Analysis of Trip Attraction as Land Use Development Effect in Palembang: Case Study on Cinde Traditional Market

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Abstract. The Government of South Sumatera Province built Light Rail Transit (LRT) station in order to facilitate public transport infrastructure in Palembang. One of the LRT station is Cinde station which is located in Cinde traditional market. Currently Cinde traditional market in progress of construction into Cinde Plaza Aldiron modern market that integrated with Cinde LRT Station. The changes in land use has important role to change trip attraction in term of number and characteristics visitor of Cinde Traditional Market area. In this work, the data trip attraction to Cinde traditional market under and after construction process was collected via questionnaire method. Statistical analysis shows that the most influenced trip attraction visitors to Cinde Plaza Aldiron are profession, transportation mode and retail item. In addition, the same factor also influences trip attraction under and after construction. According to the model, it is predicted that the integration of Cinde Plaza Aldiron with LRT mode likely to increase number of Cinde Plaza Aldiron visitors because of additional choice of transportation mode and more option item to buy.

1. Introduction

In supporting the increasing needs of infrastructure and means of transportation the Provincial Government of South Sumatra will provide mass public transport facilities such as LRT which is planned to begin operating in 2018. The LRT track built by the government is currently 24.5 km with several station points, and one of them is Market station located on Jenderal Sudirman Street.

The construction of the LRT station will have an impact on land uses around the station. In addition to the construction of LRT station, around the area is also planned to be developed Cinde traditional market becomes Plaza Cinde Aldiron which is also one of government efforts to support the improvement of social and trade facilities development. Plaza Cinde Aldiron is planned to be a mixed land use development and will be integrated with LRT stations. Plaza Cinde Aldiron which initially is a traditional market and trading place, is planned to be built into office area, modern market, retail, food court, and 12 stories parking area designed. In addition to functioning as a three stories office building area, Plaza Cinde Aldiron will also be equipped with two-story retail area, one-floor food court, two-story trading area, three-story parking area and one-story modern market in semi basement area.

Cinde Andiron Plaza development plan will certainly have an impact on the performance of Jendral Sudirman Street. It is because of the construction of Plaza Andiron will cause trip attraction on the
location surrounding. Therefore, trip attraction to Cinde market is important to be early identified. Trip attraction to Cinde market has a large enough attraction. The market is one type of land use that have a large enough attraction for the people as it relates to the process of fulfilling the daily needs [1]. The amount of trip attraction to the market depending on the various factors that influence. Research on trip attraction with the dependent variable will result in the equation in the form of a model. For that we need to know the amount of trip attraction due to the development of land use market Cinde both during construction and after construction. The purpose of research trip attraction of the Cinde market are to get the trip attraction model of visitors Cinde market at during construction or existing conditions and after construction of Plaza Cinde Aldiron.

2. Material and Method

2.1. Trip Attraction/Trip Generation
Trip generation is the number of movements coming from a zone while trip attraction is the number of movements leading to a zone. The model of generation and attraction used is to find out total number of movements in and or out of a zone. The data used in the generation and attraction model are the data of total number of transportation's/person/goods. The output of this model is the quantity of transportation or person per unit time. This generation and attraction depend on two aspects of land use [2]:
   a. Type of land use
   b. Different types of land use have different traffic generations/attractions. The generation /attraction is not only varying in the type of land use but also the level of activity.

2.2. Linear Regression
The estimate number of trips in city area at the stage of the trip generation will use this method for all travel zone based. For travel zone based, linear regression analysis method will analyze the correlation between criterion variable in form of social-economic characteristics of zone (land use) and the predictor variables in form of total traffic flow (travel) from the observed zone to the observed destination zone which produces the estimation number of trips from and to destination generated by the characteristics of social-economic zone for zone-based travel [2].

Linear regression analysis is divided into 2, as follow:
   a. Simple linear regression analysis
      The analysis of the predictor variables with 1 (one) criterion variables
      \[ Y = a + bx + k \] (1)
   b. Multiple linear regression analysis
      The analysis of one predictor variables and two or more criterion variables
      \[ Y = a + b_1x_1 + b_2x_2 + \cdots + b_nx_n + e \] (2)

Note:
Y : predictor variables.
x1,.. xn : criterion variables
b : coefficient parameter using value to estimate Y value.
E : an error value representing all unaffected factors.

