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Role of Green Infrastructure in Determining House Value in Labuan Using Hedonic Pricing Model

Nurul Nazyddah Mat Nazir*, Noriah Othman, Abdul Hadi Nawawi

Faculty of Architecture, Planning and Surveying, University of Technology MARA (UiTM), Shah Alam, Malaysia.

Abstract

This study is to look at the trends of the housing price affected by green infrastructure elements by using the Hedonic Price Approach. The researchers embark on these objectives; (a) to analyze the green infrastructure components that affect the housing market price; and (b) to examine the regression analysis on the Hedonic Pricing Model. Labuan Botanical Garden becomes a major green infrastructure component in this study. A survey questionnaire were distributed to 386 respondents lived in the housing area within 1800meter radius from Botanical Garden. Interview and observation were conducted during the study to examine the community preferences towards their housing area.

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Keywords: Green infrastructure; housing price; environment; botanical garden

1. Introduction

Generally, most of the housing development in each and every country relied on the economic perspectives and wealth of the nation (Chin and Chaw, 2003). As population shows a positive growth, demand on housing will be affected to cater the current demand on the housing sector. Nowadays, the development of new house has take into consideration on the environmental factors in order to obtain the sustainable development. Otherwise, it will contribute to the nature impact such as hazardous, soil erosion, land slide, flood and pollution. To ensure the preservation and conservation of the environment is well maintained apart from the new development, one of the approach has been introduced since 19th Century known as Green Infrastructure Approach. Green Infrastructure is a networking of green space in

* Corresponding author. Tel.: +603-55444351; fax: +603-5544 4353.
E-mail address: noriah403@salam.uitm.edu.my

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all spatial of environment which enhance the environmental quality in the area. It is consisting of park, open space, garden, street planting, trees, and vegetation (Benedict and Mc Mohan, 2002; Mansor et al., 2010). All types of Green Infrastructure components offer an ecosystem services to human being as well as animals thus their existence might influenced the pricing of the nearby properties based on the willingness to pay by the people. The major Green Infrastructure component that been highlights here is Labuan Botanical Garden as it is located approximately in the housing area.

Normally, a Botanical Garden serves universal functions towards the community in the area such as a recreational area for the community, research center and plant arboretums for the researchers (Mat Nazir, et al., 2014). Variety of information related on the form, habitat, quality of life and general biological and ecological relationship of the vegetation in the area can be found in the Botanical Garden. According to MacDougal (1990), there were special relation of plant and man in the environment as it is quiet prominent to the horticultural and economic growth of an area in a nation. Apart from that, a Botanical Garden must be placed in the easy and accessible route as well as in between reasonable walking distance as it become a focal point for the residents in the residential area to have their relax time, recreation with family and to learn about the flora and fauna during weekdays and weekends,

Besides that, Botanical Garden must function as pleasing with the natural landscape and ecological system. It is to create a balance on the nature with a variety of human activities (Shukur, et al., 2010; Mat Nazir, et al., 2014). Hence, a Botanical Garden has establishing a networking of a natural area (Kithiia and Lyth, 2011). On top of that, it should be attractive resources to attract the community. At the same time, a garden may become one of attraction for tourist, visitor or investor to work and live in the area (Shukur et al., 2010). It happens because the spill over of this Botanical Garden offers welcoming externalities to the surrounding residents (Jim and Wendy, 2010). By right, the visitors and the community will benefit from and be pleased on the scenery view and desirable living environment surrounding their housing area.

2. Literature Review

Recently, most of new developments projects especially on housing sector have promote the trend of eco-friendly lifestyle to preserve their environment (Morgan, 2009). Eco-friendly are activities that provide a positive impact to our nature as well as gives benefits to our future generation. Nowadays, people are engaged with this eco-friendly term because they are very concerned about their health from time to time (Defra, 2011; Mat Nazir, et al., 2014). It is proof by scholar named Islam (2008), where public are more aware about their environment as they always find out the best way to improve the condition of their environment. In relation to that concept, Green Infrastructure approach acts as one of the eco-friendly function towards sustainable development. Apart from that, other scholars, Benedict and McMahon (2002) stressed that Green Infrastructure networks consist of two medium. The two medium are hubs and links. A hubs is referring to the main place for the human and ecosystem and a link refers to the inter connection from one hub to another. Basically, the hub and the link have its own purposes due to the current needs, place and situation. So, for this study, the hubs will be the housing area and Botanical Garden. Where, all the Green Infrastructure elements act as a link to the hubs.

