The Influence Of Highway Transportation Infrastructure Condition Toward Commodity Production Generation for The Resilience Needs at Regional Internal Zone

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Abstract. The poultry commodity consumption and requirement is one of the main commodities that must be fulfilled in a region to maintain the availability of meat from poultry. Poultry commodity production is one of the production sectors that have a clean environment resistance. An increasing of poultry commodity generation production requires a smooth distribution to arrive at the processing. The livestock location as a commodity production is placed at a considerable far distance from residential and market locations. Zones that have poultry commodity production have an excess potential to supply other zones that are lacking in production to the consumption of these commodities. The condition of highway transportation infrastructure that is very diverse with the damage level availability in a zone has an influence in the supply and demand of poultry commodity requirement in the regional internal of Central Java province. In order to know the effect of highway transportation infrastructure condition toward the poultry commodity movement, demography factor and availability of freight vehicles will be reviewed to estimate the amount of poultry commodity movement generation production. Thus the poultry commodity consumption requirement that located in the internal - regional zone of central java province can be adequated from the zone. So it can be minimized the negative impacts that affect the environment at the zone in terms of comparison of the movement attraction and generation production at poultry commodity in Central Java.

1. Introduction

Increased demand for poultry commodities is increasing in line with the increasing demand for food consumption of the population in a developing region. Poultry commodities have an important role in food security in a region to increase protein nutritional needs and human resource quality development in the region. Production of poultry commodities in a region is increasing with the economic level per capita region and increasing demographic conditions. Increased poultry commodity production will directly increase the growth of traffic movement in distributing poultry commodities. Production generating of the poultry commodities movement requires the smooth distribution that is affected by the condition of the road infrastructure in each zone as well as the regional internal zone as a whole for a stability of the consumption tenacity needs of sustainable poultry commodity [1-3].

This research has intend to know the influence of road transportation infrastructure condition to the production generating of poultry commodity movement for the resilience of regional internal zone in Central Java Province with special purpose:

1. Identify and estimate the generating and attraction movement model of the poultry goods commodity sector based on the zones in the internal Regional Central Java Province
2. Analyze the generating and attraction movement model of the poultry commodity sector in the Regional Internal Central Java Province
3. Analyze the distribution model and the effective distribution distance in the movement for inter-zone production resilience in the internal region [1,3,4,5].

2. Literature Review

2.1 Model of Generation –Attraction Movement

One approach to transport planning in the four-stage transportation planning model is traffic generation (Trip Generation). This traffic generation depends on land use aspect, transportation and traffic flow can also be used approach quantitatively. The Trip Generation model generally estimates the number of trips for each travel destination based on the characteristics of land use and the socio-economic characteristics of each zone. The goal of Trip Generation planning is to estimate as accurate as possible the current traffic generation, which

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will be used for future predictions. Trip Generation modeling is used to predict the number of traffic generated for a given zone characteristic condition. The rise of movement is the number of moves generated by a zone of origin (Oi) and the number of moves that are interested in each destination zone (Dd) contained in the study area. The generating and attraction movement are strongly influenced by two aspects:[5,6]

2.1.1 Type of land use.

The amount of the land use activity (and intensity) .
The land use type has the characteristics of different movement generations, namely:

a. Different types of land use result in different movements
b. Different types of land use result in different types of movement
c. Different types of land use produce movement at different times.
d. Factors that influence the modeling of movement generations for people and goods are as follows::

2.1.2 Trip Production for human and goods travel determined :

a. Population income in a region and GDP of the area
b. Number of vehicle ownership as one of transportation services
c. Structure and size of households within a population of communities in residential areas that determine density
d. The value of land within the area determining the residential or commercial location
e. The accessibility of movement will encourage the rate of rise of movement

2.1.3 Trip Attraction for human movement and goods travel determined:

a. Industrial centers, commercial, shops and public services will bring workers and service users to a system of activities in a region
b. Number of employment, number of marketing places, wide of each industry.

The modeling used in movement generation is divided into two parts: Analytical model (Regression); Categories Model. In this study modeling the production and attraction movements using multiple regression analysis models [5,6].

