TRAVEL PATTERN ANALYSIS AND FREIGHT GENERATION MODELLING OF TEXTILE COMMODITIES. CASE STUDY: THAMRIN CITY SHOPPING CENTER, JAKARTA

Nauraafian Dimieka
Departemen Teknik Sipil
Universitas Indonesia
Depok, Indonesia, 16424

Nahry [1]
Departemen Teknik Sipil
Universitas Indonesia
Depok, Indonesia, 16424

Abstract

The Thamrin City area, as the largest shopping centre in Asia, certainly needs a good city logistics system so that it can run regularly. This research was conducted to analyse the pattern of freight travel in the Thamrin City area, analyse the representative freight generation model for the Thamrin City area, and the factors that influence this amount. The research method used in this research is Cross Sectional Studies. The independent variables used in this study are the gross floor area and the number of employees, while the dependent variable is the volume of freight attracted (goods receipt) and produced (goods delivery). The results of this study indicate that in the Thamrin City area there is a unique travel pattern compared to the surrounding area. It has 3 channel patterns for receiving freight and 1 pattern for delivering freight. In addition, the results also showed that both gross floor area and number of employees had a positive correlation with freight generation in the Thamrin City area.

Keywords: Freight Generation, Thamrin City, Travel Pattern, Freight Attraction, Freight Production.

Abstrak

Kawasan Thamrin City sebagai pusat perbelanjaan terbesar di Asia tentunya membutuhkan sistem logistik kota yang baik agar dapat berjalan secara rutin. Penelitian ini dilakukan untuk menganalisis pola perjalanan barang di kawasan Thamrin City, menganalisis model pembangkitan barang yang representatif untuk kawasan Thamrin City, dan faktor-faktor yang mempengaruhi jumlah tersebut. Metode penelitian yang digunakan dalam penelitian ini adalah Cross Sectional Studies. Variabel bebas yang digunakan dalam penelitian ini adalah luas lantai kotor dan jumlah pegawai, sedangkan variabel terikatnya adalah volume angkutan barang yang ditarik (penerimaan barang) dan volume barang yang diproduksi (pengiriman barang). Hasil penelitian ini menunjukkan bahwa di kawasan Thamrin City terdapat pola perjalanan yang unik dibandingkan kawasan sekitarnya. Ini memiliki 3 pola saluran untuk menerima barang dan 1 pola untuk mengirimkan barang. Selain itu, hasil penelitian juga menunjukkan bahwa baik luas lantai kotor maupun jumlah karyawan mempunyai korelasi positif terhadap timbulan barang di kawasan Thamrin City.

Kata Kunci: Bangkitan barang, Thamrin City, Pola Perjalanan, *Freight Attraction, Freight Production*

INTRODUCTION

The Logistics System influences the economy of a country. This is evident from the rapid development of China's economy due to its logistics transportation system. In addition, economic growth can also be linked to the demand for land transportation which results in a stable increase in social and environmental terms (Alises et al., 2014). As the population grows, the growth of goods, such as food, clothing, and other tertiary needs will also increase. Based on data released by the World Bank, Indonesia has a population of up to

[1] Corresponding author: nahry@eng.ui.ac.id

276.4 million. The largest concentration is in the DKI Jakarta area with 15,978 people based on the Indonesian Central Bureau of Statistics (BPS). Indonesia's large population affects the growth in demand for goods and services which has the potential to cause problems related to urban mobility and urban freight transport (de Oliveira et al., 2021). Therefore, various kinds of research and strategies have been carried out to increase the effectiveness of goods distribution activities (Apichottanakul et al., 2021). One of them is about City Logistics.

As part of the logistics system, City Logistics forms an important and specific segment of a logistics system (Mareï & Savy, 2021). Seeing the importance of city logistics to city activities, it is necessary to study city logistics so that it can run effectively and efficiently. This assessment is also important to do in order to minimize the problems that arise. However, studies related to city logistics in developing countries are rarely discussed. Even from a scientific point of view, logistics in the Global South (developing countries) is very little discussed and handled (Mareï & Savy, 2021).

In Indonesia itself, especially in the Tanah Abang and Thamrin City areas, as the largest textile shopping centers in Asia, of course, a good city logistics system is needed in order to minimize the problems that occur. However, in reality there are still many problems that arise in the area such as congestion and high carbon emissions. In fact, based on DKI government data in 2018, it was noted that congestion in the Tanah Abang area had increased by up to 60% (Ul Haq, 2018).

The Four Step Model is a method used to model travel demand. This Four Step Model is used to examine the planning of a logistics transportation system based on travel demand in an area. The first step in this method is Trip Generation. By applying Trip Generation, it can be estimated that trips originating and being attracted to the Thamrin City area. This estimate will later influence the actions that will be taken by the local government to make the logistics system in the area better.

