

# The Rate of Green Concept Application in a House Design and Its Impact on Market Value

Shasya Agita Elizabeth<sup>1\*</sup>, Khaira Amalia Fachrudin<sup>2</sup>, Dwira Nirfalini Aulia<sup>3</sup>

<sup>1</sup>Magister Manajemen Properti dan Penilaian, Sekolah Pascasarjana, Universitas Sumatera Utara, Medan, Indonesia

<sup>2</sup>Faculty Economic and Business, Universitas Sumatera Utara, Medan, Indonesia

<sup>3</sup>Departement of Architecture, Faculty of Engineering, Universitas Sumatera Utara, Medan, Indonesia

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Abstract: The green architecture concept is the solution for environmental problems in this present time. However, there are still few houses that apply the green concept in North Sumatera, either inside or outside the housing estate. This study aims to analyze the rate of green concept application in a house design and its impact on the market value. The research is conducted using a purposive sampling method with four independent variables (the use of eco-friendly materials, energy efficiency, water conservation, and the use of renewable energy), and three controlling variables (land area, building area, and position) by distributing 50 questionnaires to the residents of Citraland Bagya City housing estate. The findings show that the rate of green concept used in the house design in the study area is low, that is evident in the significance value of each variable which is higher than alpha. Furthermore, there is an implication that market value of a property nowadays has not been affected by green concept application due to people lack understanding and awareness of the importance of the green concept, which makes appraisers hard to have comparable market data while assessing the value of a property that applies the green concept.

## 1 INTRODUCTION

House is the primary need for every people. It serves as a residence, shelter, investment, and even representation of a family's social identity (Aulia & Bahri, 2012).

Global warming that is worsening the earth condition nowadays force people to be more concerned in save the environment in various aspects of life – in attitude, behavior, lifestyle, systems in the building – for they contribute to climate change. The concept of the eco-friendly house, such as green architecture concept, then becomes a solution to solve this problem (Tan, 2013). This solution could work by reducing the consumption of energy resources and greenhouse gas emissions (Popescu *et al.*, 2009). Furthermore, Fachrudin said that in the financial aspect, the implementation of sustainable design also could optimize the operational cost and increase the value of the building (Fachrudin and Fachrudin, 2015).

Along with the increasing need for property valuation, appraisers must follow up the growth of building technology either. This will lead appraiser

to include the sustainable design factor as an adjustment factor in valuation process.

In Medan City, green concept application has not widely known, shown by there are still a few houses that apply the green concept, either inside or outside a housing estate. Moreover, most people still assume that green concept is only about the color applied in the house or plantation of trees around the house (Fachrudin and Fachrudin, 2017).

Therefore, it is essential to examine the rate of green concept application in a house design and its impact on market value, so that in the future, ordinary people, developers, and appraisers will not make mistakes again in determining the selling price, buying price, and market value of a property that apply the green concept. This research aims to: (1) analyze the rate of eco-friendly materials use in a house design and its impact on market value; (2) analyze the rate of energy efficiency application in a house design and its impact on market value; (3) analyze the rate of water conservation application in a house design and its impact on market value; (4) analyze the rate of renewable energy use in a house design and its impact on market value. Furthermore,

this study expects to enrich people knowledge of sustainable design issue, so that in the future time it can be implemented in the development of environmentally friendly property in Indonesia.

## 2 LITERATURE REVIEW

### 2.1 Green Building

Green architecture concept is the solution of the environmental problems in this present time. As the criteria of green building in Indonesia, the architect must consider the sustainability of the building aspect to the tropical climate and high humidity (Aulia *et al.*, 2017). Green building is a building that in design, construction, and operation, reduces the negative impacts, and gives the positive impacts on the climate and natural environment (<http://www.worldgbc.org/what-green-building> accessed on 29 March 2017). Another definition, Olgyay and Herd (2004) said that green building is an application of applied ecology, in which the architect understands the constitution, organization, ecosystem structure, and architectural impact from an environmental perspective.

Azizi and Wilkinson (2015) said that the green building occupants have a better energy-saving attitude than those who live in a conventional building. Even the World Green Building Council (WGBC) states that buildings that apply the green concept take part in the preservation of natural resources and improve the quality of life (<http://www.worldgbc.org/what-green-building>).