2.2 Spatial Interaction Model of Goods Transportation

Black model (1972) is one of the gravity models that gives the formulation of the goods transportation total volume according to the transported commodity type from one place to another, as follows (Equation 1)

$$T_{idk} = \frac{S_{ik} . D_{dk} f_{id}}{\sum D_{dk} . f_{id}} \quad \text{.... (1)}$$

where :
T_{idk} = the number of k commodities that produced in the i region and sent to the d region d
S_{ik} = the total number of shipments of k commodities from i region
D_{dk} = the total number of demand of k commodity in d region
f_{id} = Friction/ barriers Factor (= 1 / $d_{id}\lambda$)
λ = parameter

2.3. Model Gravity (GR)

The most famous and often used method of synthetic (spatial interaction) is the Gravity Model (GR) because it is so simple that it is easy to understand and use. This model uses the concept of gravity introduced by Newton in 1686 developed from the analogy of the law of gravity.[6]

$$F_{id} = G . \frac{m_i . m_d}{d_{id}^2} \quad \text{…(2)}$$

where G is the gravity constant
In geography, force can be considered as a movement between two regions; While mass can be replaced with variables such as population or movement generating and attraction, as well as distance, time, or cost as a measure of accessibility. Thus, for transportation purposes, the GR model is expressed as: (Equation 3)

$$T_{id} = k . \frac{O_i . O_d}{d_{id}^2} \quad \text{...(3)}$$

where k is a constant

Thus, in mathematical form, the model GR can be expressed as:

$$T_{id} = O_i . D_d . A_i . B_d . f(C_{id}) \quad \text{...(4)}$$

Both Barrier equations are satisfied if the constants A_i and B_d are used, which are associated with each zone of generating and attraction. The constants are called balancing factors ;[6]

$$A_i = \frac{1}{\sum_d (B_d D_d f_{id})} \quad \text{…(5)}$$

$$B_d = \frac{1}{\sum_i (A_i O_i f_{id})} \quad \text{....(6)}$$

2.4. The Model of Attraction Limitations (ACGR)

The ACGR method defines that the movement attraction is required. By using the basic formula Gravity model used the restriction provisions that by the formula :[6]

$$B_i = \frac{1}{\sum_{i=1}^{N} (A_d . O_i . f_{id})} \quad \text{For all d and Ai = 1 for all } i$$

2.5. Model Testing

2.5.1. Correlation Test

The correlation coefficient is a measure of how close the relationship between variables in the model. Correlation Test:[6,7]

$$r = \frac{N\sum_{i=1}^{N}(X_i Y_i) - \sum_{i=1}^{N}(X_i).\sum_{i=1}^{N}(Y_i)}{\sqrt{\left[\sum_{i=1}^{N}(X_i)^2 - \left(\sum_{i=1}^{N}(X_i)\right)^2\right].\left[N\sum_{i=1}^{N}(Y_i)^2 - \left(\sum_{i=1}^{N}(Y_i)\right)^2\right]}} \quad \ldots(7)$$

2.5.2. Determination Test

$$R^2 = 1 - \frac{\sum_{i=1}^{N}\sum_{d=1}^{N}(\hat{T}_{id} - T_{id})^2}{\sum_{i=1}^{N}\sum_{d=1}^{N}(\hat{T}_{id} - T_1)^2} \quad \ldots(8)$$

$$i \neq d$$

2.6. Gravity Model Calibration

Gravity Model Calibration of Linear regression method with negative exponential barrier function. Calibration method by linear regression analysis to find the model parameters is done through the steps in the following equation :[3,6]

$$\exp(-\beta C_{id}) = \frac{T_{id}}{A_i . B_d . O_i . D_d}$$

$$log_e\left(\exp(-\beta C_{id})\right) = \log_e\left[\frac{T_{id}}{A_i . B_d . O_i . D_d}\right] \quad \ldots(9)$$

$$-\beta C_{id} = \log_e T_{id} - \log e\,(A_i . B_d . O_i . D_d)$$

$$\log_e T_{id} = \log_e (A_i . B_d . O_i . D_d) - \beta C_{id}$$

By linier transformation where : $\log^e$ Tid = Yi dan Cid = Xi

$$-\beta = B = \frac{N\sum_{i=1}^{N}(X_i . Y_i) - \sum_{i=1}^{N}(X_i).\sum_{i=1}^{N}(Y_i)}{N\sum_{i=1}^{N}(X_i^2) - \left(\sum_{i=1}^{N}(X_i)\right)^2} \quad (10)$$

$$A = \overline{Y} - B\overline{X}$$

3. Methodology

In this research, the modeling study of movement distribution use secondary data so for simplify it is used the development of zones or cities within the Central Java province with its development. Approach to the research of the movement distribution model of a very wide area that is much influenced by factors of land use in each zone requires a lot of data and information that is very complex for the accuracy Determination of Variable Model of Generation and Attraction [1-7]

3.1 Variable Dependent

Variables that affecting in movement generation (Oi) are:

Dependent variables
Y1 = Oi = Generated Movement of poultry Trip Transportation in the zone area.