The purpose of this research are:
1. Analyzing the pattern of freight travel in Thamrin City
2. Analyzing what factors affect the generation of goods (Freight Generation) in Thamrin City
3. Analyzing the right model to describe the generation of goods (Freight Generation) in Thamrin City

RESEARCH METHODS

The following is research flowchart conducted in this study.

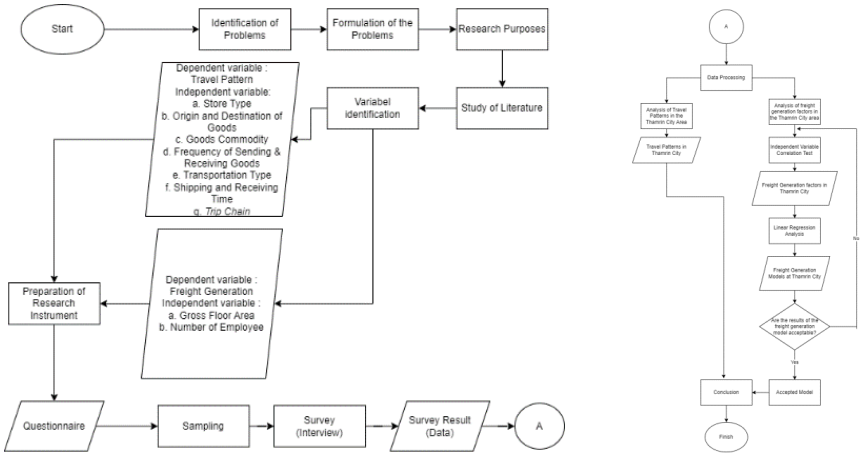

Figure 1. Research Flowchart.

The research begins by identifying problems based on existing conditions in the Thamrin City area. From the identification of these problems, it can be done to design the formulation of the problem which will later become the goal of the research conducted. To be able to answer the formulation of the problem that has been designed, a literature study is carried out related to the theory and topic of research discussion. From this literature study, variables will be obtained that will be used in research. The determination of this variable will affect the research instrument to be used. After sampling to obtain data, the next step is to process the data. The data collected will be analyzed related to travel patterns and factors of goods generation in the Thamrin City area.

RESULT AND DISCUSSIONS

Characteristics of Research Area

Thamrin city is a shopping mall area located in the Tanah Abang market area, West Jakarta, DKI Jakarta. The mall, which opened in 2010 with ten floors, is one of the largest textile centers in Asia. This shopping center is located on Jl. Thamrin Boulevard (Kebon Kacang Raya) with access in various directions. Among others, from Jl. Thamrin, Jl. Teluk Betung, as well as from Jl. KH. Mas Mansour. Figure 2 displays in detail the location of this research.

Source : (Google, 2023)

Figure 2. Location of Research Object

Sampling and Data Collection

Sampling was carried out by conducting interviews with textile traders in the Thamrin City area according to the questionnaire that had been made. In the research object under study, the overall population size cannot be determined. This is because there is no valid data regarding the exact number of outlets/shops in Thamrin City. Therefore, in this study the Lemeshow method was used. Based on the calculations that have been done, a minimum sample size of 96.04 is obtained or it can be rounded up to 97.

Based on the survey results, data were obtained from 112 respondents. However, after being reviewed, it turned out that there were seven data that could not be used due to data defects. After removing data defects, the final data for this study were 105 data. In addition, to support data related to travel patterns, short interviews were also conducted with relevant stakeholders located in the area.

Travel Pattern

Chart 1.Types of Stores in Thamrin City

Based on chart 1 the majority of shops in Thamrin City sell goods both retail and wholesale. This phenomenon occurs in line with the Tanah Abang area as the largest shopping center in the Asian region.

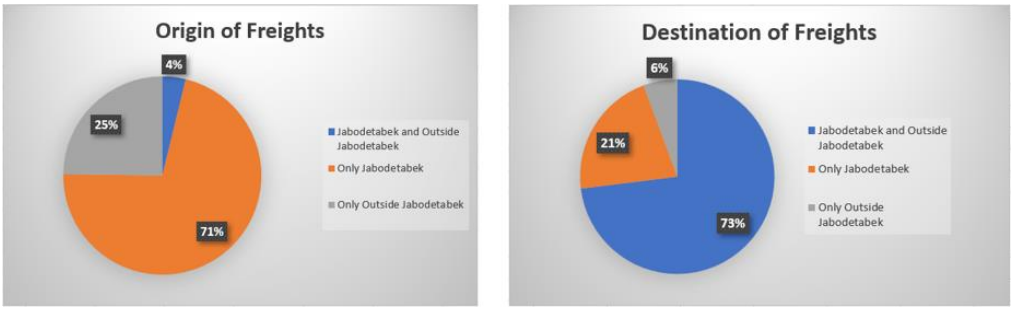

Chart 2. Origin and Destination of Freights in Thamrin City

Based on chart 2, it can be interpreted that the freight received by Thamrin city are dominated by goods originating from the Greater Jakarta area, namely 71%. Meanwhile, for shipments of goods from Thamrin City, both Jabodetabek and outside Jabodetabek both dominate, namely 73%. Jabodetabek means location around greater Jakarta Area (Jakarta, Bogor, Depok, Tangerang, and Bekasi).