2.3. Method of Collecting Data
Methods of data collection are as follows:
   a. The survey was conducted by filling out a questionnaire for visitors to Cinde market. The questionnaire survey was conducted for 11 hours starting at 07.00 am - 18.00 pm with the quantity of respondents as much as 205 respondents.
   b. The survey location of Cinde market visitor questionnaire was distributed in market and its surroundings located at Jenderal Sudirman Street Palembang and bordering Letnan Jaimas Street, and R. Nangling Street as can be seen in fig. 1.
2.4. Identification Variables
The identification of the independent variables and dependent variables used in the market visitor trip attraction model are as follows:

a. Current construction or existing conditions
The criterion variables and the predictor variables used in this research at the time of development are as Table 1:

| Variables                      | Symbols |
|--------------------------------|---------|
| Trip / trip attraction         | Y       |
| Family Status                  | X1      |
| Gender                         | X2      |
| Jobs                           | X3      |
| Arrival time                   | X4      |
| Distance from residence        | X5      |
| Duration of Shopping           | X6      |
| Transportation Used            | X7      |
| Goods purchased                | X8      |
| Total expenditure              | X9      |
| Visitor earnings               | X10     |

b. After construction or after on land use development
The criterion variables and the predictor variables used after the development are as Table 2:

| Variables                      | Symbols |
|--------------------------------|---------|
| Trip/Trip attraction           | Y       |
| Family Status                  | X1      |
| Gender                         | X2      |
| Jobs                           | X3      |
| Arrival Time                   | X4      |
| Distance from residence        | X5      |
| Duration                       | X6      |
| Transportation used            | X7      |
| Goods purchased                | X8      |
2.5. **Analysis Methods**

The analysis method of the attraction data used in this study was multiple linear regression analysis with stepwise method to generate model of visitor attraction to market.

3. **Result and Discussion**

Processing and data analysis of the research of trip attraction of the Cinde market are as follows:

1. Trip attraction to Cinde market during construction condition.
2. Trip attraction to Cinde market after construction of Plaza Andiron.

3.1. **Trip Attraction to Cinde Market During Construction**

Processing and data analysis for modeling of trip attraction to market was using mathematical modeling which is correlation between criterion and predictor variables. The analysis was calculated by multiple linear regressions using stepwise method.

From the result of data processing using SPSS, the criterion variables entered into multivariate analysis are type of profession (X3), transportation used (X7), types of goods purchased by visitors(X8). ANOVA Test/F Test is one of the model feasibility tests or also called model reliability test. If the probability score < α = 0.05, then the estimated regression model is feasible/reliable. Table 3 shows the ANNOVA test result:

| Model     | Sum of Squares | df  | Mean Square | F        | Sig. |
|-----------|----------------|-----|-------------|----------|------|
| Regression| 14.745         | 3   | 4.915       | 92.653   | .000 |
| Residual  | 10.663         | 201 | .053        |          |      |
| Total     | 25.408         | 204 | .053        |          |      |

* a Criterion Variable: Arrival Frequency.
* b Predictors: (Constant), Transportation Used, jobs, and goods purchased.

The multicollinearity test is one of the classical assumption tests. The multicollinearity test between variables is not occurred if the VIF value is less than 5. Table 4. shows multicollinearity test results. The auto-correlation test is also one of the classical assumption tests (table 5). An autocorrelation test was performed to estimate the linear regression model freed from auto-correlation by looking at the value of Dubbin-Watson.

| Model      | Unstandardized Coefficients | Standardized Coefficients | Collinearity Statistics |
|------------|----------------------------|----------------------------|--------------------------|
|            | B  | Std. Error | Beta | t   | Sig. | Tolerance | VIF  |
| (Constant) | .632| .068       | -.9289| .000|      |           |      |
| Transportation | .107| .011       | .491 | 9.604| .000 | .800      | 1.249|
| Jobs       | .094| .017       | .273 | 5.656| .000 | .896      | 1.116|
| Goods Purchased | .043| .008       | .265 | 5.430| .000 | .879      | 1.138|

* a Predictor Variable: Arrival Frequency.

| R          | R Square | Adjusted R Square | Std. Error of The Estimate | Dubbin-Watson |
|------------|----------|-------------------|---------------------------|---------------|
| .762a      | .580     | .574              | .23032                    | 1.920         |

* a Predictor: (Constant), Transportation, Jobs, and Goods purchased.
* b Criterion Variables : Arrival Frequency.
With the $R^2$ value of 0.580 indicates that the proportion of the effect of the variables of the type of work, the transportation used and the type of goods purchased by the Cinde market visitors to the arrival frequency variable is 58%. The results obtained by modeling the data processing using multiple linear regressions as follows:

$$Y = 0.094X_3 + 0.107X_7 + 0.043X_8 - 0.632$$  \hspace{1cm} (3)

From the regression equation, it can be analyzed as follows:

a. The Profession regression coefficient ($X_3$) has a positive value means that the type of profession influences the trip increase/the frequency of visitor arrivals to Cinde market 0.094.

b. The transportation regression coefficient used ($X_7$) has a positive value meaning that each additional vehicle loading will increase trip/frequency of visitor arrivals to Cinde market 0.107.

c. The regression coefficient of goods purchased ($X_8$) is positive value means that each addition of one type of goods purchased will increase trip/frequency of visitor arrival to Cinde market 0.043.

3.2. Trip Attraction to Cinde Market After Construction

Processing and data analysis for modeling of travel attraction to Cinde market using mathematical modeling is correlation relationship between criterion variables and predictor variables. The analysis was done by multiple linear regression using stepwise method.