Independent variables
X1 = Variable of population,
X2 = Variable of GRDP (Gross Regional Domestic Product),
X3= independent variable of IO Commodities poultry - zone area,
X4 = independent variable length of national roads in the district or city in Central Java,
X5 = independent variable length of provincial roads in the county and the city in Central Java,
X6 = independent variable length of local roads in the District and City in Central Java,
X7 = independent variable road conditions in both the District and the City in Central Java,
X8 = independent variable road conditions were in the District and City in Central Java,
X9 = independent variable condition of roads damaged in the District and City in Central Java,
X10 = independent variable road conditions, severely damaged in the District and City in Central Java,
X11 = independent variable number of goods vehicles in the county and the City of Central Java ,
X12 = independent variable number of goods vehicles with individual ownership status,
X13 = independent variable number of goods vehicles to the ownership status of the company[1-7]

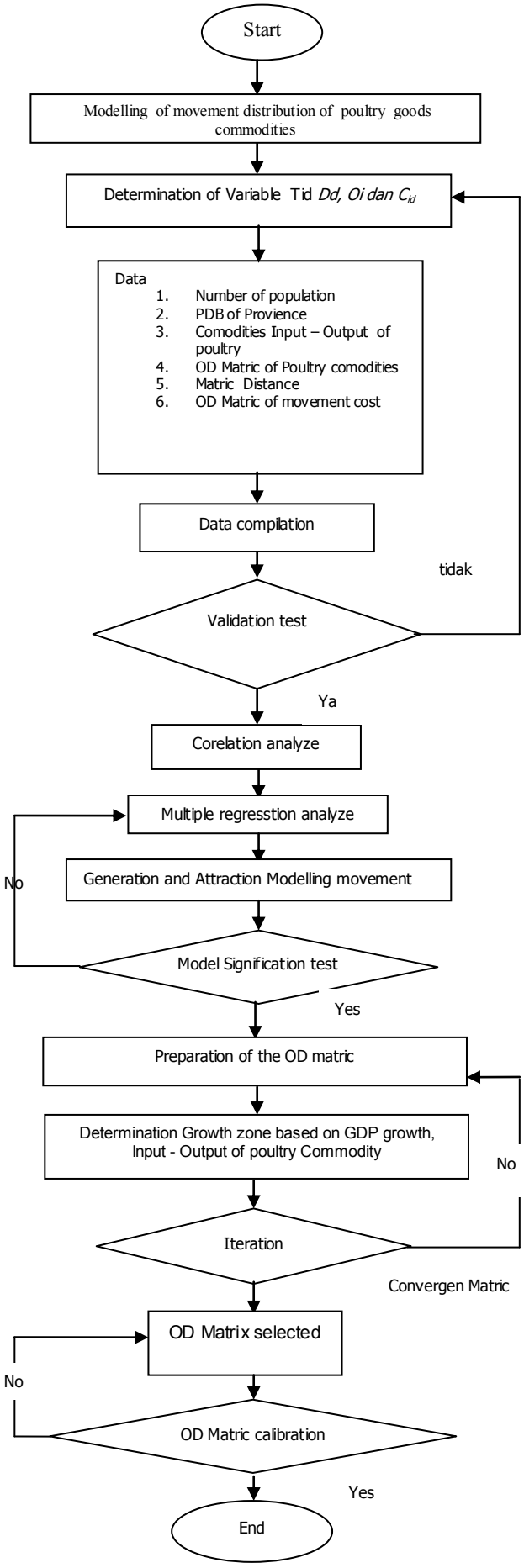

Fig 2. Modeling Flow Chart

4. Result and Discussion

4.1 Modelling of Generation and Attraction Movement of Poultry Goods Commodities

The socio-economic variables, the infrastructure condition (infrastructure) and the condition of facilities (moda) used in this study are: Projection based on trends (trend), that is based on the historical trend of development of independent variable parameters defined. Projection based on the pattern to be targeted, that is based on the direction of development to be achieved, generally this prediction is associated with spatial planning and economic development strategy in RTRW and MP3EI design. Future travel distributions in the form of MAT are obtained by including estimation of the received variables into the model. The future generating /attraction of travel can be predicted using multiple linear regression methods based on several variables of the coastal territorial condition. The study area is divided into zones, in accordance with the assumption in transport modeling that the movement starts and ends from / to a point in the zone commonly referred to as the zone centroid. While the determination of the zone system (including its limits) is based on the administrative boundary system (county and city). The zone is defined from the number of districts and cities in Central Java. [3,5,6,7]