Experience and understanding on the Green Infrastructure elements become one of the indicators on enhancing the quality of life in the neighborhood and community in the European countries. Nowadays, many people has realized on the use and benefits of the Green Infrastructure in their daily life. However, in developed countries, the awareness level still lack on it and it somehow contributes to the lack of availability knowledge on Green Infrastructure and lack of connectivity with the Green Infrastructure element itself (Chiesura, 2004; Mansor et al., 2011; Mell, 2012).

3. Methodology

This study has used two types of methodology which are the quantitative and qualitative methods. Figure below shows an overview on the research methodology of this study. There were two types of approach were used in this study which called Research Approach and Research Methods. The approach for this research is by using both methods; mixed method approach. The mixed method approach is covers on the quantitative approach and qualitative approach. The Qualitative approach is referring on the survey form distribution and analysis of Special Packages of Social Science (SPSS). The quantitative approach involved an interview with Local Authority, Developer, community, respondents and stakeholder. This study also involved researcher observation and fieldwork survey. For this context of study, checklist was used to record every elements and structures that exist at the housing area and botanical garden from researchers' behavioural observation. This helps the researchers to determine and to understand the physical characteristics of existing GI attributes and network formation in the study area. Then, an interview with the local authority, developer and community were conducted. Next step is the distribution of survey questionnaire form to the 386 respondents in the study area. The time frame of the survey distribution is approximately 3 month started from January 2013 to Mac 2013. Finally, after all form and data was collected, the process of data key in was conducted using the software of Social Packages on Statistical System (SPSS version 20.0). The data key in process, took about two weeks within 5th of April 2013 to 20th April 2013. After the process of data key in, analysis of data was conducted using the same software; descriptive statistic, ranking of mean result, correlation and multiple regression were produced.