Ali and Nsairat (2009) classify three dimensions of green building: (1) environmental aspect, which consists of site selection, energy, water, resources materials, components, environmental circulation, transportation, emission, and waste; (2) social aspect, which consists of comfort, health and environmental quality, access to facilities, participation, education control, and security; (3) economic aspect, which consists of efficiency, running cost, capital cost, operational cost, endurance, adaptability, and maintenance.

### 2.2 Valuation

Valuation is one of the service sectors that play a role to determine the economic value of someone assets (Djati *et al.*, 2016). Based on Act No. 101 in 2014 about the Public Appraiser from Ministry of Finance, valuation is a process to provide a written opinion on the economic value of a valuation object

based on SPI (Indonesian Valuation Standard), where the SPI is the basic guideline that must be obeyed by every appraiser in conducting the valuation. A property valuation reflects the value of the property in the local market of the property (Leopoldsberger *et al.*, 2011).

There are three types of approaches in property valuation; market approach, income approach, and cost approach (Popescu *et al.*, 2009; Laila and Utomo, 2013; MAPPI, 2015). The most important thing for appraisers and ordinary people to know is that the valuation approach is different from the valuation method (Figure 1).

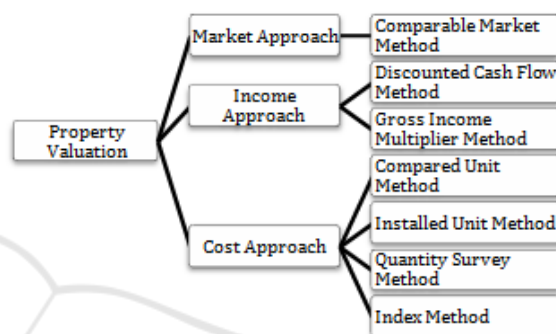


Figure 1: Valuation Approach and Valuation Method.

Furthermore, there are some adjustment factors that commonly used to estimate the market value, namely: (1) physic factor, includes soil structure, temperature, soil contour, flood-free areas, land area, building area, design, age of the building, reliability, position, and orientation (Sutawijaya, 2004; Popescu *et al.*, 2009; Fahirah *et al.*, 2010; Fahirah, 2011; Deac, 2014); (2) economic factor, includes supply and demand, transaction time, price, the rate of community income, people's purchasing ability, interest rates, the amount of available land, and land benefits (Popescu *et al.*, 2009; Fahirah *et al.*, 2010; Fahirah, 2011; Laila and Utomo, 2013); (3) social factor, includes population density, education level, security level, community life pattern, and prevailing regulations in the region (Fahirah *et al.*, 2010; Fahirah, 2011); (4) the government factor, includes the licensing process and taxation (Fahirah, 2011); (5) accessibility factor, includes the availability of public transportation, road width, road material, distance to the Central Business District (CBD), distance to the workplace, and distance to the educational facilities (Fahirah *et al.*, 2010; Fahirah, 2011; Laila and Utomo, 2013; Deac, 2014); (6) availability of facilities, including the availability of clean water, electricity, telephone network, educational, religious, health, recreational, shopping,

sports, playground, and amenities (Fahirah *et al.*, 2010; Deac, 2014).

### 2.3 Market Value

Market value is an estimation amount of money that gained from the exchange of an asset or liability, on the valuation date, between a buyer that interested in purchasing with a seller that interested in selling, in a free bonding transaction with a feasible marketing, in which both parties act on the basis of their understanding, caution, and without coercion (MAPPI, 2015).

The market value of a property is an accumulation of the land market value and the building market value. The land market value is obtained from the calculation using the comparison market data method. Then the building market value is derived from the reduction of the Reproduction Cost New (RCN) by building depreciation at the valuation date (Sutawijaya, 2004). The calculation of the building RCN can use the BTB MAPPI (Building Technical Cost Method issued by the Society of Indonesian Appraiser).