Table 1. Results of Double Regression Analysis Phase II

Yi = 2,98 + 0,864 X1 + 0,111 X2 + 0,0637 X3 + 0,0343 X4 + 0,0063 X5 - 0,038 X6 + 0,0090 X7 - 0,0568 X8 + 0,0195 X9 - 0,0145 X10 - 0,0924 X13

Predictor	Coef	SE Coef	T	P	VIF
Constant	2,977	2,010	1,48	0,152	
X1	0,8642	0,1413	6,12	0,000	6,4
X2	0,11121	0,08889	1,25	0,223	1,7
X3	0,06368	0,04862	1,31	0,203	2,1
X4	0,03430	0,03196	1,07	0,294	1,7
X5	0,00629	0,05292	0,12	0,906	3,2
X6	-0,0379	0,1197	-0,32	0,755	5,4
X7	0,00901	0,07012	0,13	0,899	1,9
X8	-0,05677	0,08185	-0,69	0,495	3,3
X9	0,01948	0,08339	0,23	0,817	4,9
X10	-0,01453	0,02687	-0,54	0,594	1,5
X13	-0,09243	0,06446	-1,43	0,165	1,8

S = 0,197069 R-Sq = 90,8% R-Sq(adj) = 86,4%

Analysis of Variance

Source	DF	SS	MS	F	P
Regression	11	8,79493	0,79954	20,59	0,000
Residual Error	23	0,89323	0,03884		
Total	34	9,68815			

Source : Data Analysis, 2016

4.1.1. Normality test

Normality test used in this research is One Sample Kolmogorov-Smirnov Test with complete observation through scatterplot chart. In the One Sample

Kolmogorov-Smirnov test, it is known that the normal distribution of data if the residual has Asymp. Sig (2-tailed) above 15% and vice versa if residual has Asymp. Sig (2-tailed) below 15% then the data distribution in regression analysis is not normal. The normality test is shown in Fig. 3.[7]

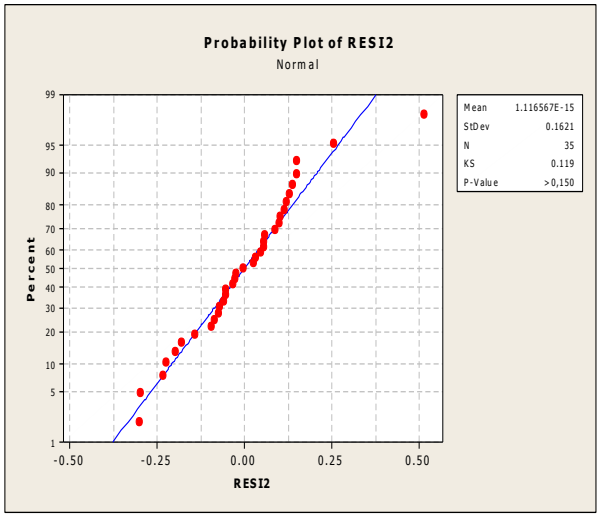

Fig. 3. Graph of Normality Test of Poultry Commodities

4.1.2. Anova Test (Analisis Of Variance)

Anova test shown in Table 1 yielded multiple regression model of commodity movement based on F test value resulting F value counted 20.59 bigger than F table (F value table with df1 = 11 and df2 = 23 ie 2,24) with significance level 0,000. The probability of significance is much smaller than 0.05, then the regression model can be used to predict Y as the Awakening (Oi). Assessment of model parameters from the regression results using the least square estimation method shown in Table output. 1. the result of analysis of computation program Minitab 16 is formulated in the formation of equation with Logarithm Natural (Ln) shown in equation. [4]

