

Land use attraction model for Logistic Service Provider (LSP) on Trunojoyo road in the City of Malang

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Abstract. Land use was closely linked to the traffic, one of which is the use of logistic service provider (LSP). The existing LSP in Malang City has an average operating around ten hour. The number of freight transport was not often offset by supporting facilities such as parking for loading and unloading. The main purpose of the research was to create land use attraction model of LSP on Trunojoyo road. The research used multiple linear regression. The results showed that attraction model of LSP was $Y_{LSP} = 17.081 + 0.689X_1 + 0.532X_3 + 0.011X_6$ and it gives the highest influence to the road's level of service of 3.6 per cent.

Keyword: *Logistic service provider, land use, attraction model*

1. Introduction

Transportation defined as an act or activity of transporting or transporting the goods or persons. Transportation is a means of liaison between production areas with markets or can also be said to bridge producers with consumers. Efficient urban transport system is one of the prerequisites of sustainable economic growth [1]. Quality of logistics service needed in economic growth. Logistic definition by Council of Logistic Management (2000) is a part of supply chain management in planning, implementing and controlling the flow and storing of goods, information and services effectively and efficiently from point of origin to destination point according to consumer demand. The quality of good logistics services has a major impact on the economy of a region and a country [2]. One of the logistic services influenced by online business or e-commerce uncontrolled in Indonesia. It reached 40 per cent or 25 per cent of the total growth of the national logistics industry which is estimated to reach 15.2 per cent in 2019. Indonesia is number one as countries with e-commerce markets compared to six other Southeast Asian countries since 2014 [3]. The head of Association of Indonesian Express Delivery Service Company (ASPERINDO) in 2016 to 2020 explained that industrial shipping services increase 14 per cent to 15 per cent.

The increase in online businesses will enhance the competitiveness of transport services (logistics) itself. Land use has relationship with traffic because every space activities will generate movement attraction and movement intensity depending on land use function such as economic activity [4]. Malang City is the second largest city in East Java Province that serves as National Activity Centre (East Java Provincial Spatial Plan 2011-2031) and it also referred to as the City of Education and Tourism. The development of Malang City has an effect on the increase of economic activity, land use change and population growth, where thousands of students are increasing every year. The increasing



number of students had an impact on transportation in Malang city because most of the students were carrying private vehicles. This cause a lot of congestion. Population growth in Malang city is 5.11 per cent in 2015 to 2016.

The head office of LSP in Malang city has an average operating time starting at 08:00 am to 18:00 pm. Activities in the office have an impact on traffic because the activity of delivery of goods made by consumers who send or collect items by motorcycle or car.

2. Literature Review

2.1 Land Use

Land use is the function of land. Land use varies from area to area. Land use (countryside) can include forestry and farming in rural areas. Land use (towns and cities) could be housing or industry in urban areas [5]. Land use in urban and rural areas has different characteristics. According to the Law Number 26 of 2007 and the Minister of Public Works Regulation Number 41 of 2007 rural areas is the region that has a major agricultural activities including the management of natural resources with the composition as a function of the rural area, government services, social services and economic activities.

2.2 Logistic Service Provider

The Development of National Logistics System [6] states that logistics is a part of the supply chain that handles the flow of goods, information flows, and money flows through procurement, warehousing, transportation, distribution, and delivery services or courier services. Logistic service provider according to [7] is a company or institution that provides transportation for freight forwarding services from the origin of goods to the destination and storage service goods or warehousing on a paid basis. Based on logistics activities, logistic infrastructures consist of logistics nodes and logistics links to move goods from the origin to the destination point [6]. Based on [8] related to the Implementation of Law Number 38 of 2009 concerning about post stipulates. Post is a written communication and or electronic mail service, package service, logistics service, financial transaction service, and postal agency service for public interest. Postal and courier service companies in freight forwarding can be use air transport, trucks and trains to the transport packages.

2.3 Interaction Model of Land Use and Road Network

According to [9] there is an interaction between the generation/attraction movement model and the model of road network capacity. So, to identify the both interaction need to pay attention to the influence of attraction movement model in a region with land use variables. The influence between the road network capacity model in an area with land use variables and the influence between the model of the attraction movement with the model of road network capacity shown as follows:

$$V_{\text{total}} = \Sigma V_{\text{internal}} + \Sigma V_{\text{external}} \quad (1)$$

Notes:

V_{total} = total vehicle / hour volume in a corridor
 $\Sigma V_{\text{internal}}$ = total volume of vehicle / hour movement from the attraction of land use
 $\Sigma V_{\text{eksternal}}$ = total volume of external / hour vehicle movement from neighbourhood roads or alleys plus the volume of continuous vehicle / hour movement on a corridor

2.4 Road

According to [10], a road is a land transport infrastructure covering the entire section of road, including complementary buildings, and equipment intended for traffic, which is the surface of the ground, above ground, below ground or water surface, as well as on the water surface, except for rail railroad and cable roads. The road section includes the road benefits of space, the right of way, and the road surveillance of space. Based on [11], road was grouped into several classes based on the function

and intensity of traffic for the purposes of regulating the use of roads and the smoothness of road traffic and carrying capacity to receive the heaviest axis load and dimensions of motor vehicles.

