coordinate Converter, a website offering coordinate converter, whose address is http://twc.fr/. The result of the conversion is in table 3.

| Kab | X Coordinate | Y Coordinate |
|-----|--------------|--------------|
| Bogor | -62°26'47" | 106°41'25" |
| Cianjur | -69°49'18" | 107°08'22" |
| Bandung | -7°19' | 107°31'31" |
| Garut | -7°12'10" | 107°35'14" |
| Tasikmalaya | -7°21'41" | 108°6'46" |
| Sukabumi | -7°18'58" | 108°11'41" |

## Table 3: Coordinates of cities/regions which have been converted (dd mm ss)

| City/Region | X Coordinate | Y Coordinate |
|-------------|--------------|--------------|
| Bogor Regency | -62°26'47" | 106°41'25" |
| Cianjur Regency | -69°49'18" | 107°08'22" |
| Bandung Regency | -7°19' | 107°31'31" |
| Garut Regency | -7°12'10" | 107°35'14" |
| Tasikmalaya Regency | -7°21'41" | 108°6'46" |
| Sukabumi City | -7°18'58" | 108°11'41" |
Table 3. Cont.

| City/Regency         | Latitude  | Longitude |
|----------------------|-----------|-----------|
| Ciamis Regency       | 7º 19'33" | 108º 20'2" |
| Majalengka Regency   | 6º 50'10" | 108º 12'36" |
| Sumedang Regency     | 6º 52'56" | 107º 50'55" |
| Subang Regency       | 6º 34'18" | 107º 28'56" |
| West Bandung Regency | 6º 59'20" | 106º 32'54" |
| Sukabumi Regency     | 6º 54'43" | 107º 33'32" |
| Kuningan Regency     | 6º 58'34" | 108º 28'51" |
| Purwakarta Regency   | 6º 33'24" | 107º 26'24" |
| Karawang Regency     | 6º 18'6"  | 107º 18'9"  |
| Pangandaran Regency  | 7º 42'8"  | 108º 29'31" |
| Banjar City          | 7º 21'44" | 108º 32'26" |
| Bekasi Regency       | 6º 21'52" | 107º 10'11" |
| Cirebon Regency      | 6º 45'53" | 108º 28'42" |

To locate the coffee distribution warehouse center in each cluster, the result of distance calculation is put into Logware. Logware is set of software programs useful to analyze various logistics problems and case studies. The result of this and plot cluster 1 is in figure 3.

Figure 3. A display of the input and result of “Plot” on Logware.

After this software calculation, a P-Median calculation is done to figure out the total cost of each cluster. The result of total cost calculation of each city/regency is in table 4. The following is the steps in determining the warehouse location using P-Median:

Minimize \[ TC = \sum \sum V_i R_i d_{ij} X_{ij} + \sum F_j Y_j \] (1)

\[ \sum_j X_{ij} = Y_j \text{ (for all } i) \]

\[ X_{ij} \leq X_{ij} \text{ (for candidate } i, \text{ pair } j) \]

\[ \sum_j X_{ij} = p \] (2)

\[ X_{ij} = (0,1) \text{ (for all } i, \text{ pair } j) \]

\[ v_j = \begin{cases} 1, & \text{if open facilities} \\ 0, & \text{if closed facilities} \end{cases} \] (3)
Where:

\[ v_{ij} = \begin{cases} 
1, & \text{if demands or offers assigned for facilities } j \\
0, & \text{then the reverse} 
\end{cases} \]  \hspace{1cm} (4)

\[ v_i = \begin{cases} 
1, & \text{if facility located is found, concluded with } j \\
0, & \text{then the reserve} 
\end{cases} \]  \hspace{1cm} (5)

\[ v_j = \begin{cases} 
1, & \text{if open} \\
0, & \text{if open or candidate site} 
\end{cases} \]  \hspace{1cm} (6)

Note:

TC = Total cost of logistics

\( i \) = Point of demands or offers (sink) then the total number N

\( j \) = candidate facilities (source of numbers then total M)

\( v_i \) = Point I at demands or offers volume

\( R_i \) = freight rates with demands or offers point i

\( d_{ij} \) = Distance between demands or offers on point I and facility j

\( p \) = To find the total facilities

\( F_i \) = Warehouse fixed cost

Using equation (1) to (6), data from table 2 and 3, with transportation cost and the cost of building the warehouse results in table 4.