Ln Yi = 2,98 + 0,864 Ln X1 + 0,111 Ln X2 + 0,0637 Ln X3 + 0,0343 Ln X4 + 0,0063 Ln X5 - 0,038 Ln X6 + 0,0090 Ln X7 - 0,0568 Ln X8 + 0,0195 Ln X9 - 0,0145 Ln X10 - 0,0924 Ln X13 … (11)

4.2 Estimated results of the Attraction Modelling of Poultry Commodity Movement on Zones in Central Java

Furthermore, based on the result of modelling that use movement attraction data. Estimated results from attraction modelling of poultry commodity movement is estimated based on data condition from each zone in Central Java. By using Matlab computation method, the simulation model of movement generation in each zone according to the magnitude of movement is shown in Figure 4.

The rise of poultry production movement in each zone in Central Java has characteristic dominated by condition of middle passage path and connecting lane from region internal of Central Java province region.[4,-,7]

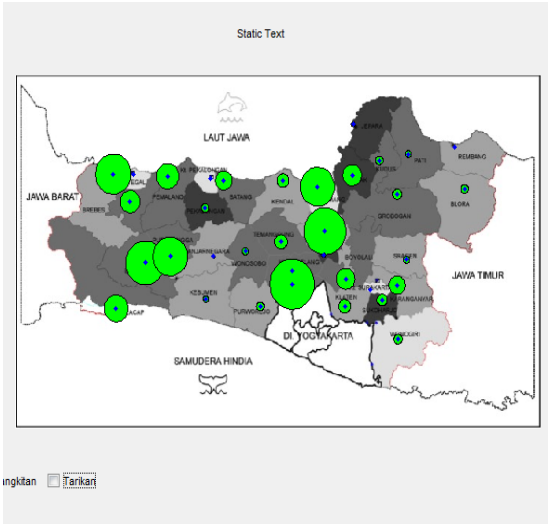

Fig. 4. Estimation of the Poultry Commodities Movement and Its Results by Zone In Central Java

4.3 Estimated results of Poultry Movement Modelling Model in Zones in Central Java

Furthermore, based on the model results using tensile motion data, the result estimation of the poultry commodities movement modelling simulated in each zone in Central Java by using Matlab computation method shown in Figure 5.

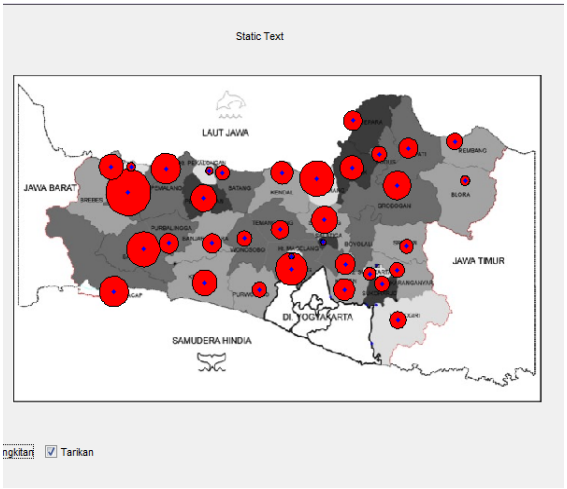

Fig. 4. Estimated Attraction Movement of Poultry Commodities and Results by zone In Central Java

The Estimation Result of the Movement modeling in each zone in Central Java shows that most of the pull of poultry commodity movement has almost uniform characteristics with higher quantity in cities with demographic condition and higher GRDP level. Especially in big cities in Central Java have the pull of movement of poultry commodity is greater. This shows that the consumption of poultry commodities and

derivatives is quite large within the regional internal of Central Java Province. [4-7]

4.4 Comparison of Movement Generaton Modelling Estimated results of Poultry Commodities Movement at Zones in Central Java

By knowing the magnitude of the generation and attraction of poultry commodities movement in each zone in the region of Central Java Province, Supply and demand conditions of poultry commodities can be obtained by knowing the comparison between the movement generation and the movement attraction of poultry commodities from each zone in the province of Central Java. Results Simulation comparison of the production of generating and attraction movement by using matlab computation method shown in the figure. 5

