The Application of Index Model for Valuation a New Gas Station

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Abstract. Index Model is a method for location valuation. The highest index value is 5 meant that very reasonable while the lowest value is 1 which meant something very unworthily. There are two factor to determine index value. First, the level of gas demand measurement by activity approach within of 500 meters radius from the new location plan of gas station. Activity level is measured by counting the number of trading center, financial center and education center, social center within of 500 meters radius from the location. Second, the levels of competition and convenience of gas station location. The levels of competition is measured by count the number of gas station within of 500 meters radius, while the convenience location measure the distance to the nearest traffic light, land area of new gas station. The measurement is done with Geographical Information System (GIS). The method of this research used in order to measure the location compatible as index model. There are three levels of index model, first is to evaluate the levels of relative important in each criteria towards others criteria. Second, the data standardization for each criteria and third is counting index value with added up the multiplication between others criteria with each criteria standard value.

Keywords: Gas Station, Index Model, Gis

1. Introduction

One of the contributing factor that caused this fraud is location factor, where if the distance between one gas station with the other is too close, then it will lead to decreased turnover on each gas station. In Surabaya, for instance, there are two gas stations that are separated by distance which is less than 500 meter. This paper is strive to design a decision-support model for the new gas station based on Geographic Information System (GIS) by considering economic and geographic factor so that it is possible for the new gas station to avoid this decreased turnover problem. This economic factor is important because it's concerned of a long-time prospect, where theoretically, once a business is established then it is expected to have a long life cycle. Meanwhile, geographic factor is expected to support this life cycle to stay longer considering the ease of location accessibility and comfort level of the business. The location selection is a very critical process in every company as this decision determines the sustainability of the company itself. The fault on choosing a company location cannot be shortly changed because it involving a huge investment and had an impact on the whole company strategies (Zainab et al, 1996). With the result of this paper it is expected that the fault of location-choosing is not to be happen again. The method for valuation a location is index model. Index model calculates the index value for each unit area and produces a ranked map based on the index values. The weighted linear combination method is a common method for computing the index value (Malczewski, 2000). The method of weighted linear combination involves evaluation of three levels. First, the relative importance of each criteria, or factor, is evaluated against other criteria. Second, data for each criterion are standardize and third, the index value is calculated for each unit area by summing the weighted criterion values and dividing the sum by the total of the weigths. The main problem on this paper is how to applied the index model for valuation the new gas station.

2. Literature Review

The right location can be critical to the success of your business and poor decisions are usually difficult and expensive to overcome. Location is particularly important for retail businesses. When buying an established business it is still necessary to check the suitability of the location because it will be reflected in

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the price paid for goodwill. There are many factors to take into account when making a decision about the location of business, including customers, transport, the neighbourhood, finances and the longer term future.

For common people, the location selection is turns to be something easy and instinctively, that is based only on Gut Feeling (Bhushan and Tayal, 1979; Berman and Evans, 1992). But for the company, this matter is highly important. It is because the demand and bargain factor for the product is closely related with location selection. Many of the researchers assert the significance of location in determining company success, they are Hasty and Reardon (1997), Birkin et al (1996), and Berry (1976). Environment plays an important role in determining the success of a good location searching. This circumstance is including the sector of target customers. If the location is set within the target customer area, then the maximal profit will be achieved (Berman and Evans, 1992).

Location searching is a process in searching an appropriate location for the company. It is performed under the circumstances to develop a company to new region. It emphasized physical condition of the location and environmental to create the product's attracting and repellent factors. The position of location here needs to be seen as an inseparable entity with the surrounding factors. Bolen (1988) stated that every location in the earth had its analyzable advantages and disadvantages. These factors can be classified into 2 physical condition, they are real physical and analysis physical. Real physical is a visible condition in related area such as land condition, the width, and the distance from the highway company has criteria to see this real physical condition. Analysis physical, in the other hand, is physical condition obtained from physical analysis such as population analysis, neighborhood factor, and competitor analysis. Right after the entire strength and weakness are collected was the decision is to be made.

Location appraisal is a process of making a valuation against a location to choose the best one. Sorting of location searching will normally provide many locations to choose from. So to make a choice from several locations it is necessary to make assessment of each location (Ghosh, 1994). Location appraisal then will be used as a standard to obtain strong evidence in order to make a better choice. Location appraisal here is a process to make an assessment about a new locations obtained from location selection. This Assessment of the desired location involves several processes that is used in the current assessment is by using the Index model. Those locations will be evaluated with several established criteria.