3. Methods

The research divided into 4 steps. Firstly, collecting data such as infrastructure, sales proceeds, human resources, product capacity. All of the data will be used to identify the characteristic of LSP in Malang city. Secondly, collecting some data related to LSP attraction such as building area, parking area, total visitors, total goods, employee, operational time, operational vehicles, and type of services. Thirdly, analyse using partial correlation and finally create LSP attraction model using multiple linear model (Figure 1).

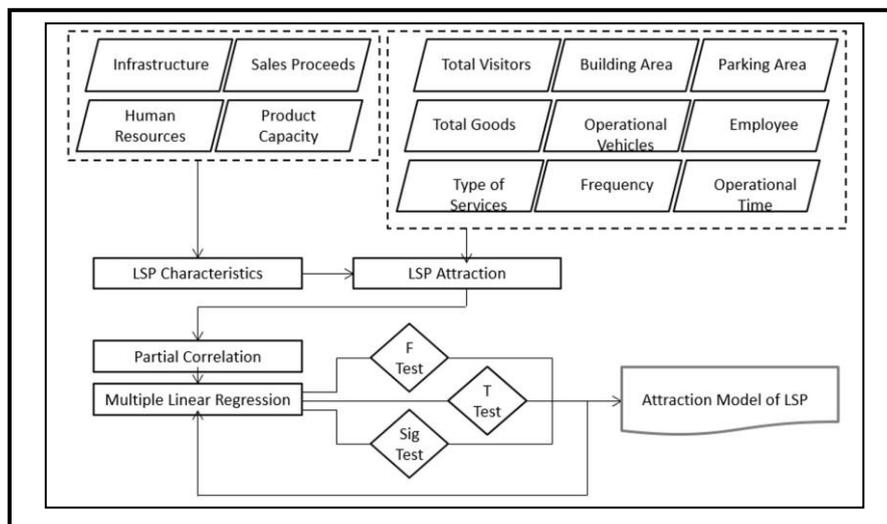


Figure 1. Research framework.

3.1 Data Collection

Primary data collection conducted by looking at the condition of the field directly. The data to be search for in this case is as follows:

3.1.1. Land Use

The location of LSP in the city of Malang amounted to 33 companies. Then from the 33 companies will conduct an interview survey of the company to obtain supporting data in order to create attraction model of LSP. Table 1 shows LSP companies in Malang City.

Table 1. Name of Logistic Service Provider (LSP) in Malang City.

No.	Name	Brand	Address
1.	PT. Index Transportama	Paket Express	Jl. Trunojoyo No. 23 B
2.	PT. Pahala Express	Pahala Express	Jl Kapten Pattimura, Ruko Pattimura Indah 21
3.	PT. TIKI Indonesia	TIKINDO	Jl Kapten Pattimura, Ruko Pattimura Indah 21
4.	CV. Karya Indah Delapan Express	KI8 Express	Jl Kapten Pattimura, Ruko Pattimura Indah 21
5.	PT. Karya Indah Buana Express	KIB Express	Jl. Trunojoyo, Stasiun Kota Malang
6.	PT. Herona Express	Herona Express	Jl. Trunojoyo, Stasiun Kota Malang
7.	PT. Kereta Api Logistic	Kalog Express	Jl. Trunojoyo, Stasiun Kota