In general, the three factors that affect the market value are the age of the building, location, and developer's credibility. The age of the building has an impact in which the newer the building is built, the more possible it uses the latest materials and technology. Thus, the extent of damage to the building is low, so that the market value of the building can be higher than that the older buildings (Popescu *et al.*, 2009; Fahirah *et al.*, 2010). Location is considered because a property that located in a strategic location, near the CBD and public facilities, will have a higher value than similar properties located in a quieter location (Popescu *et al.*, 2009; Laila and Utomo, 2013; Deac, 2014). Finally, the developer's credibility is related to the consumer trust. Due to the economic principle, the high demand will be in line with higher supply. So this will also have an impact on the increased value, for similar properties, in the same area but developed by different developer (Yudi, 2015).

### 2.4 Green Design in Valuation

There are various criteria of green property valuation. WGBC classifies the criteria into efficiency in energy consumption, water conservation, and other renewable resources (<http://www.worldgbc.org/what-green-building>). According to Greenship Homes, the green criteria are the appropriate site development, energy

efficiency and conservation, water conservation, material resources, indoor health and comfort, building and environment management (AAPI & Wilkinson, 2006). Then, AAPI and Wilkinson classify the green criteria into energy conservation, water conservation, material selection, use of renewable materials, environmental quality in buildings and the occupants' health, construction processes that minimize energy use, site ecology, and recycling systems (AAPI and Wilkinson, 2006). The methodology for green property valuation is building requirements in energy, energy prices, and inflation (Popescu *et al.*, 2009).

Sustainability in real estate valuation is an attempt to identify, avoid, minimize, and mitigate current or future losses in the social, environmental, and economic impacts. Green features that increase the market value in a particular location can not apply equally elsewhere, due to geographical differences as well as other sustainability issues (Runde and Thyore, 2010).

### 2.5 The Use of Eco-Friendly Materials

The use of eco-friendly materials will decrease the litigation risk. Moreover, this can also impact to construction quality and regular maintenance, so that the market response to the risk reduction will have an impact on increasing the value of the property (Fachrudin & Fachrudin, 2017). Furthermore, the uses of eco-friendly materials also influence the RCN, which will have a direct impact on increasing market value as well (Runde & Thyore, 2010).

Green Building Council Indonesia classify some criteria about the use of eco-friendly materials which are the primary refrigerant, the use of used material, the use of refrigerant without ODP, the use of certified wood, the use of prefabricated material, and local material (Green Building Council Indonesia, 2013). There are some examples of the use of used materials, such as Ridwan Kamil Bottle House (in which the wall is made from used bottles), roof garden, and wall coverings that can absorb solar heat.

### 2.6 Energy Efficiency

Energy efficiency is related to reducing the number of energy use, especially for non-renewable resources and greenhouse gas emissions concerning contribution to global warming (Reed & Wilkinson, 2006). The rate of energy use is directly in line with the amount of operational costs, and inversely with the Net Operating Income (NOI). The higher the rate

of energy consumption, the higher the operational costs and the lower the NOI will be. In this case, the rate of energy efficiency becomes the parameter (Runde and Thyore, 2010). The implications of energy efficiency are in operational costs, capitalization or discount rate, and projected lease in discounted cash flow analysis (Fachrudin and Fachrudin, 2017).

A building with excellent design is possible to apply the reducing of energy use in the building. Some examples of energy-efficiency action are reducing the electricity usage for beauty purpose, replacing inefficient equipment, and regulating the time of use of electrical equipment (Lubis, 2007). Then, the use of energy-saving household, energy-saving lighting (artificial or natural day lighting), design strategy (orientation of buildings to minimize daylight heat), and the application of the latest technology (AAPI and Wilkinson, 2006). A sufficient number of windows and vents also affect the air circulation in the room that can minimize the use of AC (Green Building Council Indonesia, 2013).

## 2.7 Water Conservation

Population growths, the change of land use, and incomplete water resource management have impacts on the degradation of water resources quality and capacity on earth. Then, the solution for saving the water resource from running out is by protecting the water resource itself (Supardi, 2010). One example of water conservation in a house is the use of reuse water. Water conservation also includes the action of minimizing the use of shower, rainwater storage in the tank, the use of eco WC that release less water volume, using sensor-based sanitary equipment, household wastewater recycling, and chilled beams. The result of the recycling of wastewater can be used for watering plants or washing cars (AAPI and Wilkinson, 2006).