3. Research Location

The research location is in Gubeng district in Surabaya City, Indonesia as shown Figure 1.
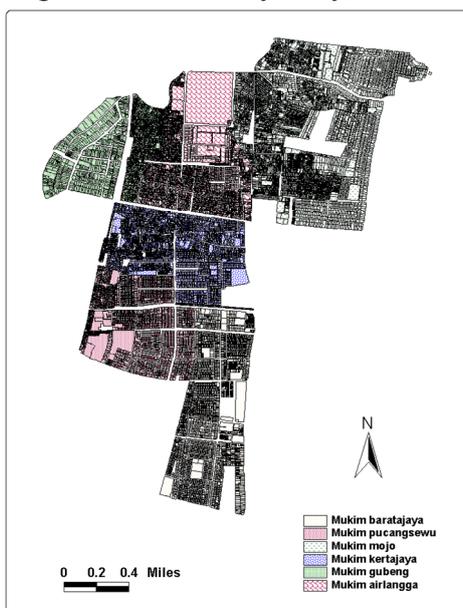

Fig 1. Gubeng District Map, Surabaya City

4. Index Model

Index models are commonly used for suitability analysis and vulnerability analysis (Kang Tsung Chang, 2008). The formula to count index value is as follow:

$$I_i = \sum_{i=1}^{n} W_i X_i$$

With I_i is the index value, n is the criterion, W is the weight and X is the standard value.

Basically there are 3 steps in calculation index value:

Step 1: Evaluated relative importance of each criteria against the other criteria or weighting.

Step 2: standardize the data for each criteria

Step 3: calculating index value by sum up the multiplication result between weighting with standard value if each criteria

Index value for gas station new location is established from market demand and competition level. If market demand is high, then feasibility value will be high to, and vice versa. If competition level is high then the feasibility will be low and vice versa. Market demand from gas station new location candidates is found with situational and activity approach around the gas station within the 500 meters radius. based on those approaches, there are 5 criteria for demand. They are:

- Number of trade center within 500 meters radius
- Number of houses within 500 meters radius
- Number of education center within 500 meters radius
- Number of financial center within 500 meters radius
- Number of social center within 500 meters radius

Competition level and ease of access are find by seeing the nearest gas station and ease traffic. Based on those approaches, there are 3 criteria to determine the competition level:

- Number of gas station within 500 meters radius
- Distance to the nearest traffic light
- Land area

The total of importance criteria is eight and weighting of each criteria shown in table 1.

Table 1. Weighting of 8 feasibility criteria on gas station new location

No	Criteria	Weight (%)
1	Number of trade center within 500 meters radius	13
2	Number of houses within 500 meters radius	8
3	Number of education center within 500 meters radius	9
4	Number of financial center within 500 meters radius	10
5	Number of social center within 500 meter radius	9
6	Number of gas station within 500 meters radius	20
7	Distance to the nearest traffict light	15
8	Land Area	16
Total		100

5. Result and Discussion

5.1. Result

The result is the system software of valuation a new gas station. The feasibility output from a new gas station location as shown in Figure 2.
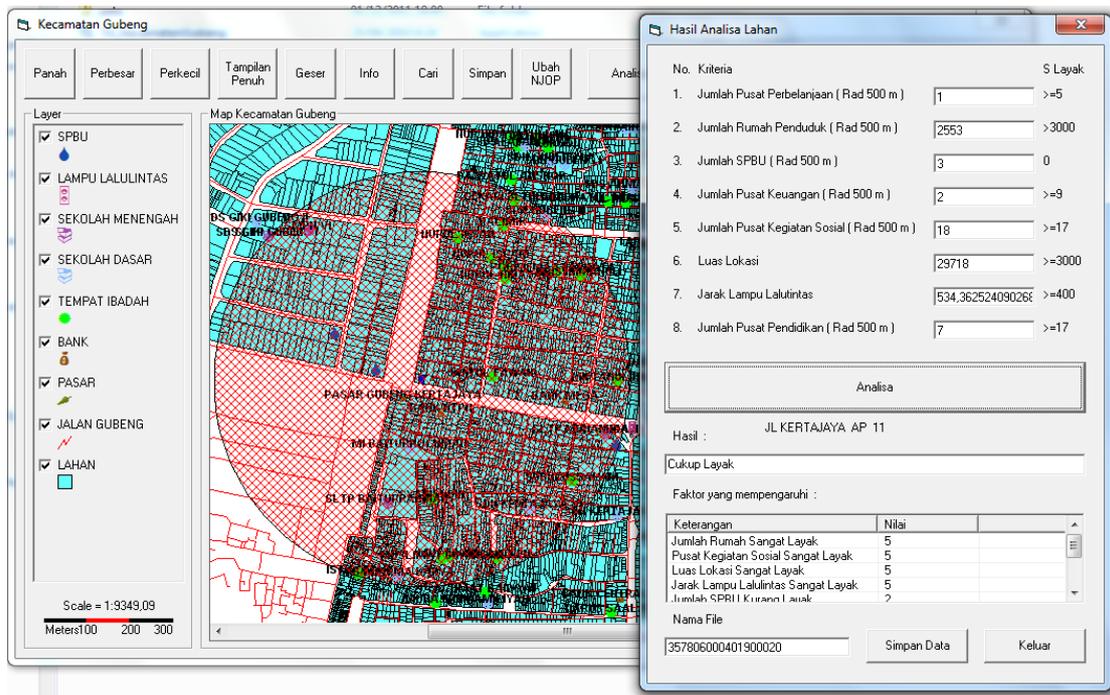
Fig 2. Feasibility a new gas station location