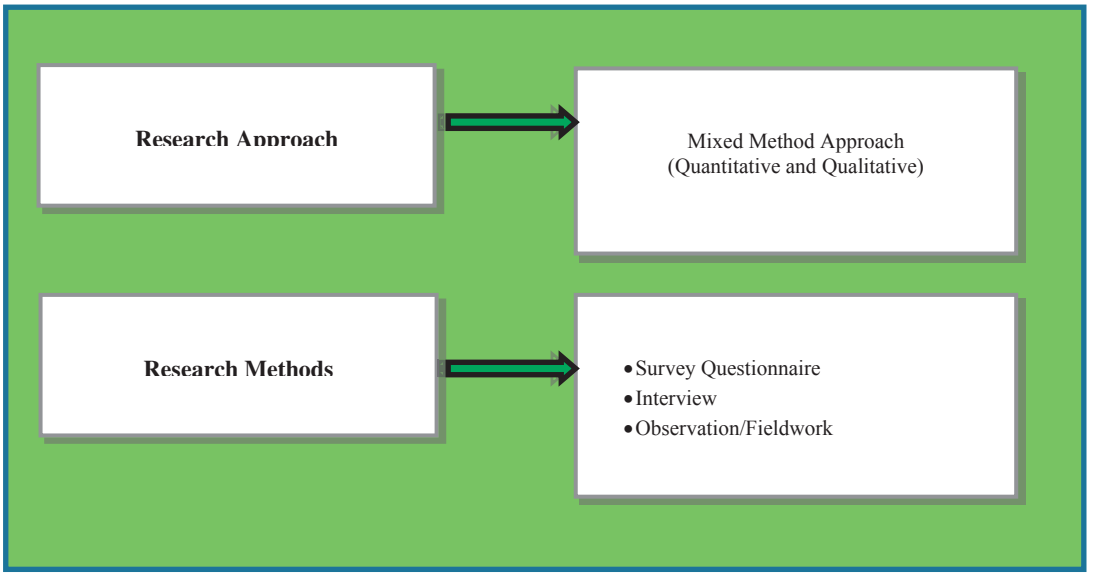

Fig. 1. Existing green infrastructure components in study area

4. Study Area

In the context of this study, Labuan Botanical Garden has been chosen as the main GI component as it is located approximately to the housing area. Generally, it serves a recreational area, plant arboretum area

and research center. Most of the people in the community use the facilities provided frequently. Basically, the Labuan Botanical Garden was developed in 1852 with total area of 50 acres. It is one of a recreational park consists of varieties of trees and beautiful scenery in Labuan. The park possesses amazing landscape and beautiful old trees. It offers huge perimeter houses, a hibiscus garden of different species, herbal garden with a variety of herbs and spices, a reading corner, a man-made lake with an arched bridge, a reflexology pathway, a tai-chi ground and other community activities. It provides a pedestrian walkways, bike path and road for easy access.

Fig. 2. Location plan and radius of study area (450m, 900m, 1800m)

The map above (Figure 2) shows the housing area that was involved in this study. It has been highlighted in 1800 meter radius from the Labuan Botanical Garden. The housing areas are Taman Guan Huat 1 (18 units), Lazenda Villa 7 (26 units), Amananda 18 (18 units), Taman Danta Ria (21 units), Taman Cheong Soon (24 units), Taman Wong Wo Lo (39 units), Taman Miramar (60 units), Taman Guan Huat 2 (44 units), Taman Island (42 units), Taman Jasa (24 units), Taman Kawan-Kawan (40 units), Taman Ragah (30 units). Basically, total numbers of the housing units are 386 units. Total area for this study area is 908.02 hectares with population of 1,158 people.

5. Findings

5.1. Frequency of respondents

For the context of this study, total respondents were 386 people. It was based on 12 selected housing areas. Based on the survey results, only 63% (237) of them willing to answer all questions in the questionnaire form. The other 37% (149) declined. From all the respondents, 62% are male respondents and 38% are female respondents living in the radiuses 1800 meters in the study area. According to the output of the survey, the Malays represented the majority of ethnicity of the respondents with 39% and the Indian was the lowest ethnicity with 1%. The largest percentage of the respondents (72%) was adults

between ages of 21 to 45 years old. Majority of the respondents resided in the study area between 1 to 5 years. The respondents of this study were from the 4 to 6 family size. Most of the respondents (74%) were married. From the total answered respondents of 237, 85% of them were aware on GI components in their housing area. Only 15% of them were not aware of the GI components.

From the results, the frequency of awareness on GI among respondents from Malaysia was 89% equal to 180 people while 11% were non Malaysian that aware of the GI elements in their housing area. The non-Malaysian in this study consist of respondents from America, Saudi Arabia, Philippine and Indonesia.

5.2. Frequency of house type

Based on the radius of 1800 meter from the housing area, 4 types of housing was point it out. Based on the Table 1 and Figure 3 below, double storey terrace house recorded the highest percentage in the study area with 43 percent equal to 106 units. It is followed by double storey semi detached house 32 percent equal to 74 units. Next is bungalow house with 13 percent equal to 30 unit of house and last but not least is single storey terrace with 12 percent equal to 27 units of house.