In line with AAPI and Wilkinson, GBCI also sets out several criteria included in water conservation measures, including water meters, water use calculations, water use reduction, water recycling, alternative water sources, rainwater storage and efficient use of landscaping water (Green Building Council Indonesia, 2013). The relationship between water conservation with valuation is that water conservation will affect the operational cost, capitalization or discount rate, and projected lease in discounted cash flow analysis (Fachrudin and Fachrudin, 2017).

## 2.8 The Use of Renewable Energy

Energy sources consist of two types; fossil energy sources and renewable energy sources. Fossil energy sources consist of petroleum, natural gas, and coal, while renewable energy sources consist of water energy, geothermal, wind energy, and solar energy (Sugiyono, 2016). In households, the use of solar energy applied in two forms, photovoltaic solar, also known as the solar cell, that capable of converting solar energy into electrical energy, and thermal solar that used as household hot water providers (Lubis, 2007).

## 2.9 Land Area and Building Area

The larger size of the land area, the higher the market value of the property will be. In this case, the larger size of the building area also will gain the higher the market value of the property (Fahirah *et al.*, 2010). However, this term could not be the same in all places, depending on the highest and best use concept of the neighborhood.

## 2.10 Position

Position affects the market value, regarding where the location of the house; whether it is in the middle position or at the corner (Fahirah *et al.*, 2010). A house that is at the corner position, of course, has a higher value, for it has the more accessibility and facade from the two sides of the road. Besides, a corner house usually has an excessive land area. In a housing estate, the position can also be interpreted as the placement of blocks within the housing estate, whether in the front, middle or back, from the access of the main entrance of the housing estate.

## 3 METHOD

This research is quantitative research. The researcher applied the purposive sampling method for data collecting by distributing questionnaires that consist of close questions for respondents in the study area. The study area is in Citraland Bagya City housing estate, and the respondents are the residents of that housing estate. Among 1.138 built houses, there are only 98 inhabited houses. To determine the number of respondents, the researcher uses Slovin Theory, with a formula:

$$n = \frac{N}{1 + Ne^2} \quad (1)$$

Where  $e$  = error (10%)  
 N = Population (98)  
 n = Sample

From the calculation, the result for the number of sample for this study is 50. The researcher used four independent variables (the use of eco-friendly materials, energy efficiency, water conservation, and the use of renewable energy), and three controlling variables (land area, building area, and position), with indicators of each variable as follows (Table 1):

Table 1: Research Variables.

No.	Variable	Indicator
1	The use of eco-friendly materials (X <sub>1</sub> )	(1). The use of certified wood (2). The use of eco-paint for wall (3). The use of used/ recycled material for interior/ exterior
2	Energy efficiency	(1). The use of energy-saving household
	(X <sub>2</sub> )	(2). The application of natural lighting at noon (i.e., skylight)
3	Water conservation (X <sub>3</sub> )	(1). The use of eco sanitary (i.e., shower, urinal, water flush, WC, tap water) (2). The application of liquid wastewater recycling systems, used for irrigation, flushing
4	The use of renewable energy (X <sub>4</sub> )	(1). The use of solar panel
5	Land area (X <sub>5</sub> )	(1). Land area
6	Building area (X <sub>6</sub> )	(1). Building area

### 4 RESULTS AND DISCUSSIONS

Citraland Bagya City as the study area is one of housing estate that located in Deli Serdang District, North Sumatera. This housing estate planned as a satellite city that built on 211 Ha lands that divided into seven housing cluster, one shop house cluster,

one clubhouse, retail, office, and a mall. Reason for choosing this housing estate as the study area is because of among the small number of available green concept houses this concept has ever once researched. Moreover, Indah, the architect team leader, said that in this housing estate, is being built one cluster that will apply the green concept, namely Electric House.

As the result of the 50 questionnaires distribution in the study area, there are 76% men and 24% women aged 41-55-year-old (64%) that become the respondents. In average, the house is inhabited by five people (46%), and followed by four people, more than six people, and three people respectively (32%, 14%, and 8% respectively).