5.2. Discussion

Compare with similar model design by Nayan (2006), the difference lies on its methodology. The conceptual framework of Decision Support System (DSS) for Location of New Gas Station in Malaysia by Nayan (2006) shown in figure 3.
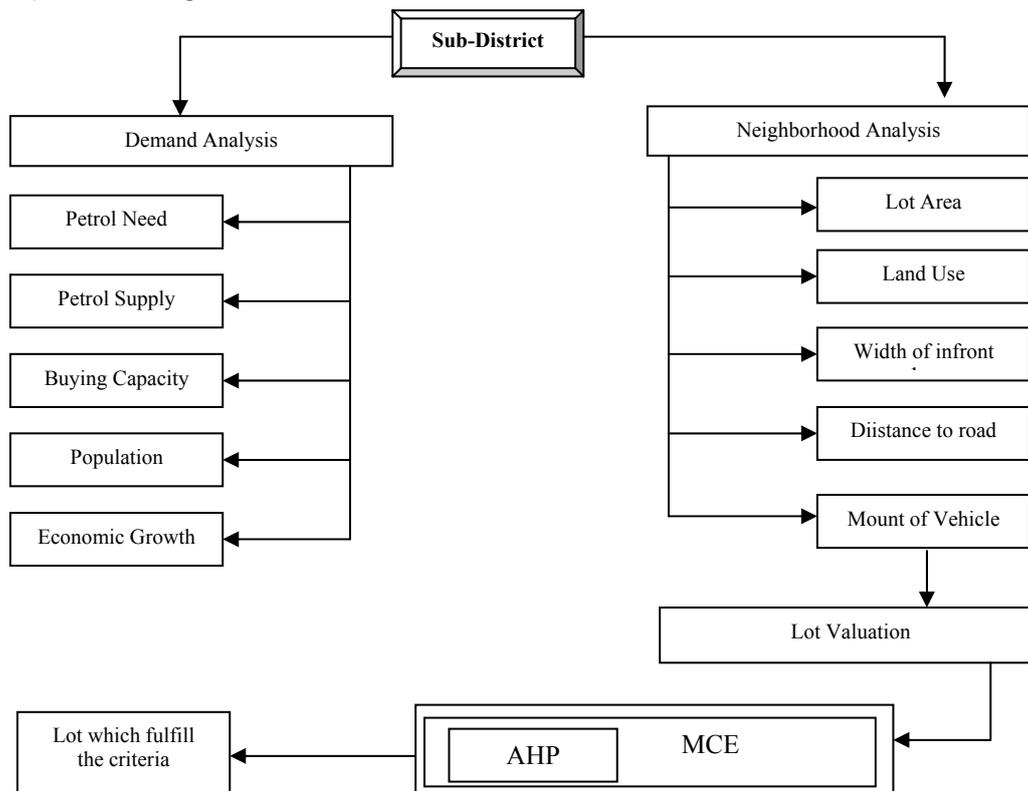

Figure 3: Conceptual Framework of DSS for the new location of Gas Station in Malaysia by Nayan (2006)

This paper is using index model, while Nayan's version was using Multi Criteria Analysis (MCA) combined with Analytical Hierarchical Process (AHP). Another difference is in this paper there are input of particular location. This system used combined tools between programming language Visual Basic and Map Object, while Nayan's version was using Avenue language in Arc View.

4

6. Conclusion and Future Recommendation

6.1. Conclusion

The main problem in this paper was how how to applied the index model for valuation the new gas station. Therefore the conclusion will be the analysis of new location candidate with the approach of demand and competition which able to create one system for assessment of gas station's new location. It will ease the users both in deciding the land location that will be analyzed and to interpret the result because there are only 5 index (Highly unfeasible, not feasible, fairly feasible, feasible and highly feasible). This model also can be used in the other region with some modification, especially within the radius of new gas station. Every region will have a special characteristic, for a region with low people density then radius from gas station location can be enlarged, and vice versa.

6.2. Future Recommendation

Another demand factors such as people purchasing level, the products price, the price of product substitution etc was not being studied in this paper yet, hence in future research the factors that affect demand level can be expanded. And so about competition level and the ease of location accessibility, there are more factor that had an impact on those two things while there are only three factors studied here, they are numbers of gas station within 500 meter radius, distance to nearest traffic light and the area of new gas station location. Other factors are ratio between the front yard against location's circumference, another gas station turnover within 500 meter radius, type of gas offered etc has not been used yet in this paper. Therefore for future research those factors can be used for competition level and ease of location accessibility variable to for better research output.

7. Acknowledgement

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