Chart 3. Distribution of Freights Receipt and Delivery

Based on chart 3, it can be seen in the receipt of freights, most goods in the Thamrin City area come from the DKI Jakarta area by 67%. Meanwhile, the delivery of freight is relatively more evenly distributed with the most destinations being DKI Jakarta, namely 29%.

Figure 3. Hijab and Gamis shop in Thamrin City

Based on figure 3, the dominant textile commodity in Thamrin City is apparel. Which consist of Muslim clothing, robes, hijab, batik, and other types of apparel.

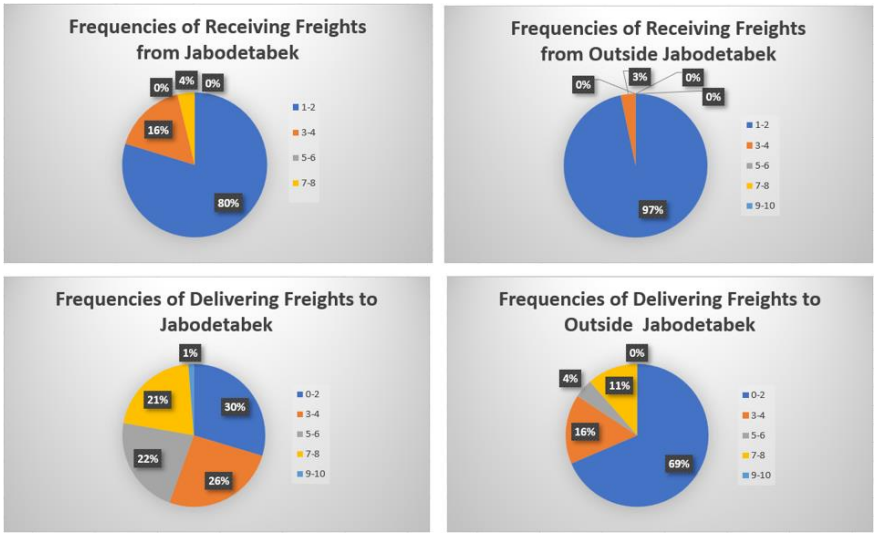

Chart 4. Graph of Receiving and Delivering of Freights in Thamrin City

Based on chart 4 it can be interpreted that the majority of receiving freights in the Thamrin City area is only around 1-2 times per week either from Jabodetabek or outside Jabodetabek. It can also be seen that the percentage of frequency of delivery of freights to the Jabodetabek area is more evenly distributed compared to areas outside Jabodetabek.

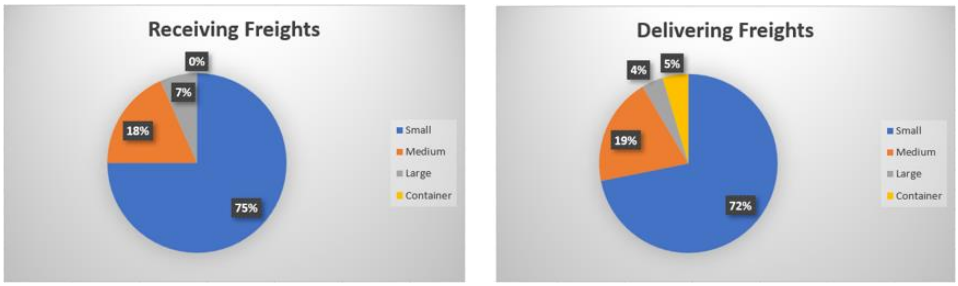

Chart 5. Type of vehicle used

The mode of transportation studied in this study is trucks. The majority mode of transportation used in delivering and receiving goods in the Thamrin City area is small trucks. This is because the majority of the volume of delivering and receiving goods in the Thamrin City area is only around 0-10 tons as in graph 1.

The loading and unloading dock operating hours in Thamrin city are 5 a.m. to 10 p.m. Large vehicles usually load and unload in the morning or at night. Meanwhile, the highest intensity of loading and unloading usually occurs during the day between 1pm and 3pm. At this hour, vehicles that load and unload are usually dominated by small to medium trucks.