The researcher uses SPSS to conduct the data analysis process, by doing validity and reliability test, which show that all the variables and the indicators are valid and reliable ( $r \geq 0,354$  and Cronbach alpha  $\geq 0,7$ ). Then, for the three tests of classical assumption test – normality test, multicollinearity test, and heteroscedasticity test – all the variables also pass the test. The last test in this research is the goodness of fit test, which includes F-Test and T-Test.

F test is used to test the influence of the independent variable on the dependent variable. If the independent variable has a significant influence on the dependent variable, then the regression equation model is categorized as fit. The criterion is H accepted if  $F_{count} \leq F_{table}$ . From the result of F-Test on this research variable, it is known that  $F_{table}$  value is 16,485. With  $df_{regression} = 2$  and  $df_{total} = 49$ , the value of  $F_{count}$  is 2.203. Since  $F_{count} < F_{table}$ , then this regression equation model is declared fit. Then, T-Test indicator in this research is that a variable is said to affect if significance  $< \alpha$ . It is shown that only land area and building area that has significance  $< \alpha$ , with the amount of 0,00, while the other indicators have significance  $> \alpha$  (Table 2).

Table 2: Result of T-Test.

Model	UnstdCoef.		StdCoef.	t	Sig.	Collinearity Statistics		
	B	Std. Error	Beta			Tol.	VIF	
1	(Constant)	-,443	1,389		-,319	,751		
	The use of eco-friendly materials(X <sub>1</sub> )	,039	,060	,059	,654	,517	,789	1,268
	Energy Efficiency (X <sub>2</sub> )	-,004	,032	-,013	-,126	,901	,598	1,671
	Water Conservation (X <sub>3</sub> )	-,106	,090	-,125	-1,170	,248	,558	1,791
	The use of renewable energy (X <sub>4</sub> )	,028	,234	,012	,118	,906	,621	1,611
	Land area (X <sub>5</sub> )	,780	,117	,630	6,642	,000	,707	1,415
	Building area (X <sub>6</sub> )	,478	,120	,367	3,999	,000	,753	1,328
	Position (X <sub>7</sub> )	-,008	,194	-,005	-,043	,966	,554	1,804

a. Dependent Variable: y

### 4.1 The Use of Eco-Friendly Materials

The results of this study show that the rate of eco-friendly materials application in the study area is still low. More than 50% of respondents do not use the eco-friendly materials in their houses, related to the use of certified wood, eco-paint, and recycled materials. The T-Test result (Table 2) also shows that the use of eco-friendly material did not affect the market value (sig value = 0,517). It is in contrast to Runde and Thoyre (2010) theory that said the use of eco-friendly materials would have an impact on increasing a house RCN that will be in line with the increase of its market value.

Someone decided to buy or use an eco-friendly product is closely related to his environmental concern. In this case, it means that respondents' awareness in the study area on the environment is relatively low. With all of their activities, people, especially in big cities, spend more time outside than at home. However, as a representation of the social identity, most people will make the facade and interior of the house as attractive as possible regardless of its impact on the environment (Lubis, 2007). It is because of people mindsets who think that "the expensive is the best" (Junaedi, 2005).

### 4.2 Energy Efficiency

The results of this study show that the respondents' awareness in applying energy efficiency in their homes is quite good in some aspects (use of energy-saving household and the use of LED lights), and still quite low in some other aspects (natural lighting and natural cooling). Their environmental concerns and future projection considerations make them start using energy-saving households and LED lights.

However, the need of recognition (social representation) and less favorable climatic conditions also make them rely on artificial lighting and artificial cooling.

Runde and Thoyre (2010) said that the rate of the energy use is inversely related to NOI. In market value formula, market value is NOI divided by capitalization rates; it is known that NOI is in line with market value. It can be concluded that the use of energy affects the market value. However, the results obtain that the rate of energy efficiency application does not affect the market value. However, in fact, with the less energy consumption in a house, it will not only be an added value of the house but also give a positive impact to the environment (Fachrudin & Fachrudin, 2015). But the T-test results (Table 2) show that the application of energy efficiency was not significantly affect the market value (sig value = 0,901).

In this case, the fixture and furniture of the house were also the determining factors. Therefore, most of the middle up class houses in North Sumatera must have already had AC and luxurious interior and furniture that no longer prioritize the use of natural cooling and natural lighting as one form of energy efficiency.