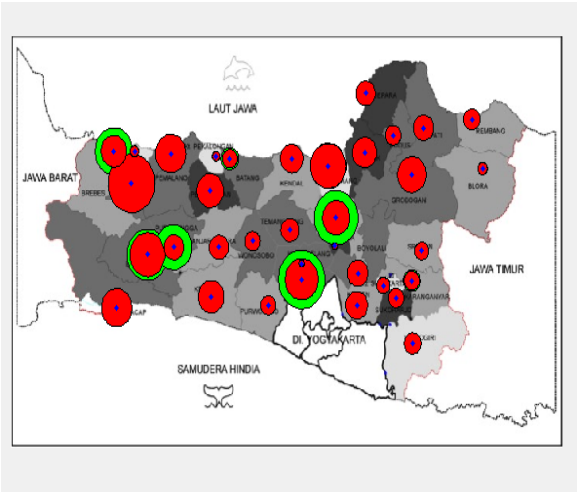

Fig. 5. Comparison of Generation and Atraction Movement Estimation of Poultry Commodities and Results by zone In Central Java

Based on the estimation of simulation results, the comparison of poultry commodity movements generation and attraction in each zone in Central Java shows that the pull of movement of poultry commodities is greater than the production of movement generation. In zones with higher production volumes indicate contribution to the surrounding zones. So the resistance of a zone to the consumption of poultry commodities can be obtained from the surrounding zone based on production capacity in a more surplus zone.[4-7]

4.5 Model Distribution Movement of Poultry Commodities with Limit of Attraction Movement on Zone in Central Java

By using the exponential negative resistance function ACGR stages are as follows: The calculation process on distribution model estimation is done by the iteration process shown in equation 6

$$B_1 = \frac{1}{\left[A_1.O_1.\exp(-\beta C_{1.1}) + A_2.O_2.\exp(-\beta C_{2.1}) + \ldots + A_{35}.O_{35}.\exp(-\beta C_{35.1})\right]}$$

$$B_2 = \frac{1}{\left[A_1.O_1.\exp(-\beta C_{1.2}) + A_2.O_2.\exp(-\beta C_{2.2}) + \ldots + A_{35}.O_{35}.\exp(-\beta C_{35.2})\right]}$$

$$B_3 = \frac{1}{\left[A_1.O_1.\exp(-\beta C_{1.3}) + A_2.O_2.\exp(-\beta C_{2.3}) + \ldots + A_{35}.O_{35}.\exp(-\beta C_{35.3})\right]}$$

$$\ldots$$

$$B_{35} = \frac{1}{\left[A_1.O_1.\exp(-\beta C_{1.35}) + A_2.O_2.\exp(-\beta C_{2.35}) + \ldots + A_{35}.O_{35}.\exp(-\beta C_{35.35})\right]} \quad . \quad (12)$$

The value of Bd subsequently used obtained is used to calculate the value of each matrix cell using the basic formula of the gravity model in equation 7

$$T_{1.1} = O_1.A_1.B_1.D_1.\exp(-\beta(C_{1.1})$$
$$T_{1.2} = O_1.A_1.B_2.D_2.\exp(-\beta(C_{1.2})$$
$$T_{1.3} = O_1.A_1.B_3.D_3.\exp(-\beta(C_{1.3})$$
$$\ldots \quad ..(13)$$
$$T_{2.1} = O_2.A_2.B_1.D_1.\exp(-\beta(C_{2.1})$$
$$\ldots$$
$$T_{35.35} = O_{35}.A_{35}.B_{35}.D_{35}.\exp(-\beta(C_{35.35})$$

By using the basic equation of the gravity model, the matrix iteration calculation is done by computing programming with MATLAB 2012 so as to get the value of β in the convergent matrix condition.[6,7]

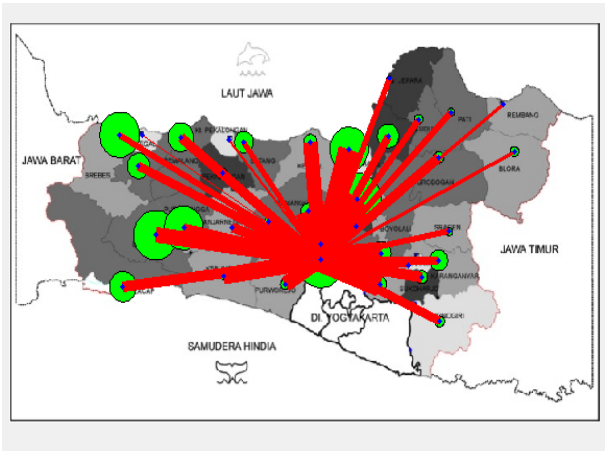

Fig. 6. Simulation Sample of Distribution from production zone to zones in Central Java Province.