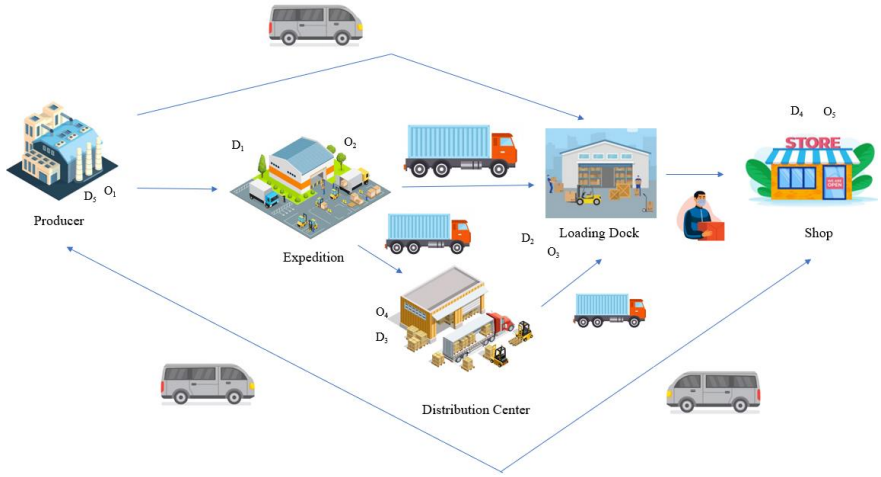

Figure 4. Freights Receipt Trip Chain in Thamrin City

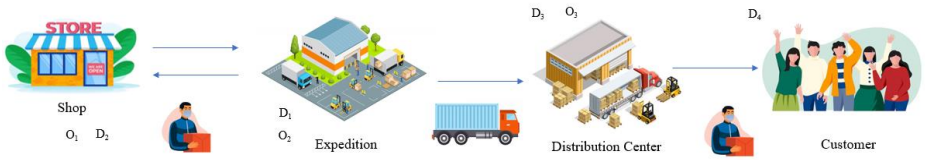

Figure 5. Freights Delivery Trip Chain in Thamrin City

Based on the results of interviews conducted with respondents and stakeholders, the Trip Chain at Thamrin City was obtained as shown in Figures 4 and 5. In the trip chain for receiving freight, there are three types of flows. Meanwhile, in the trip chain for delivering freight, there is only one channel.

Descriptive Statistical Analysis of Data

The data used for statistical analysis in this study amounted to 105 survey data and consisted of four variables, namely Freight Production (FP) as (Y1), Freight Attraction (FA) as (Y2), Gross Floor Area (GFA) as (X1), and Number of Employees (NE) as (X2).

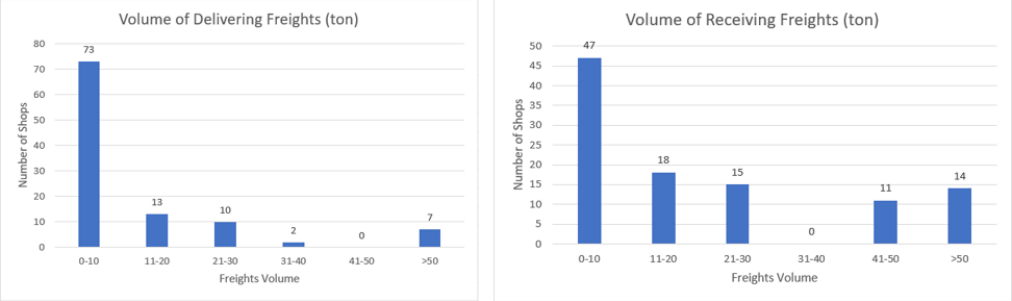

Figure 6. Total Delivery and Receipt of Freights

In the dependent variable, Y1 and Y2, based on figure 6, the most FP and FA produced at outlets/shops in the Thamrin City area are in the range of 0-10 tonnes/day. The resulting FP and FA are 73 stores for FP and 47 stores for FA respectively.

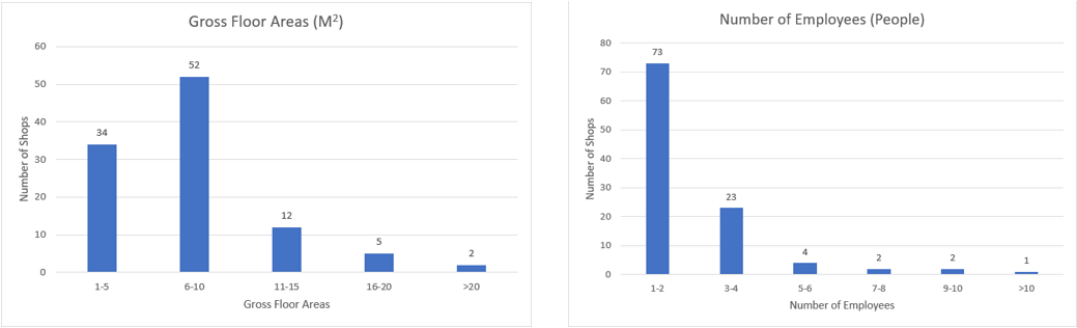

Figure 7. Gross Floor Areas and Number of Employees

Presentation of data for the independent variables, X1 and X2, can be seen in figure 7. In the GFA variable, the most dominant store area is in the range of 6-10 m2, namely 52 shops. Meanwhile, for the NE variable, the number of store employees in Thamrin city is in the range of 1-2 people, namely 73 stores.