**Table 4.** Transportation cost recapitulation.

| Warehouse Center | Region             | Cost ($) | Total Cost ($) |
|------------------|--------------------|----------|----------------|
| **Bogor Regency**| Sukabumi Regency  | 62,737,96| 83,084,64      |
|                  | Bekasi Regency     | 122,84   |                |
|                  | Karawang Regency   | 20,223,84|                |
| **West Bandung** | Regency            |          |                |
|                  | Cianjur Regency    | 26,31    | 1,600,823,14   |
|                  | Purwakarta Regency | 26,71    |                |
|                  | Bandung Regency    | 58,02    |                |
| **Kuningan**     | Regency            |          |                |
|                  | Subang Regency     | 44,275,80| 119,438,10     |
|                  | Sumedang Regency   | 59,037,85|                |
|                  | Majalengka Regency | 16,124,45|                |
| **Tasikmalaya**  | Regency            |          |                |
|                  | Garut Regency      | 234,57   | 307,934,40     |
|                  | Tasikmalaya City   | 87,81    |                |
|                  | Pangandaran Regency| 38,199,55|                |
|                  | Ciamis Regency     | 34,561,98|                |
|                  | Banjar City        | 515,90   |                |

2.3. Determination of warehouse center

Determining the location of coffee export warehouse center also requires the same steps: Logware and P-Median calculations. Furthermore, an analysis on factors contributing to the determination of export warehouse is needed, as shown in Table 5. A location theory analysis is conducted on every distribution warehouse center localization of each cluster. Table 6 presents an example of the factors analysis of Cluster 1, in Bogor Regency. Bogor Regency is one of several places in West Java which have certified coffee. At the present time, coffee certification is very important because consumer demand for sustainable coffees is rising by 20-25% a year as opposed to just 2% in the conventional market, and whereas certified coffees were just 1% of market in 2001, they were 8% by 2010 and are predicted to be 20% by 2015 [13]. Consumers paid considerably more for Fair Trade-certified coffee than for the other alternatives available. Although Fair Trade provided price premiums to producer organizations, a larger share of the retail prices remained in the consuming country relative to conventional coffee trade [14].
Table 5. Factors contributing to warehouse determination for each cluster.

| Sources | Factors | Factor Classification |
|---------|---------|-----------------------|
| Study and several location theories (Smith, Weber, Losch, Isard, Richardson, Alfred in [8]) | • Industrial location  
• Transportation cost  
• Salary  
• Aglomeration  
• Total production  
• The lack of fuel | Factors affecting relocation of warehouse as the result of several literature is classified into 5 factors:  
• Distance  
• Transportation  
• Facilities and infrastructure  
• Human resources  
• Raw material |
| Liang & Wang [8] | • Critical Attributes  
• Objective Attributes  
• Subjective Attributes | |
| Chen-Tung Chen [8] | • Investment cost  
• Possibility of extending location  
• Availability of raw materials  
• Human resources  
• Proximity to consumers | |
| Jesuk Ko [8] | • Population conditions  
• Transportation conditions  
• Market conditions  
• Location Conditions  
• Related costs | |

Table 6. Factors analysis based on the selected warehouse.

| Location        | Criteria                  | Information                                                                 |
|-----------------|---------------------------|-----------------------------------------------------------------------------|
| Bogor Regency   | Distance Factor           | The distance between plantation and distributors is near, to make the distribution process efficient in time |
|                 | Transportation Factor     | There are distributors who become direct goods collectors from farmers. The distance between plantation and these collectors are near, and the transportation cost is borne by the farmer, meanwhile distribution process from the collectors to the main distributors needs a longer distance since the main distributors are near the city center. |
|                 | Facilities and Infrastructure Factor | Public transportations are rare, but access to some areas is good enough and not block the distribution process. Government aid in providing machines has not extensively spread, farmers are not active enough in government instances. |
|                 | Human Resources Factor    | The coffee farmers are local villagers. They are educated enough in processing cherry beans to green beans. However, there are some of them who sell their cherry beans to the main distributors without sorting process. |
|                 | Raw Material Factor       | Some active farmers can get cherry beans certification. Access to clean water is easy to get. |

3. Results and discussion

3.1. Cluster determination

The cluster classification use Clustering Method (agglomerative clustering). The method concerns to the distance of inter-cities/regencies in West Java. The following steps are carried out in the clustering method:

**Step 1** Determine the number of clusters desired.
In this study, West Java has 27 regions / locations which will be divided into 4 clusters, thus one cluster consists of 6-8 regions / locations.