Table 1.Frequency of house type in study area

Type of House	Frequency	Percent
Single Storey Terrace	27	12
Double Storey Terrace	106	43
Double Storey Semi Detached	74	32
Bungalow	30	13
Total	237	100

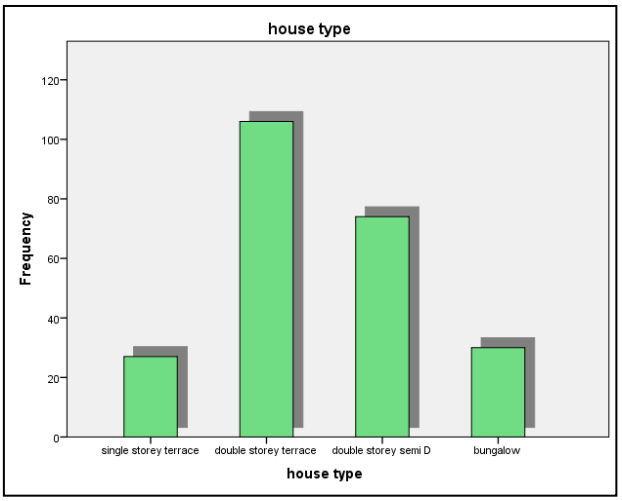

Fig. 3. Frequency of different type of house

6. Discussion and Analysis

6.1. Analysis of coefficient

The table below shows the coefficient analysis obtained from the survey conducted by researchers. It is used to calculate the housing price based on Model 28.

Table 2.Coefficient analysis

Model	β	t	Sig.
(Constant)	530997.641		.001
distance to town	60019.131	.995	.000
distance to fire bridged	-173065.630	-.805	.000
distance to commercial centre	44352.914	.612	.000
Number of bedroom	17189.616	.180	.000
parking area	36244.894	.309	.000
GI-housing area has water bodies	17189.616	.180	.000
GI-housing area located in sloping land	25223.794	.287	.000
GI-housing area has community centre	6605.228	.091	.017
GI-distance to work place	48215.441	.453	.000
GI-housing area located near to masjid/religious centre	38055.454	.365	.000
lot size (sq ft)	125.633	.138	.000
house extension	9838.275	.102	.001
number of bathroom	6663.349	.064	.001
green parking space	25005.959	.275	.000
Material of house	19172.714	.190	.000
increased privacy	48215.441	.453	.000
reduce traffic congestion	19041.848	.189	.000
increase social interaction	28906.149	.274	.000
age of the house	17935.335	.173	.000
GI-solar system	6347.090	.088	.025
GI-housing area has proper perimeter road/access road	12746.128	.144	.000
sale price/rental price	8162.928	.062	.004
GI-housing area located near to bus and taxi stand	10699.562	.133	.000
GI-easy access to park/botanical garden	14701.940	.157	.001
GI-facilities for disabled people	9950.485	.075	.001
GI_easy access to school	10670.716	.091	.005
GI-distance to nearest greenway.	10502.445	.114	.001
GI-distance to police station	42724.906	.590	.000

*Dependent variable is Market Price

6.2.

Multiple regression

They were a following form to extract the Multiple Regression Hedonic Pricing Model. (Shukur, 2010). Equation below shows the variables of the study.

$$Y = \beta 0 + \beta 1X1 + \beta 2X2 + \beta 3X3 + \beta 4X4 + \beta 5X5 + \beta 6X6 + \beta 7X7 + \beta 8X8 + \beta 9X9 + B10X10 + \beta 11X11 + \beta 12X12 + \beta 13X13 + \beta 14X14 + \beta 15X15 + \beta 16X16 + \beta 17X17 + \beta 18X18 + \beta 19X19 + \beta 20X20 + \beta 21X21 + \beta 22X22 + \beta 23X23 + \beta 24X24 + \beta 25X25 + \beta 26X26 + \beta 27X27 + \beta 28X28 + e$$

Where,

Y = is the dependent variable (market price)

X1, X2, X3, X4, X5, X6, X7, X8, X9, X10, X11, X12, X13, X14, X15, X16, X17, X18, X19, X20, X21, X22, X23, X24, X25, X26, X27 and X28 are the dependent variables

