The Effect of Green Home, Green Behavior, and Livability on the Financial Incentive in Medan City, Indonesia

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Abstract. A green home focuses on the efficient usage of resources. The purpose of this study was to examine the effect of green homes, green behavior, and livability on financial incentives. The population of this study is a largest and oldest housing in Medan City and sample is 100 houses. The method that used is path analysis. The findings show that the application of the green concept according to the residents have positive and significant impact on livability within alpha 5 percent, but livability has positive and unsignificant impact on the financial incentive. The application of green concept have no significant effect either directly or through livability to the financial incentive. Factor affecting the financial incentive is green behavior. It is expected that residents can increase the awareness about environment and have green behavior.

1. Introduction

Investment will generate return, either yield or capital gain. There are two components of return, namely yield and capital gain [1]. Based on [2] and [3], green home can give financial benefit of increasing rental payments from tenants and increasing the value of the home. The financial benefits in terms of financial investment is the yield and capital gain. Financial benefit in [2] is used interchangeably with financial incentives. Financial incentives of green homes according to [2] are cost savings on future electricity bills, the increasing of green home’s value, the higher rental, and cost savings on future water bills. Although there are only few studies in literature that examine the benefit of green residential properties, it is reasonable to believe that the sustainable homes could provide tangible and intangible benefit to homeowners [2]. The value of green buildings is increased as it represents an initiative to reduce the environmental impact globally by consuming less energy [4].

Currently, about 20% of energy usage comes from the household sector, the use of water can reach more than 200 liters per person per day, and 65% of the landfill waste is household waste [5]. Therefore, the design of green home and its residents’ green behavior is essential for environmental sustainability. Green home focuses on increasing the efficient usage of energy, water conserving, durable and non-toxic materials, with high-quality spaces and high recycled content materials, while reducing the home's impact on household health and environment during the home's lifecycle. Green home also can make
the residents healthy and productive. Green design can reduces operating costs, enhances building marketability, increases resident’s productivity, and help create a sustainable community [6].

Green home, based on [2] is home that actually apply green concept, while housing in Medan City, do not meet all the elements mentioned above. Will houses in Medan City, which not meet all the elements, be able to provide financial incentive? If not, what factors that could provide the financial incentive?

Green behavior may also affect the financial incentives. [7] Found that green purchasing may improve the financial saving and financial gain. The purchases may includes the purchase of supplies, consumer products, cleaning products, equipment’s, physical plants, automotive, landscaping, and materials to build a building.

Application of green features should influence livability. Homeowners are motivated to has own homes that could attain a desired level of livability [2]. Livability may be understood in terms of healthier and satisfying way of living. The attribute of livability are healthy living experience, proximity house to public community activities, green neighborhood which offers superior infrastructure, and landscaped greenery and recreational facilities [2].

In urban context, embodies the concept of livable city should be supported by sustainable city. Livable city is where public space in the center of social life and being focused throughout the community [8]. According to [9], the concept of livable city used to realize that the idea of development as improvement in quality of life which requires both physical and social habitat for its realization. Based on the opinion of [8] and [9], it can be analogized to a house, that a sustainable home will be able to improve the livability. Green environment makes people feel well-being, peace, and quiet [10]. Green city is a key for achieving livable Cities [11].

Livable communities generally incorporate high standards of transportation, infrastructure and security to enhance healthy living, work, and play [12]. The healthy living and appropriate site development may produce financial incentives.

In Medan city, Indonesia, green house term is not widely known. People just assume that green house is just a house surrounded by green trees. However, there are a few houses that applying some of the concepts of green. A residential complex, the oldest and largest in this city, in this case the name was shortened to TS1 Housing, known as housing that meet certain elements for such green open spaces of green design that produces the circulation of clean air and natural light, and some house using environmentally friendly materials. Houses in this complex do not have a uniform design, homeowners can design and modify their homes so that the characteristics of each house is different. With an area of 150 hectares, several houses close to public facilities and some far from the facilities.

The applications of green home directly affects the financial incentive [2], while in Medan city, application of the green concept is not complete. Could these circumstances provide financial incentives? or will the behavior of residents provide financial incentives?

Based on what mentioned above, the research questions are: Does green home application have influence towards livability? Does green home application, livability, and green behavior has influence toward Financial Incentives? Does green home application has indirect effect to financial incentives through livability?