**Step 2** Search for objects with a minimum distance

**Step 3** Look for the second closest area / location to-n
(it depends on the number of regions desired in one cluster), to simplify the searching process, use Ms. Excel with minimization formula.

**Step 4** Mark the nearest location in different color

**Step 5** Eliminate selected districts / cities in searching locations for the next cluster, the selected location no longer appears in the matrix for site selection in the next cluster.

**Step 6** Repeat the step 1 to step 5 until there is only one cluster left.
Based on the calculation results, the West Java Region is classified into 4 clusters, as shown in Figure 4. From this cluster determination, it can be seen that every cluster has a potential region producing coffee. This clustering process is aimed to create market segmentation, understand consumer behaviors, identify new product opportunities, select market testing, and reduce data/object [15]. The basic process of cluster determination is considering the distance of every data and conducting standardization process like finding out a big difference in total areas which are active in coffee production [16].

**Figure 4.** Division of the west java map cluster.

### 3.2. Determination of warehouse location for each cluster

#### 3.2.1. Determination of observation location coordinates

Location coordinates can be found by using Google Maps application. The coordinates obtained from Google Maps are in the form of Latitude and Longitude. The data is then converted into degrees minutes seconds coordinate format (dd mm ss). This conversion is done by using The World Coordinate Converter, a website offering coordinates converter, whose address is http://twcc.fr/. In determining the warehouse there are 6 steps done as follows [17]:

**Step 1** Find the Latitude and Longitude Coordinates
- Determining the Latitude and Longitude Coordinates for each destination by using web-based applications: Google (www.google.com) or Google Maps (maps.google.com)

**Step 2** Copy the Latitude and Longitude Coordinates

**Step 3** Convert Latitude and Longitude Coordinates
- The next step is converting latitude and longitude coordinates into degrees minutes and seconds coordinates (dd mm ss form) by using web-based converter application http://twcc.fr/.

**Step 4** Input the latitude and longitude to be converted
- Then, input the latitude and longitude in the available column and select dec. degress.

**Step 5** Coordinate conversion process
- To change the conversion process to coordinates dd mm ss, select Deg.min.sec.

**Step 6** Copy the degrees minutes and seconds coordinates (dd mm ss)
The coordinates are used for testing the software logware

3.2.2. Determination of warehouse location for each cluster. In this study, the Optimization Model (P-Median Method) determines the center of distribution warehouse for each cluster as well as the export warehouse center in West Java. Optimization Model (P-Median Method) can be used as a medium to minimize new provisions in determining warehouse center. The Optimization Model (P-Median Method) can determine locations based on criteria of needs, distance and distribution costs [18]. The output obtained from Optimization Model (P-Median Method) is a result which needs to be agreed and consensus by all agencies involved, without making new problems. The following is the steps to determine the warehouse location of each cluster and export center in West Java using the Optimization Model (P-Median Method).

Step 7: Open the Logware application and select P-Median method
Step 8: Input problem labels data, horizontal scaling factors, vertical scaling factors, number of facilities to locate.
Step 9: Select linear grid coordinator in Coordinate Options
Step 10: Fill the Location Data in the label point column accordant to the name of City / Regency studied
Step 11: Fill in the X and Y coordinate the results of the coordinate convention dd mm ss at the previous coordinate determination step
Step 12: Fill the Volume, Transport Rate, Fixed Cost, and Candidate sites
Step 13: Select the command "Solve" in the Logware display, the coordinates will be obtained from all locations inputted before, then complete with the selected warehouse location center.
Step 14: Press X to return to the previous display, then select the command "Plot" on the Logware display, thus the software coordinates will be obtained, applied it to the map of West Java.