X1= Distance to Town (1 if near to town; 0 if not)
X2= Distance to Fire Bridged (1 if near to fire bridged; 0 is not)
X3= Distance to Commercial Centre (1 if near to commercial centre; 0 if not)
X4= Parking Area (1 if has parking area; 0 if not)
X5= Housing Area Has Water Bodies (Green Infrastructure) (1 if has water bodies; 0 if not)
X6= Housing Area Located in Sloping Land (Green Infrastructure) (1 if located in sloping land; 0 if not)
X7= Housing Area Has Community Centre (Green Infrastructure)(1 if has community centre; 0 if not)
X8= Housing Area Located Near to *Masjid*/Religious Centre (Green Infrastructure) (1 if located near to to *Masjid*/Religious Centre; 0 if not)
X9= Lot Size (1 if corner lot; 0 if not)
X10= House Extension (1 if house extended; 0 if not)
X17= Perimeter Road and Access Road (Green Infrastructure) (1 if has proper road; 0 if not)
X18= Sales Price (1 if affordable; 0 if not)
X19=House Located Near to Bus Stop and Taxi Sand (Green Infrastructure) (1 if near to bus stop and taxi stand; 0 if not)
X20= Easy Access to Botanical Garden or Park (Green Infrastructure) (1 if easy access to Botanical Garden or Park; 0 if not)
X21= Easy Access to School (Green Infrastructure) (1 if easy access to school, 0 if not)
X22= Distance to the Nearness Greenway (Green Infrastructure) (1 if nearest to greenway; 0 if not)
X23=Number of bedroom (1 if additional bedroom; 0 if no)
X24=Distance to work place (Green Infrastructure) (1 if near; 0 if not)
X25=Material of house (1 if brick; 0 if wood)
X26=Solar System (Green Infrastructure) (1 if use solar system; 0 if not)
X27=Facilities towards disabled people (Green Infrastructure) (1 if provided; 0 if not)
X28=Distance to Police Station (1 if near; 0 if not)

β0 is a Constant Value. Where the β1, β2, β3, β4, β5, β6, β7, β8, β9, β10, β11, β12, β13, β14, β15, β16, β17, β18, β19, β20, β21, β22, β23, β24, β25, β26, β27 and β28 are the coefficient of the independent variables in the study and the e is stand for an error.

6.3. Equation regression

The equation estimation for Hedonic Pricing Model are as below:

$$Y = RM\ 530{,}997.641 + RM\ 60{,}019.131X1 - RM\ 173{,}065.630X2 + RM\ 44{,}352.914X3 + RM\ 36{,}244.894X4 + RM\ 17{,}189.616X5 + RM\ 25{,}223.794X6 + RM\ 6{,}605.228X7 + RM\ 38{,}055.454X8 + RM\ 125.633X9 + RM\ 9{,}838.275X10 + RM\ 6{,}663.349X11 + RM\ 25{,}005.959X12 + RM\ 48{,}215.441X13 + RM\ 19{,}041.848X14 + RM\ 28{,}906.149X15 + RM\ 17{,}935.335X16 + RM\ 12{,}746.128X17 + RM\ 8{,}162.928X18 + RM\ 10{,}699.562X19 + RM\ 14{,}701.940X20 + RM\ 10{,}670.716X21 + RM\ 10{,}502.445X22 + RM\ 17{,}189.616X23 + RM\ 48{,}215.441X24 + RM\ 19{,}172.714X25 + RM\ 6{,}347.090X26 + RM\ 9{,}950.485X27 + RM\ 42{,}724.906X28 + e$$

This study involves the dummy variables, X1, X2, X3, X4, X5, X6, X7, X8, X9, X10, X11, X12, X13, X14, X15, X16, X17, X18, X19, X20, X21, X22 , X23, X24, X25, X26, X27, and X28 has been coded as 0 and 1 based on the status of variables to incorporating to the Regression Model. So for this study, two different equations has produced based on the dummy variables (0 and 1).