Relationships of green home applications, livability, green behavior, and financial incentives are as follow:

![Figure 1. Conceptual Framework](image)

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2. Method

This research is a causality, which aims to find an explanation in case-effect form between some variables that developed. The data used are primary data that are the cross section. The research was conducted at TS1 Housing in Medan, North Sumatera Province, Indonesia. The population of this study was residents from 2286 houses. Targeted population are residents of occupied houses, i.e. 1886 houses. The number of samples by using Slovin formula at alpha 10% is 95 and rounded up to 100 samples. Random sample was used in this research.

Questionnaires about green concept application compiled based on Greenship Homes V.1.0 from Green Building Council Indonesia [5] and [2]. There are 79 questions with yes and no answers. Each answer yes is given 1 point, and answer no is given 0 point. The maximum point will be 79 and the minimum point will be 0. The points are percentage by deviding with 79, and scaled into 5 interval scales. A scale of 5 is the high application of green, the scale of 1 is the low application of green. Scales of 2 to 4 is an interval scale between 1 and 5.

Questionnaire for livability, green behaviour and financial incentive variables are modified and developed from [2], [4], and [13]. This questionnaire using 1 to 5 points of Likert Scale, where 1 for strongly disagree and 5 for strongly agree. Validity and reliability test was conducted to another 30 residents who are not the sample. There are three questions that are not valid.

Indicators for financial incentive variable are electricity cost savings, water cost saving, home value, rental value, and the willingness to spend high cost for green home investment to get long term benefit. For green behaviour variable, the indicators are behavior about the used of friendly material, energy efficient transportation, preference to be in open green spaces, energy saving, efficient use of the goods, preference using electronic documents than paper, saving electricity, protecting the environment, buying goods with less garbage, and like to participate in protecting the environment. For livability variable, the indicators are healthy life experience at home and the existence of public facilities near the home.

Structural equation are:

\[ Y_1 = \rho_{Y1X1}X1 + \varepsilon_1 \]  
\[ Y_2 = \rho_{Y2X1}X1 + \rho_{Y2X2}X2 + \rho_{Y2Y1}Y1 + \varepsilon_2 \]  
Indirect effect \( X_1 \) to \( Y_2 \) over \( Y_1 \) = \( \rho_{Y1X1}X1 \times \rho_{Y2Y1} \)

Where:

\( Y_1 \) = endogenous variable of livability  
\( X_1 \) = exogenous variable of green home application  
\( X_2 \) = exogenous variable of green behavior  
\( Y_2 \) = endogenous variable of financial incentive  
\( \rho_{Y1X1} \) = path coefficient \( X_1 \) to \( Y_1 \)  
\( \rho_{Y2X1} \) = path coefficient \( X_1 \) to \( Y_2 \)  
\( \rho_{Y2X2} \) = path coefficient \( X_2 \) to \( Y_2 \)  
\( \rho_{Y2Y1} \) = path coefficient \( Y_1 \) to \( Y_2 \)  
\( \varepsilon_1 \) = path coefficient variable error \( 1 \)  
\( \varepsilon_2 \) = path coefficient of error \( 2 \)
3. Results and Discussions

3.1. Results

3.1.1. Descriptive Statistics. The Description on Green Home Application are as follow:

| No. | Item                                      | Mean  | Standard Deviation |
|-----|-------------------------------------------|-------|--------------------|
| 1   | Appropriate site development              | 0.75  | 0.12               |
| 2   | Energy efficiency and conservation        | 0.51  | 0.15               |
| 3   | Water conservation                        | 0.49  | 0.22               |
| 4   | Material resources and cycle              | 0.52  | 0.23               |
| 5   | Indoor health and comfort                 | 0.82  | 0.19               |
| 6   | Building environment management           | 0.52  | 0.02               |

Table 1 describe that application of green features in indoor health and comfort is the the highest while water conservation is the lowest.

3.1.2. Result of effect green home application on livability. Test of classical assumption results show that the model had meet the normality residual assumption with $\rho$ value is 0.255 (> 0.05); the model is also free from heteroskedasticity problem, with Glejser test; t value is 0.055 (>0.05); and the model is not experiencing autocorrelation; Dubin Watson value is 2.161. Value of $d_u$ on Durbin Watson table for k=1 and n=100 is 1.6944. Thus 2.161 is located between $d_u$ to 4 - $d_u$.