### 4.3 Water Conservation

The results of this study show that the rate of water conservation application in the study area is still low. There are only 16% of respondents that use eco-sanitary equipment in their houses, and even only 2% that apply water recycling systems for secondary needs. The lack of public awareness and understanding are the primary cause of the less application of water conservation in the study area.

T-test results in Table 2 also show that the application of water conservation was not significantly affect the market value (sig value = 0,248). It is in contrast to Fachrudin and Fachrudin (2017) theory that said water conservation would affect the rate of capitalization, discount rate, and market value of a property.

#### 4.4 The Use of Renewable Energy

The results of this study show that the use of renewable energy does not significantly affect the market value of houses that apply the green concept (sig value = 0,906). This fact is inseparable from the people introduction and awareness of the importance of renewable energy in a household. The significant initial capital is the primary considerations that make someone prefer not to use the renewable energy. No wonder if in the study area, there is no house use solar panel.

#### 4.5 Land Area

The results of this study show that the land area has a significant effect on the market value of a house (sig value = 0; less than alpha). It is in line with Fahirah *et al.* (2010) theory that said the land area affects the market value of a property. In fact, in valuation practice itself, land area is also become one of the adjustment factors in determining the market value of an object. The land areas that fulfill the HBU concept will be an addition to the market value of the property.

#### 4.6 Building Area

The results of this study show that the building area has a significant effect on the market value of a house (sig value = 0; less than alpha). It is in line with Fahirah *et al.* (2010) theory that said the building area affects the market value of a property. In fact, in valuation practice, building area is one of the adjustment factors in determining the market value of an object. In the same neighborhood, for the similar land area, a larger building area obviously will have a higher market value.

#### 4.7 Position

The results of this study show that position does not affect the market value of a house (sig value = 0,966). It is in contrast with Fahirah *et al.* theory (2010) that position affects the market value of a property. In fact, a house located in a more strategic

position would have a higher market value than a house located in a non-strategic position. In the study area, position factor does not affect the market value, because the credibility of the developer that built this housing estate is good enough. So that the consumer assumes anywhere of position in this housing estate is just the same, and they only need to consider the land area, building area, and design that suitable to their taste and budget.

As a summary, the rate of green concept application in the design of the house in the study area is still low, and the result of the variable test shows that the application of green concept does not affect the market value. Among the adjustment factors commonly used in valuation practice, three of them that researchers use as control variables – land area, building area, and position – it is only position that does not affect market value, while land area and building area affect the market value. Besides, other things that affect the market value of a house, in general, is the age of the building, the location of a strategic object, and the credibility of the developer (Popescu *et al.*, 2009; Fahirah *et al.*, 2010; Laila & Utomo, 2013; Deac, 2014). These factors are seen when houses in Citraland Bagya City compared with nearby housing estate (Veteran Housing Estate and TVRI Housing estate), with the age of older buildings, the land market value in Citraland Bagya City is higher than the two other housing estates. Concerning location, Citraland Bagya City housing estate is also categorized more strategic and more accessible when compared with the other two housing estates. Last, the developer credibility, Citraland Bagya City housing estate is developed by a well-known developer, namely Ciputra. The influence of this developer credibility influences the increase of market value in the area, where for the houses in those two other housing estate that used to develop by a non-well-known developer have a lower land market value than those in Citraland Bagya City housing estate.

## 5 CONCLUSIONS

The conclusions of this research are: (1) The rate of eco-friendly materials use in the study area is low and has no significant effect on the market value; (2) The rate of energy efficiency application in the study area is low and has no significant effect to the market value; (3) The rate of water conservation application in the study area is low and has no significant effect to the market value; (4) The rate of renewable energy use in the study area is low and

has no significant effect to the market value; (5) In line with common valuation process, in which land area and building area are included in adjustment factors that affect the market value of a property, this research result also shown that those two factors significantly affect the market value; (6) Although position is one of the adjustment factors in valuation that affect the market value, the result of this research shown that position has no significant effect to market value. All of these conclusions bring the fact that the market value of property nowadays has not been affected by green concept application due to people lack understanding and awareness of the importance of the green concept.

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