6.4. Equation 1 (Regression for dummy variables is 0)

Assuming that dummy variables is 0, the equation and calculation of house price are as below:

$$\hat{Y} = RM\ 530{,}997.641 + RM\ 60{,}019.131(1) - RM\ 173{,}065.630(0) + RM\ 44{,}352.914(1) + RM\ 36{,}244.894(0) + RM\ 17{,}189.616(0) + RM\ 25{,}223.794(0) + RM\ 6{,}605.228(0) + RM\ 38{,}055.454(0) + RM\ 125.633(0) + RM\ 9{,}838.275(0) + RM\ 6{,}663.349(0) + RM\ 25{,}005.959(0) + RM\ 48{,}215.441(0) + RM\ 19{,}041.848(0) + RM\ 28{,}906.149(0) + RM\ 17{,}935.335(0) + RM\ 12{,}746.128(0) + RM\ 8{,}162.928(0) + RM\ 10{,}699.562(0) + RM\ 14{,}701.940(1) + RM\ 10{,}670.716(0) + RM\ 10{,}502.445(0) + RM\ 17{,}189.616(0) + RM\ 48{,}215.441(0) + RM\ 19{,}172.714(1) + RM\ 6{,}347.090(0) + RM\ 9{,}950.485(0) + RM\ 42{,}724.906(0) + e$$

$$\hat{Y} = RM\ 669{,}244.34$$

6.5. Equation 2 (Regression for dummy variables is 1)

Assuming that dummy variables is 1, the equation and calculation of house price are as below:

$$\hat{Y} = RM\ 530{,}997.641 + RM\ 60{,}019.131(1) - RM\ 173{,}065.630(1) + RM\ 44{,}352.914(1) + RM\ 36{,}244.894(1) + RM\ 17{,}189.616(1) + RM\ 25{,}223.794(1) + RM\ 6{,}605.228(1) + RM\ 38{,}055.454(1) + RM\ 125.633(1) + RM\ 9{,}838.275(1) + RM\ 6{,}663.349(1) + RM\ 25{,}005.959(1) + RM\ 48{,}215.441(1) + RM\ 19{,}041.848(1) + RM\ 28{,}906.149(1) + RM\ 17{,}935.335(1) + RM\ 12{,}746.128(1) + RM\ 8{,}162.928(1) + RM\ 10{,}699.562(1) + RM\ 14{,}701.940(1) + RM\ 10{,}670.716(1) + RM\ 10{,}502.445(1) + RM\ 17{,}189.616(1) + RM\ 48{,}215.441(1) + RM\ 19{,}172.714(1) + RM\ 6{,}347.090(1) + RM\ 9{,}950.485(1) + RM\ 42{,}724.906(1) + e$$

$$\hat{Y} = RM\ 952{,}438.99$$

The Equation 2 shows the interrelationship of the house price with all the Green Infrastructure variables which contributes to the new housing price in selected housing area. Based on the equation, the total price of house has been increase from RM 530, 997.64 to RM 952,438.99. The result indicates 79 percent greater than the constant price.

7. Major Findings

The major findings for this research were:

- Most of the respondents were aware with the Green Infrastructure components.
- There are varieties of Green Infrastructure components in the study area which been categorized into hub and
  linkages such as botanical garden, street trees, pocket planter, ornamental trees, pedestrian walkways, private
  garden, playground and many more.
- Green Infrastructure is the best approach to preserve and conserve our natural life support system and balance the
  ecosystem of human being as well as flora and fauna.
- Green Infrastructure contributes to the housing market price in Labuan housing area.

8. Conclusion and Recommendation

In short, for future research, the researchers suggest other Green Infrastructure elements to be included into the study to find out the trend of output and results. Besides that, the future study also can be expanding into the bigger radius for the purpose of getting bigger respondents. In addition, other locations in Borneo should be taken into consideration for future study in order to find out the effectiveness of the Green Infrastructure in in determining the housing prices at various locations in Malaysia.

In the context of study, it is positively shows that Green Infrastructure has contributes indirectly towards the house and property price as per revealed by the previous researchers. It is clearly stated that a network of green open space and green elements is an essential part of urban redevelopment in the city and town area. By maintaining, preserving and conserving the nature, it will generate the economic growth of the city as well as the nation. It can be concluded that the Green Infrastructure elements provides benefits towards the community in term of economic, social and environment.

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