The model goodness of fit shows R$^2$ is 0.104; significance F is 0.01; and significance t for green home application variable is 0.01. This shows that the model has predictive ability fit although only 10.4%.

The mathematical equation model is:

\[ Y_1 = 0.323X_1 + 0.896e_1 \]  

(4)

3.1.3. Result of effect of Green Home Application, Livability, and Green Behavior toward Financial Incentives. Test of classical assumption results show that the model has meet the normality residual assumption with $\rho$ value is 0.358 (> 0.05); the model is free from multicollinearity; the model is also free from heteroskedasticity problem, with Glejser test found significant test value $t$ each one is > 0.05; and models are not experiencing autocorrelation; Dubin Watson value is 2.137. Value of $d_u$ on Durbin Watson table for k=3 and n=100 is 1.7364. Thus 2.137 is located between $d_u$ to 4 - $d_u$.

The model goodness of fit shows R$^2$ is 0.339; significance F is 0.0001; and significance t for green home application variable is 0.107, livability variable is 0.926 and green behaviour variable is 0.0001. This show that model has predictive ability fit although only 33,9%.

The mathematical equation model is:

\[ Y_2 = 0.143X_1 + 0.551X_2 - 0.10Y_1 + 0.813e_2 \]  

(5)

3.1.4. Indirect influence of green home application to financial incentives through livability

Indirect effect $X_1$ to $Y_2$ over $Y_1 = \rho_{Y1X_1}X_1 \times \rho_{Y2Y1}$

\[ = 0.323 \times -0.010 \]

\[ = -0.00323 \]

From the results of the equation two which states that the effect of financial incentives to livability is not significant, it can be said that the influence of -0.00323 is also not significant.

The direct effect of green home applications to financial incentives is 0.143 and not significant. Indirect effect through livability is smaller, i.e, -0.00323 and not significant.
3.2. Discussion

3.2.1. Discussion about influence of Green Home Application towards Livability. House which applying the green concept in this study will improve the livability positively and significant at alpha 5%. Green home residents have a healthy life experience. This is in accordance with the opinion of [10] related to green environment and [11] opinion regarding green city. Green environment makes people feel well being, peace, and quiet. Green city create livable cities.

3.2.2. Discussion about the effect of Green Home Application, Livability, and Green Behavior on Financial Incentives. Green concept in residential applications are positive and not significant at alpha 5%. This is not in accordance with the findings of [2], because the concept of green in this study has not been fully applied. The initial investment for green home sometimes expensive, such as the installation of solar panels, bio pore, water saving fixtures, and waste management. Medan City's residents prefer cheaper investment whereas expensive investment at the beginning will provide long-term benefit.

Influence of livability on financial incentives is negative and not significant. It shows that home with enhance healthy living, work and play not provide financial benefit. It has not been able to save electricity and water bills, because green concept application has not been fully implemented. The increase in home values and rental values are also not due to the livability of the house. Most of Medan city's residents are more focused on the location of the house and not on livability in consideration of buying and selling homes.

Influence of green behavior to financial incentives is positive and significant at alpha 5%. This is in accordance with [7] who found that green purchasing may increase financial saving and financial gain. Green homes are not just about physical building but also residents behavior.

Factor of human behavior is paramount to obtain financial incentives which in this case is saving operational expenses of the house. Green behavior will make the wise use of water and electricity. [4] found that residents' energy saving behavior practice is encouraged by the pro-active building managers in the green buildings to assist with energy saving behavior. [14] found that there are a positive and statistically significant premium for transactions with residential green building features.

3.2.3. Discussion about indirect effect of green home application on financial incentives through livability. Application of green home on this study has no direct effect on financial incentives. Indirect effect through livability also had no significant. Application of green home only improving the livability significantly. This happens because the concept of green in this study has not been fully applied. Application of material resources and cycle; energy efficiency and conservation; building environment management; and water conservation is still done at a low level. Besides the problem of healthy life experience has not been a major consideration in the demand and supply of houses, people tend to pay attention to social class of housing location.

4. Conclusions
Application of green home is not yet fully done. The largest average value of the application is on indoor health and comfort and this is greatly improving livability.

The implication is that the awareness of the importance of environmental sustainability should be embedded in every person. Especially to the young generation. If awareness is already there, then they will build a house with the green concept better. This is that we can provide a good living environment for next generations.

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