Figure 6 shows that the production of a surplus poultry commodity will supply the less-productive zone of poultry production.

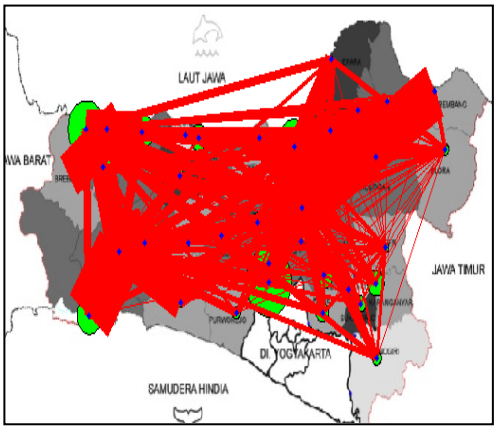

Fig. 7. Simulation of Distribution between production zones to zones throughout the Central Java Province.

Figure 7 shows that the magnitude of the *dissire line* from and to the production zone has large magnitudes, indicating that the volume of distribution movements between production zones of poultry commodity movements generation and attraction has an effect on the distance of movement between zones. The interaction of cultivation. The resilience of poultry commodities is determined from the level of production and consumption at zones in accordance with the growing needs and market potential of poultry commodities within the internal - regional of Central Java province.[5-7]

4.6 Distribution Distances of Poultry Commodities Movement with the Atraction Movement Limit at Zone in Central Java

Based on the modeling results of the distribution of poultry commodity movements in each zone in Central Java province shows that the generation and attraction movement of poultry commodities has a very large distance distribution volume at the distance between zones 100-200 km shown in Figure 8

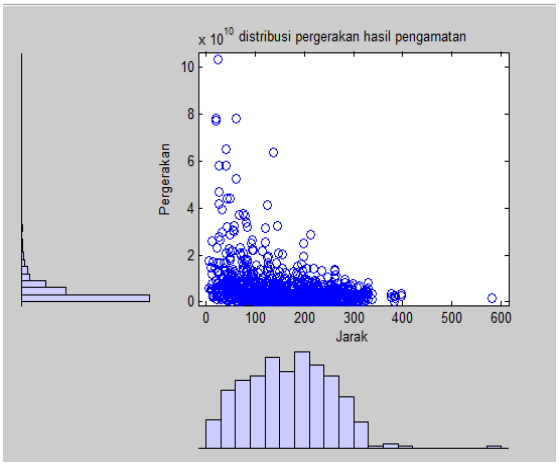

Fig .8.. Distribution Distance of movement generation and attraction between poultry commodities zone.

It shows that the interaction between zones with the distance has a very strong relationship on the system of inter-zone dependence on supply and demand needs required. The resilience of poultry production needs has a great contribution to the price stability of poultry consumption in a region independently. Resilience based on the stability of goods movement distribution requires the support of good road infrastructure condition and smoothly to maintain a smooth flow of distribution. So that will reduce the impact of environmental decline due to the movement of shipping poultry production delivery traffic in the distribution path channel that resulted in environmental pollution due to odor generated due to delivery of poultry from the production zone to the consumption zone. [5-7]

5 Conclusion

Based on data analysis and modeling from the generation and attraction of poultry commodity production in the Central Java province region can be concluded that the condition of road infrastructure has a significant influence on the amount of generation and attraction movement production of poultry commodities. A smooth cross-zone distribution system with the support of road infrastructure and adequate transportation conditions will strengthen the resilience of the production and consumption needs of stable and independent poultry commodities within a regional internal area. Effective and efficient distribution distances will reduce the impact of odor pollution generated in the movement of poultry commodities between zones. So that further requires the better arrangement of supply chain system from poultry commodity movement system in distribution system.

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