From the result of data processing using SPSS the predictor variables entered into multivariate analysis are type of profession ($X_3$), transportation used ($X_7$), and type of goods purchased by visitors ($X_8$). ANOVA Test/F Test is one of the model feasibility tests or also called model reliability test. If the prob. score < $\alpha = 0.05$, then the estimated regression model is feasible/reliable. Table 6 shows the ANOVA test results:

|       | Sum of Squares | df | Mean Square | F      | Sig.  |
|-------|----------------|----|-------------|--------|-------|
| Regression | 15.879         | 3  | 5.293       | 103.203 | .000b |
| Residual  | 10.309         | 201| .051        |        |       |
| Total    | 26.188         | 204|             |        |       |

* Criterion Variable: Arrival Frequency.

* Predictor: (Constant), Transportation Used, Goods purchased, and Jobs.

The multicollinearity test is one of the classical assumption tests. The multicollinearity test between variables is said not to occur if the VIF value is less than 5. The following Table 7 shows test results:

| Model             | Unstandardized Coefficients | Standardized Coefficients | Collinearity Statistics |
|-------------------|-----------------------------|---------------------------|-------------------------|
|                   | B   | Std. Error | Beta | t     | Sig.   | Tolerance | VIF  |
| (Constant)        | -.651| .066       | -9.842| .000 |       |       |       |
| Transportation    | .066| .008       | .385 | 8.022| .000  | .852     | 1.174 |
| Goods purchased   | .089| .010       | .398 | 8.589| .000  | .910     | 1.099 |
| Jobs              | .116| .016       | .331 | 7.185| .000  | .924     | 1.082 |

* Predictor Variable: Arrival Frequency.

The auto-correlation test is also one of the classical assumption tests. An auto-correlation test was performed to estimate the linear regression model freed from auto-correlation by looking at the value of Dubbin-Watson. The following Table 8 shows the results of the auto-correlation test:


### Table 8. Summary Model

| R  | R Square | Adjusted R Square | Std. Error of The Estimate | Dubbin-Watson |
|----|----------|-------------------|---------------------------|---------------|
| .779\(^a\) | .606 | .600 | .22647 | 1.961 |

\(^a\) Predictors: (Constant), Transportation, Goods Purchased, and jobs.

\(^b\) Criterion Variable: Arrival Frequency.

With the \(R^2\) value of 0.606 indicates that the proportion of the effect of the variables of the type of work, the transportation used and the type of goods purchased by the Cinde Market visitors to the arrival frequency variable is 60.6%. The results obtained by modeling the data processing using multiple linear regressions as follows:

\[
0.116X_3 + 0.066X_7 + 0.089X_8 - 0.651
\]

From the regression equation, it can be analyzed as follows:

a. The coefficient of regression of profession (\(X_3\)) is positive value means that the type of profession has an effect on to increase trip/visitor arrival frequency to Cinde market 0.116.

b. The transportation regression coefficient used (\(X_7\)) has a positive value meaning that each additional transportation loading will increase trip/frequency of visitor arrivals to market 0.066.

c. The regression coefficient of goods purchased (\(X_8\)) is positive value means that every addition of one goods purchased will increase trip/frequency of visitor arrival to Cinde market 0.089.

### 4. Conclusion

Based on the results of data analysis that has been done, it can be concluded as follows:

a. The result of trip attraction model to Cinde market at construction process is \(Y = 0.094 X_3 + 0.107 X_7 + 0.043 X_8 - 0.632\) with \(R^2\) value of 0.580. If seen from the value of \(R^2\) value shows that the proportion of the effect of profession type variables, transportation used, and types of goods purchased by Cinde market visitors to the arrival frequency variable of 58%. The type of visitor work influences the increase of trip/arrival frequency of 0.094, each additional vehicle loading will increase trip/arrival frequency by 0.107 and every addition of one type of goods to be purchased will increase trip / frequency of visitor arrival to Cinde market by 0.043.

b. The result of trip attraction model to Cinde market after on land use development Plaza Cinde Aldiron is \(Y = 0.116 X_3 + 0.066 X_7 + 0.089 X_8 - 0.651\) with \(R^2\) value of 0.606. The result of \(R^2\) value shows that the proportion of the effect of profession type variables, transportation used and types of goods purchased by Cinde market visitors to the arrival frequency variable of 60.6%. The type of visitor work influences the increase of trip/arrival frequency of 0.116, each additional vehicle loading will increase trip/arrival frequency by 0.066 and every addition of one type of goods to be purchased will increase trip/frequency of visitor arrival to Cinde Market by 0.089.

c. Factors influencing trip attraction Cinde market visitor on existing condition or during construction and after the development of land use is the type of visitor work, the transportation used, and the type of goods purchased by market visitors. With these factors will increase the trip of visitors to Cinde market.

### References

[1] Rita R, Ismail A M and Asmirza M S 2005 J Trip Attraction Models in Traditional Markets Case Study : Padang Bulan Medan Market vol 2 (in Indonesia)

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