Table 1. Research Variable Descriptive Statistics

Parameter \ Variable	Independent Variable		Variabel Bebas	
	Freight Production (Y1)	Freight Attraction (Y2)	Gross Floor Areas (X1)	Number of Employees (Y2)
Mean	15.198	26.434	7.867	2.562
Median	6	15	6	2
Modus	0	5	4	1
Minimum	0	0.15	2	1
Maksimum	150	150	40	30
Standar Error	2.692	3.092	0.499	0.312
Standar Deviasi	27.589	31.688	5.116	3.195

In table 1 there are 7 descriptive statistical parameters that can be compared. Based on the mean on the dependent variable. It is interpreted that in the Thamrin City FA area, it is more dominant than FP. This is in line with the behavior patterns of conventional traders who tend to stockpile goods first as supply while waiting for buyers to act as demand. It is also aligned with the resulting median and mode. In the independent variables, the mean, mode, and median values for each variable are not much different. This shows that the area of the shop and the number of employees surveyed is the majority of data in Thamrin city.

The minimum and maximum parameters can be interpreted that at least there is receipt of goods (FA) every day at Thamrin City, but not for delivery of goods (FP). FP can have a value of 0 because it is waiting for a prior order from the buyer as a form of demand or the shop being surveyed does not serve online sales so the buyer must come directly to the store. Based on the standard deviation resulting from the four variables, it can be interpreted that the FA and FP values have a fairly wide range or vary for each store in Thamrin City. The standard error indicates the standard deviation of the sampling distribution of a statistic. This means that the smaller the standard error value, the average of the samples obtained is getting closer to the average of the population. From the values obtained, it can be interpreted that for both GFA and NE the mean sample values are close to the population mean values. When compared with the standard errors of FA and FP, it can be said that the mean values resulting from the two samples of the dependent variable are not as representative of the values of the independent variables.

Linear Regression Analysis

Linear regression analysis was carried out with the help of the SPSS application. In this linear regression analysis, six equations will be made that consist of FA vs GFA, FA vs NE, FA vs GFA and NE, FP vs GFA, FP vs NE, and FA vs GFA and NE. For the resulting regression equation to be valid and usable as a predictor in the future, the resulting regression equation must meet the seven conditions described as known as classic asumption.

In addition to fulfilling these six conditions, The resulting regression equation also needs to be validated with the Root Mean Square Error (RMSE) Test. The RMSE test is a method for evaluating models from linear regression which is generated by measuring the accuracy of the model's measurement results (Hans, 2022b). The accuracy of the RMSE test is seen from the value generated from the test. The closer to 0 it can be said that the prediction results of a model are more accurate (Hans, 2022b). The RMSE test sample is determined by taking a minimum of 10 data or 10% of the total data used. Thus, the data that will later be used to calibrate the linear regression equation is the data for calibration minus the data for RMSE.

In the calibration of this linear equation, two types of equations are carried out, namely the regression equation with the intercept and the regression equation without the intercept. This is done as a form of calibration to produce the best equation as a predictive tool.

Table 2. Initial Sample Normality Test (left); Normality Test After Removing the Outliers (right).

One-Sample Kolmogorov-Smirnov Test

		FP	FA
N		105	105
Normal Parameters[a,b]	Mean	15.1976	26.4345
	Std. Deviation	27.58873	31.68780
Most Extreme Differences	Absolute	.291	.217
	Positive	.270	.217
	Negative	-.291	-.203
Kolmogorov-Smirnov Z		2.980	2.225
Asymp. Sig. (2-tailed)		.000	.000

a. Test distribution is Normal.
b. Calculated from data.

One-Sample Kolmogorov-Smirnov Test

		FP_Outliers	FA_Outliers
N		96	97
Normal Parameters[a,b]	Mean	8.1120	19.2023
	Std. Deviation	8.59849	18.00597
Most Extreme Differences	Absolute	.174	.190
	Positive	.174	.190
	Negative	-.173	-.145
Kolmogorov-Smirnov Z		1.700	1.873
Asymp. Sig. (2-tailed)		.006	.002

a. Test distribution is Normal.
b. Calculated from data.

Based on table 2 it can be interpreted that both the initial sample and after removal of the outliers still not normally distributed. This is indicated by the resulting significance value which is still <0.05. Therefore it is necessary to do data transformation to normalize the data.