The result of the software calculation of distribution warehouse center for each cluster is in Table 7. The flow of coffee distribution between the warehouse distribution center and the coffee export warehouse center is in Figure 5. Warehouse location selection is done based on the calculation of location distance that has been determined. Then, it is selected or calculated using the P-Median method to be chosen as the best warehouse location so that transportation costs and warehouse fixed costs are optimal.

| No. | Cluster | Cities/Regencies | Distribution Warehouse Center |
|-----|---------|------------------|-------------------------------|
| 1.  | Cluster I | Sukabumi Regency  
Bogor Regency  
Bekasi City  
Karawang Regency | Bogor Regency |
| 2.  | Cluster II | Cianjur Regency  
Purwakarta Regency  
West Bandung Regency  
Bandung Regency | West Bandung Regency |
| 3.  | Cluster III | Subang Regency  
Sumber Regency  
Majalengka Regency  
Kuningan Regency | Kuningan Regency |
| 4.  | Cluster IV | Garut Regency  
Tasikmalaya Regency  
Tasikmalaya City  
Pangandaran Regency  
Ciamis City  
Banjar City | Tasikmalaya Regency |
3.3. Determination of warehouse center

Determination of the warehouse center is useful to abridge the distribution flow assumed as inefficient. Thus, it can reduce transportation cost and increase farmers' income in impact. Export warehouse centers are determined based on the land area owned, the yields obtained every harvest season, and locations that are accessible by public transportation. The steps of determining warehouse center by using Location Theory are:

- **Step 1** Collect variables in Location Theory from various sources
- **Step 2** Determine the main variables which are the most dominant
- **Step 3** Determine the sub variable of the main variable
- **Step 4** Identify each variable in each city/regency selected
- **Step 5** Determine the location which complies the criteria of all variables

The selection of export warehouses is carried out in areas near the coast so that a port can be built and adjusted to the variables in Location Theory for industrial location selection. As for the options for the construction of the export warehouse locations in West Java are Bekasi, Karawang, Subang, Indramayu, Cirebon Regency, and Cirebon City. From the six candidates, Cirebon Regency was chosen as the export gateway in West Java. These results are selected using the Logware application which has considered the cost, volume and transportation costs.

Based on the results of literature review, there are several factors contributing to the determination of warehouse location in each cluster, as in Table 5. The factors resulted from the literature review are used as research variables. Formulation of variables and sub-variables research is in Table 8.

### Table 8. Variables based on factor classification.

| No. | Variables | Sub Variables                        |
|-----|-----------|--------------------------------------|
| 1   | Distance  | Distance to market                   |
|     |           | Distance to residence                |
|     |           | Distance to raw material sources     |
| 2   | Transportation | Road access                |
|     |           | Public transportation                |
|     |           | Transportation cost                  |


Table 8. Cont.

|   | Facilities and infrastructure | Electrical network | Water access | Phone network |
|---|-------------------------------|--------------------|-------------|--------------|
| 3 |                                |                     |             |              |
| 4 | Human resources               | Availability of human resources |
| 5 | Raw material                  | Quantity of Cherry beans | Continuity of Cherry beans |

Setting a location for an industry (large scale) comprehensively needs a combination of various knowledge and disciplines. Factors considered in determining the location are the availability of raw material, labor wages, security assurance, supporting facilities, local market absorption, the accessibility from production house to the destination market (especially market accessibility to overseas), political stability of a country and regional policy (regional regulation).

4. Conclusion

Based on the result of this study, it can be concluded that the problems of coffee commodities in West Java are the flow of coffee supply chain which is yet very complex and only run by a single party (not running in one door), and West Java coffee exports are still carried out outside West Java and need cooperation with related parties in dealing with the velocity of money at the level.

In improving the problem of coffee commodities’ distribution channel in West Java, a distribution path analysis should be conducted, and after that, cluster determination which is classified into 4 can be conducted. Each cluster has its representation as a distribution warehouse center, and from the entire region in West Java, one location is selected as an export gate. Determination of the location is carried out by the Optimization Model (P-Median Method) who’s the result has considered volume and transportation cost. Afterwards, besides software testing, the Location Theory of each closed region is used.

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