No.	Name	Brand	Address
			Malang
8.	PT. Leuwi Gajah Paket	Lega Paket	Jl. Sunandar Priyo Sudarmo
9.	PT. Bali Semesta Agung	BSA	Jl. Panji Suroso 88
10.	PT. Satria Antaran Prima	SAP Express Courier	Jl. Sunandar Priyo Sudarmo No.Kav. H 8
11.	Star Cargo	STAR Cargo	Jl. Terusan Borobudur
12.	PT. Hira Adya Narenda	HIRA Express	Jl. Yulius Usman 29 C
13.	PT. ELTEHA	ELTEHA	Jl. Brigjen Slamet Riyadi No. 45
14.	CV. Putra Harapan	PH Cargo	Jl. Brigjen Slamet Riyadi
15.	PT. Eka Sari Lorena Logistic	ESL	Jl. Hasyim Ashari No. 20
16.	CV. Hartama Jaya Abadi	REX	Jl. Brigjen Slamet Riyadi
17.	PT. Kent Transindo Indonesia	Platinum Logistic	Jl. Panji Suroso No.96
18.	PT. Sinar Aji Cepat Bhayangkara	SA Cepat	Jl. Simpang Wilis
19.	PT. Wahana Prestasi Logistik	Wahana Logistik	Jl. Ki Ageng Gribig, Ruko E
20.	PT. Indah Cargo Malang	ICM	Jl. Mayjen Panjaitan No. 30
21.	PT. Tritama Bella Transindo	Bella Transindo	Jl. Supriyadi
22.	PT. Tiki Jalur Nusantara Express	JNE	Jl. Hamid Rusdi No.125-127
23.	PT. Pos Logistics Indonesia	POS	Jl. Merdeka Selatan
24.	PT. Pandu Siwi Sentosa	Pandu Logistik	Jl. Ciliwung
25.	CV. Titipan Kilat Malang Jaya	TIKI	Jl. Arief Rachman Hakim No. 8
26.	Mandala Logistik	Mandala Logistik	Jl. Ciliwung
27.	Priority Cargo and Pakage	PCP	Jl. Soekarno Hatta Blok MP
28.	PT. Speedy Turtle	Speedy Turtle	Jl. Perumahan Bukit Cemara 7
29.	PT. Sakura Inter Buana	SKR Express	Jl Kapten Pattimura Kav. 14B, Ruko Pattimura Indah 21
30.	PT. Dakota Buana Semesta	Dakota Cargo	Jl. R. Tumenggung Suryo No.21-D
31.	PT. Global Jet Express	J&T Express	Jl. LA Adi Sucipto
32.	PT. Jaringan Ekspedisi Transportasi	JET Express	Jl. Letjend S. Parman No.40 Blimbing
33.	PT. Dian Mega Kurnia	DMK Cargo	Jl. Trunojoyo, Stasiun Kota Malang

Land use survey conducted to the land use existing of Trunojoyo road in Malang City. The purpose of land use survey is to determine the type of land use and the amount of generation movement by the land use type in the study location.

3.1.2. Road Characteristics

The road characteristics identification was conducted to determine the road capacity. It consists of a hierarchy of roads, road dimensions, type of road, dividing direction, the side barriers, and the city

size. The results will be compare with the secondary data. It will be used to analyse the road's level of service.

3.1.3. Trip Attraction

The attraction model conducted at LSP location in Malang city to analyze the attraction of LSP. After conducting a survey in accordance with the required variables, the data processed to produce an attraction model of LSP.

3.1.4. Interviews

Interviews conducted to obtain data from each company that allows for data retrieval. The data used as input to determine the factors affect generation/attraction of land use for LSP.

3.1.5. Traffic Counting

Traffic Counting conducted to determine the volume of traffic both internal volume and external volume. The data used to determine the road's level of service in Trunojoyo road. The road observed is Trunojoyo road and other roads. Trunojoyo road would be seen the continuous volume that would be calculated by plate matching, while for the alley volume conducted by calculating the vehicles coming out and entering from or to the alley. Alley has 2-ways would be observed by two surveyors. The survey conducted on the weekday, ie on Wednesday, starting at 6:00 am to 21:00 pm every one hour.

Secondary survey conducted in two ways. It conducted by searching literature study and looking for data from related institutions in this research. Studies conducted on agencies related to this research used to obtain supporting information. In this research, secondary survey would be conducted on several agencies as in the following Table 2.

3.2 Partial Correlation

Partial correlation is a method of measuring the correlation between the independent variable and the dependent variable by controlling one of the independent variables to see the natural correlation between uncontrolled variables. Partial correlation analysis involves two variables. One variable that considered influential would be controlled or made fixed as a control variable [12].

Table 2. Secondary Survey.

Agencies	Data Needs
Regional development planning agency	- Spatial Plan of Malang City - Master Plan for Road Freight Traffic Malang City - Detailed Spatial Plan of the Malang City
Central Bureau of Statistics	Malang City in Figure
Department of Transportation	Local Transportation Arrangements of Malang City
Communication and informatics office	List of delivery / delivery service providers

$$r_{XY} = \frac{n\sum XY - \sum X \sum Y}{\sqrt{n\sum X^2 - (\sum X)^2} \sqrt{n\sum Y^2 - (\sum Y)^2}} \quad (2)$$

Notes:

r_{xy} = correlation coefficient
 n = number of respondents
 X = Score of variable X
 Y = Score of variable Y

3.3 Multiple Linear Regression

Multiple linear regression analysis conducted to determine land-use interaction model with road networks. It can be seen the internal volume derived from land use activities. The research used stepwise method. The stepwise method is a method that selects explanatory variables (independent variables) based on the largest partial correlation with the variables already included in the model. The variables that have been included in the model could be removed, so that the necessary steps become more [13]. The following is the equation for the linear regression model:

$$Y = A + b_1x_1 + b_2x_2 + \dots + b_nx_n \quad (3)$$

Notes:

Y	= Dependent Variable
$x_{n...n}$	= Independent Variable
a	= Constant
$b_1...b_n$	= Regression Coefficient
Y_{LSP}	= Number of movement
X_1	= Total visitors
X_2	= Building area (m ²)
X_3	= Parking area (m ²)
X_4	= Total employee
X_5	= Operational vehicles
X_6	= Total goods (kg/day)
X_7	= Type of services
X_8	= Operational time (minutes)
X_9	= Frequency of delivery of goods/day

4. Results and Discussions

4.1 Characteristic of Selected LSP Locations

The location of the LSP is concentrated in Klojen Sub-district, but each LSP has locations spread over several streets, so consideration is needed to determine the road to be used as the site. Selection of the sites conducted based on several considerations, namely (1) the largest spread of head office / branch location of LSP and (2) directly impact on the road with the highest road hierarchy in Malang, Secondary Arterial road. LSP in Trunojoyo Road consists of Herona Express, Kalog Express, KIB Cepat, DMK Cargo and Paket Express. The fourth location of the LSP is lined up at kiosks located in Malang City Station except Paket Express which is located more to the north. All of LSP is a freight forwarder where the main mode is by using the train mode and generally the goods shipped are goods with large volumes. Loading and unloading activities were carried out at the time of a train arriving or departing at 08:00 am to 10:00 am and 16:00 pm to 17:00 pm. While the goods delivery activities conducted at 12:00 am to 17:00 pm. Unavailability of parking space for loading and unloading at the location of the LSP makes the customer who sends the goods using pick-up must queue first but the queue was conducted on the roads thereby making the road capacity is reduced. In addition, all of LSPs did not have a space enough to accommodate the items that come, so that the new goods arrive must be located on the street parking (Figure 2).

Vehicle types used for operations vary from two wheels to more than six wheels, ie motorcycles, grand vans, pick-up or box, CDE trucks, CDD trucks, fuso crank trucks, double fuso trucks, and fuso wingbox trucks. Some types of vehicles have different functions such as fuso vehicles which are used for the transport of large quantities to be shipped out or from within the city. As for pick-up / box and CDE trucks are generally used to deliver goods inside the city (Figure 3).



Figure 2. LSP condition in the study area.



Figure 3. Fuso Engkel Wingbox Truck (a), Pick-up Boxes (b), and CDD Truck (Colt Diesel Double).

4.2 Attraction Model of LSP

Attraction model of LSP analysed using multiple linear regression analysis with stepwise method in a model as follows:

$$Y_{LSP} = 17.081 + 0.689(X_1) + 0.532(X_3) + 0.011(X_6) \quad (4)$$

Notes:

- Y_{LSP} = Dependent variable, number of movements
- X_1 = Independent variable, number of visitors
- X_3 = Independent variable, parking area
- X_6 = Independent variable, quantity of goods

Based on the significant test, it can be concluded that the independent variables of visitor number (X_1), parking area (X_3) and number of goods (X_6) have influence on partially bound variable.

4.3 Application of Attraction Model of LSP on Trunojoyo Road

There are five LSPs in Trunojoyo Road. The average value was taken from 17 LSPs that became the model samples, so the average value of the number of visitors was 63 persons, the average parking area was 36.1 m² and the average value of the total goods was 823.8 kg/day. Based on the average value is obtained the number of LSP movements are:

$$\begin{aligned} Y_{LSP} &= 17.081 + 0.689(X_1) + 0.532(X_3) + 0.011(X_6) \\ Y_{LSP} &= 17.081 + 0.689(63) + 0.532(36.1) + 0.011(823.8) \\ Y_{LSP} &= 17.081 + 43.407 + 19.183 + 9.062 \\ Y_{LSP} &= 88.73 \approx 89 \text{ pcu/days} \end{aligned}$$

Based on the calculation results can be seen the amount of land use attraction of LSP in Trunojoyo road, as follows:

$$\begin{aligned} Y_{LSP} &= Y_{LSP} \times \text{population} \\ Y_{LSP} &= 88.73 \times 5 \\ Y_{LSP} &= 443.66 \approx 444 \text{ pcu/days} \end{aligned}$$

Based on the model, after the value of each variable consisting of the number of visitors of 63, the parking area of 36.1 m² and the amount of goods of 823.8 kg/day is included. The resulting movement is 443.66 pcu/days.

5. Conclusion

Attraction Model of LSP is: $Y_{LSP} = 17.081 + 0.689(X_1) + 0.532(X_3) + 0.011(X_6)$. The average value of each variable consisting of the number of visitors is 63, the parking area is 36.1 and the quantity of goods is 823.8. Then the movement attraction is 443.66 pcu/day. The road's level of service is worst at 16.00 pm - 17.00 pm (E). It was influenced by LSP attraction of 2.7 per cent.

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