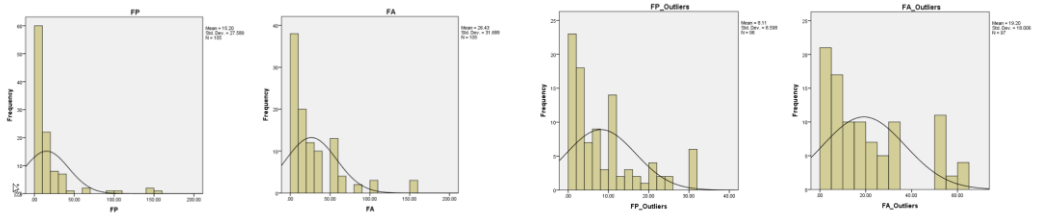

Figure 8. Histogram Graph on Initial Data (left); Histogram Graph on Outliers Removal Data (right)

Table 3. Data Transformation Normality Test Results

One-Sample Kolmogorov-Smirnov Test

		FP_1Log	FP_SQRT	FA_Log	FA_SQRT	FP_Outlier1Log	FP_OutlierSQRT	FA_OutlierLog	FA_OutlierSQRT
N		105	105	105	105	96	96	97	97
Normal Parameters[a,b]	Mean	.8424	2.9443	1.1044	4.3879	.7423	2.3531	1.0270	3.8758
	Std. Deviation	.56084	2.56736	.60405	2.69249	.47064	1.61312	.56102	2.05521
Most Extreme Differences	Absolute	.086	.161	.090	.128	.112	.094	.110	.128
	Positive	.086	.161	.063	.128	.109	.094	.090	.128
	Negative	-.067	-.126	-.090	-.079	-.112	-.072	-.110	-.115
Kolmogorov-Smirnov Z		.880	1.654	.923	1.314	1.102	.924	1.083	1.258
Asymp. Sig. (2-tailed)		.421	.008	.362	.063	.176	.360	.192	.084

a. Test distribution is Normal.
b. Calculated from data.

Based on figures 8, both FP (Y1) and FA (Y2) data have peaks that are skewed to the left. Thus, the possible transformations for FA and FP are logarithmic (LOG) or root transformations (SQRT) according to the data transformation theory. After calibration, the best data transformation for FA and FP is logarithmic transformation. This can be seen from the significance value generated in the logarithmic transformation is greater than the root transformation. This can be seen in table 3.

In the equations of the two variables, namely FA vs GFA & NE and FP vs GFA & NE, extreme data removal (Outliers) is only performed to normalize the data. This is because based on table 4, the correlation between the independent variables (GFA and NE) is close to 0.8 which allows for multicollinearity symptoms so that it does not meet the requirements of linear regression. Proof of failure to fulfill the classical assumption test requirements of linear regression for these two variables can be seen in table 7.

Table 4. *Pearsons* Correlation Test

Correlations

		FP	FA	GFA	NE
FP	Pearson Correlation	1	.497**	.443**	.513**
	Sig. (2-tailed)		.000	.000	.000
	N	105	105	105	105
FA	Pearson Correlation	.497**	1	.483**	.319**
	Sig. (2-tailed)	.000		.000	.001
	N	105	105	105	105
GFA	Pearson Correlation	.443**	.483**	1	.798**
	Sig. (2-tailed)	.000	.000		.000
	N	105	105	105	105
NE	Pearson Correlation	.513**	.319**	.798**	1
	Sig. (2-tailed)	.000	.001	.000	
	N	105	105	105	105

**. Correlation is significant at the 0.01 level (2-tailed).

Table 5.Variable Relations and Forms of Equations

Variable Relation	Form of Equation
Y vs X	Y= A + Bx
Y vs Log (X)	Y = A + Blog(x)
Log (Y) vs Log (X)	$Y= AX^B$
Ln (Y) vs X	$Y= Ae^{BX}$

Equation calibration for one variable (FA vs GFA, FA vs NE, FP vs GFA, and FP vs NE) was performed with four variations of equation calibration. The calibration results of the four variations will later form a unique equation for each variable as shown in table 5.

Table 6. Proposed Model for Each Variable Combination

Variable	Equation	Parameter					
		R^2	Calculated t	t table	calculated F	F table	RMSE
FP vs GFA	$FP = GFA^{0.868}$	0.868	17.05	1.989	290.712	3.953	0.13
FP vs NE	$FP = e^{0.39NE}$	0.474	9.208	1.986	84.784	3.942	0.363
FP vs GFA,NE	There are no eligible model						
FA vs GFA	$FA = GFA^{1.319}$	0.87	24.023	1.988	577.1	3.952	0.261
FA vs NE	$FA = e^{0.79NE}$	0.649	12.531	1.988	157.014	3.952	0.617
FA vs GFA, NE	There are no eligible model						

Table 6 is the regression equation proposed as the best estimator for each calibration. In the FP vs GFA, NE and FA vs GFA, NE equations there are no regression models that can be proposed as estimators. This is because there is a classic assumption test that does not pass the test on the resulting calibration equation. This can be seen in the red column in table 7. The results of the RMSE test for each equation can be seen in table 8.

Table 7. Classical Assumptions Test Results FP vs GFA, NE (top); Classical Assumptions Test Results FA vs GFA, NE (down)

Equation / Data & Parameter	Number of Data	Y1 = X1 + X2																							
		With Intercept												Without Intercept											
		t test			F test	Multicollinearity test				Glesjer heteroscedasticity test			R^2	t test		F test	Multicollinearity test				Glesjer heteroscedasticity test		R^2	Spearman heteroscedasticity test			
						GFA		NE									GFA		NE					With Intercept		Without Intercept	
		Constant	GFA	NE		Tolerance	VIF	Tolerance	VIF	Constant	GFA	NE		GFA	NE		Tolerance	VIF	Tolerance	VIF	GFA	NE		GFA	NE	GFA	NE
Preliminary Data	95	0.517	0.334	3.111	17.996	0.351	2.848	0.351	2.848	0.868	0.276	0	0.281	1.417	3.159	37.821	0.26	3.842	0.26	3.842	0.18	0.005	0.449	0.51	0.003	0.009	0.001
Data Ater Removing Outliers 1	86	0.04	4.766	-1.642	12.879	0.604	1.655	0.604	1.655	0.007	0.021	0.517	0.237	5.984	-1.687	59.835	0.171	5.861	0.171	5.861	4.764	-0.192	0.588	0.005	0.37	0.006	0.369
Data Ater Removing Outliers 2	78	-1.014	6	-1.799	20.415	0.647	1.547	0.647	1.547	0.502	0	0.017	0.352	6.768	-2.024	69.811	0.18	5.564	0.18	5.564	0	0.767	0.638	0.001	0.07	0.005	0.258
Data Ater Removing Outliers 3	76	-0.218	3.161	0.191	10.623	0.512	1.954	0.512	1.954	0.145	0.018	0.532	0.225	3.864	0.181	59.697	0.136	7.343	0.136	7.343	0	0.52	0.617	0.002	0.136	0.001	0.135

Equation / Data & Parameter	Number of Data	Y2 = X1 + X2																							
		With Intercept												Without Intercept											
		t test			F test	Multicollinearity test				Glesjer heteroscedasticity test			R^2	t test		F test	Multicollinearity test				Glesjer heteroscedasticity test		R^2	Spearman heteroscedasticity test			
						GFA		NE									GFA		NE					With Intercept		Without Intercept	
		Constant	GFA	NE		Tolerance	VIF	Tolerance	VIF	Constant	GFA	NE		GFA	NE		Tolerance	VIF	Tolerance	VIF	GFA	NE		GFA	NE	GFA	NE
Preliminary Data	95	0.228	4.354	-1.368	15.992	0.351	2.848	0.351	2.848	0.868	0.072	0.266	0.256	6.959	-1.331	61.477	0.26	3.842	0.26	3.842	0	0.034	0.569	0.001	0.017	0.004	0.012
Data Ater Removing Outliers 1	87	-0.628	4.761	1.164	29.015	0.543	1.841	0.543	1.841	0.002	0.005	0.193	0.409	5.955	1.195	117.257	0.211	4.735	0.211	4.735	0	0.145	0.728	0.001	0.068	0.04	0.154

Table 8. RMSE test for each Equation

FP VS GFA						
$FP = GFA^{0.868}$						
No	ID Data	X1	Actual Y	Y Model	(Ymodel-Actual Y)	$(Ymodel-Actual Y)^2$
1	96	0.85	0	0.868	0.868	0.754
2	97	1.11	1.2	1.095	-0.105	0.011
3	98	1.11	1.04	1.095	0.055	0.003
4	99	0.95	1.04	0.956	-0.084	0.007
5	100	1.11	1.04	1.095	0.055	0.003
6	101	0.95	0.2	0.956	0.756	0.572
7	102	0.95	0.57	0.956	0.386	0.149
8	103	0.95	1.38	0.956	-0.424	0.179
9	104	0.85	0.88	0.868	-0.012	0.000
10	105	1.04	0.89	1.035	0.145	0.021
SUM						1.700
RMSE						0.130

FP VS NE						
$FP = e^{0.39NE}$						
No	ID Data	X1	Actual Y	Y Model	(Ymodel-Actual Y)	$(Ymodel-Actual Y)^2$
1	96	0.48	0	1.205	1.205	1.452
2	97	0.6	2.77	1.263	-1.507	2.272
3	98	0.6	2.4	1.263	-1.137	1.293
4	99	0.48	2.4	1.205	-1.195	1.428
5	100	0.6	2.4	1.263	-1.137	1.293
6	101	0.7	0.47	1.313	0.843	0.710
7	102	0.6	1.32	1.263	-0.057	0.003
8	103	0.6	3.18	1.263	-1.917	3.676
9	104	0.48	2.03	1.205	-0.825	0.680
10	105	0.9	2.04	1.419	-0.621	0.386
SUM						13.194
RMSE						0.363

FA VS GFA						
$FA = GFA^{1.319}$						
No	ID Data	X1	Actual Y	Y Model	(Ymodel-Actual Y)	$(Ymodel-Actual Y)^2$
1	96	0.780	0.700	0.721	0.021	0.000
2	97	1.080	1.300	1.107	-0.193	0.037
3	98	1.080	0.850	1.107	0.257	0.066
4	99	0.900	1.180	0.870	-0.310	0.096
5	100	1.080	1.780	1.107	-0.673	0.453
6	101	0.900	-0.700	0.870	1.570	2.466
7	102	0.900	-0.820	0.870	1.690	2.857
8	103	0.900	0.700	0.870	0.170	0.029
9	104	0.780	0.150	0.721	0.571	0.326
10	105	1.000	1.700	1.000	-0.700	0.490
SUM						6.820
RMSE						0.261

FA VS NE						
$FA = e^{0.79NE}$						
No	ID Data	X1	Actual Y	Y Model	(Ymodel-Actual Y)	$(Ymodel-Actual Y)^2$
1	96	0.3	1.61	1.27	-0.34	0.12
2	97	0.48	3	1.46	-1.54	2.37
3	98	0.48	1.95	1.46	-0.49	0.24
4	99	0.3	2.71	1.27	-1.44	2.08
5	100	0.48	4.09	1.46	-2.63	6.92
6	101	0.6	-1.61	1.60	3.21	10.33
7	102	0.48	-1.9	1.46	3.36	11.29
8	103	0.48	1.61	1.46	-0.15	0.02
9	104	0.3	0.35	1.27	0.92	0.84
10	105	0.85	3.91	1.95	-1.96	3.83
SUM						38.044
RMSE						0.617

Based on table 6 it can be interpreted that both GFA and NE have an effect on the magnitude of FP and FA. This is in accordance with what was stated by Pani et al. in 2018 in his publication entitled Modeling urban freight generation: A case study of seven cities in Kerala, India. In his publication, Pani stated that the number of employees and land area affect the size of the FG. In addition, Chaudhari et al. in 2022 in the Impact Analysis of Urban Freight Trips Generated from Wholesale Market, Ahmedabad also revealed that the number of trips increases as the number of workers increases and the number of trips drawn will also increase as the store area expands.

When comparing the effect of GFA on FP and FA, GFA will produce a greater FA than FP by including the same variables. This characteristic can also be seen in the effect of NE on FP and FA. The coefficient on FA is greater than FP due to the characteristics of Thamrin City itself. Most shops in Thamrin City still use a conventional trading pattern where traders supply goods first while waiting for buyers to arrive. In addition, as previously elaborated, in Thamrin City there are still shops that do not serve online purchases. This causes buyers to come directly to the store to buy goods (reducing the volume of goods shipped).

The RMSE test on FP produces a value of 0.13 for GFA and 0.363 for NE. Whereas in FA, the RMSE test that was carried out produced a value of 0.261 for GFA and 0.617 for NE. If you look at the RMSE value, the FP equation can be said to be more representative than the FA equation. This is because the deviation of the results from the model and the actual figures are not much different.

The R2 value of FA vs GFA is greater than that of FP vs GFA. However, the RMSE FP vs GFA value is smaller than the FA vs GFA value. From these two things it can be interpreted that:

1. If you look at the ability to influence the independent variable on the dependent variable, the FA vs GFA equation can be said to be better than FP vs GFA.
2. If you look at the magnitude of the deviation in the value generated by the model from the original value, the FP vs GFA equation can be said to be better than FA vs GFA.

This result is also applied to FA vs NE and FP vs NE

CLOSING

Conclusion

Based on the research that has been conducted at Thamrin City, the following conclusions are drawn:

1. The shops in Thamrin City are dominated by wholesale and retail stores. The number of receipts of goods in Thamrin City is more than the delivery of goods due to the wholesale type trading pattern in Thamrin City. Both the delivery and receipt of goods are dominated by goods located in the Jabodetabek area. The main commodity from Thamrin City is apparel. Both receipt and delivery of goods are carried out at most with a frequency of 1-2 times a week. The dominant type of vehicle used for sending and receiving goods is small trucks. The intensity of time for receiving and sending goods mostly occurs between 1pm and 3pm. In the goods receiving trip chain, there are 3 receipts. Meanwhile, in the trip chain for shipping goods, there is only 1 channel.
2. Factors that affect trip generation in the Thamrin City area are the shop's gross floor area (GFA) and number of store employees (NE).
3. The best equation model to describe Freight Production (FP) in Thamrin City is FP = GFA0.868 for the GFA variable and FP = e0.39NE for the NE variable. While the best equation model to describe Freight Attraction (FA) at Thamrin City is FA = GFA1.319 for GFA variable and Y = e0.79NE for NE variable.

Suggestion

After conducting research in the Thamrin City area, there are several suggestions that can be made to make the research better. These suggestions are as follows:

1. Adding the amount of data to the research so that the results obtained are more representative.
2. Ensure that the respondent is a shop owner (not just an employee). This is so that the results obtained are valid regarding qualitative data.
3. Doing further research related to other factors that influence trip generation in the Thamrin City area. This is to be able to compare the resulting models and represent trading conditions in Thamrin City in more detail.

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