Building Incentive Structure in the Context of Green Building Implementation: From the Local Government Perspective

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This paper aims to examine and establish the purpose of the building incentive structure to stimulate green building implementation in consideration of the low number of green buildings in developing countries, particularly in Indonesia. Based on a purposive sampling technique to select departmental heads and sectional heads from the local government of the capital city of Indonesia, self-administered questionnaire data were analyzed using partial least squares structural equation modeling (PLS-SEM). The research results suggest the following. (1) There is a significant and positive impact of the building incentive structure on green building implementation. In addition, (2) The "Sustainability in Green Building Concept" has the most positive influence on the internal building incentive structure, but the "Efficiency of Green Building" has the most positive influence on the external building incentive structure. Therefore, these practices should receive attention from government officers. Finally, (3) "Environmental Development" was found to have an inner effect on green building implementation, especially creating "Green Building Comfort," because it tends to hamper the first step toward green building implementation, which is aesthetic green features selection and pollution number reduction. This work can be considered as the first empirical effort toward a better model of a green building incentive based on the local government perspective.

Keywords: *Green Building; Green Building Implementation; Incentive; Building Incentive; Local Government.*

1. INTRODUCTION

Green building is an eco-friendly building concept considered able to counter the negative impact of building on the sustainable environment both now and in the future. At the beginning of the development of the green building concept, there are relatively many challenges, especially to start the adjustment from the conventional concept to the green building concept by building stakeholders. Therefore, some developed countries in the buildings development process using the green building concept have the idea to accelerate the process of introducing and adapting building stakeholders to the green building concept by providing incentives. Some countries in Asia that have successfully applied incentives to green building stakeholders, such as Hong Kong, Singapore, and Malaysia, are shown in Table 1. There are three incentive models to promote the development of green buildings, particularly in Asia, such as Gross Floor Area (GFA), property tax, and both (GFA and tax). As the fourth ranked in the construction industry in Asian countries, Indonesia is significantly far behind compared to some neighboring countries in terms of green building growth. The average growth of green building in Indonesia is three buildings per year or 23 building in total, consisting of 17 Greenship-certified buildings, two Green

Mark-certified buildings, three LEED-certified buildings, and one building certified as both Greenship and Green Mark.

Table 1 Growth of green building in Asia by incentive implementation

Country	Year	Duration (Year)	Number of green building		Growth number	Type of incentive
			Before incentive	After incentive		
Hong Kong	2011–2015	4	225	416	48	GFA
Singapore	2005–2015	10	17	1.696	170	GFA
Malaysia	2009–2013	4	1	137	35	Tax
India	2001–2018	7	1	1.500	215	Mix

Green building implementation is known as an integrating process that consists of building design, construction, operation, maintenance or renovations, and recycling or demolition by considering environmental conditions. It means that the processes care about human health and comfort and the sustainability of natural resources through environmental efficiency and conservation programs. Therefore, creating a good incentive model in developing countries to accelerate green building concept implementation, particularly in Indonesia, should involve paying attention to key success factors of green building implementation. There are four key success factors in green building implementation, such as sustainability, efficiency, comfortability, and manageability. Furthermore, green building implementation factors are developed based on the context of infrastructure development, such as regional policies, economic uncertainty, knowledge level, and environment development.

This study aims to observe the effect of building development factors in general on the implementation of the green building concept. Infrastructure investment planning affects the sustainability of the green building concept because building life cycle costs are part of the economic uncertainty concept assessed through technological developments and economic growth value. However, to maintain the availability of resources and reduce emissions requires relatively high financing. Based on these literature findings, the following can be hypothesized:

H1: The uncertainty of economic growth negatively influences the sustainability of green building implementation.

H2: The uncertainty of economic growth positively influences the comfortability of green building implementation.

Environmental development significantly influences the ability to improve the efficiency and effectiveness of buildings by saving energy, reducing water use, and decreasing the amount of construction waste. Previous research has shown that 60–90% of human life is spent in buildings; in addition, technology development potentially increases the occupancy rate. Therefore, research on increasing the efforts toward occupant comfort for both building users and the building environment has shown relatively high interest today. Building on these arguments, it is hypothesized that:

H3: Environmental development positively influences the efficiency of green building implementation.
H4: Environmental development positively influences the comfortability of green building implementation.

Building knowledge aspects affect the sustainability of buildings and the ability to obtain green building certification. Improving knowledge of the concept of environmental friendliness indirectly stimulates the entire community and governments of the world to invest in sustainable development and innovation, specifically in terms of building construction and mitigating the impact of climate change through the green building concept. The application of information systems in building simplifies the management of such buildings. As governments seek to balance economic growth with the negative impacts of these developments on the environment, scientists have sought an information system to control these impacts. Accordingly, this study posits that:

H5: Knowledge improvement positively influences the sustainability of green building implementation.
H6: Knowledge improvement positively influences the manageability of green building implementation.

Regional policy is a form of government or authority in building responsibility toward environmental conditions in the region. Such policies can be in the form of limits on the value of the efficiency of certain resources in buildings and of standard building limits in general. In China, the relatively rapid growth of buildings is not accompanied by a regional policy for the management of buildings, so 28% of the energy produced in China is used only for building operations, which decreases environmental sustainability, i.e., generating 50% of the total carbon emissions in China. In 2000, the Chinese State Government began to develop environmentally friendly policies through research funded directly by the Chinese Government. By 2015, China has reduced energy use by 16% and reduced carbon emissions by 17%. Furthermore, China's policy direction is to continue toward the target of 30% energy-efficient building usage by the year 2020. The assessment indicators for regional aspects in several countries of the world include the amount of energy savings, emission reductions generated, water savings, and satisfaction with building occupants. Consistent with the literature, this study therefore postulates that:

H7: Regional policy positively influences the efficiency of green building implementation.
H8: Regional policy positively influences the manageability of green building implementation.

Economic conditions affect the availability of investors in the infrastructure sector. The description of this condition can be predicted through a feasibility study before the employment contract begins with consideration of economic stability. The main functions of this feasibility study enable both internal and external reviewed of weaknesses and strengths in the project development. Some aspects of economic feasibility studies include economic value evaluation, financial aspect assessment, risk assessment, and data collection of issues of environmental development and social conditions of society (Bause, Radimersky, Iwanicki, & Albers, 2014). Based on these literature findings, the following can be hypothesized:

H9: The uncertainty of economic growth negatively influences the sustainability of green building implementation.

Some of the literature on green building incentives proves that incentives for project owners, both developers and building owners, are an attraction that can benefit green building stakeholders. In general, the provision of internal incentives depend on the users and building management (internal stakeholder), while external incentives are generally managed according to government policies or regional authorities. However, in the future, buildings can acquire many internal incentives, even when external incentives are reduced or discontinued. Based on the literature above, some hypotheses concerning incentive implementation in green building are stated as:

H10: The sustainability of green building implementation positively influences the incentive model.
H11: The efficiency of green building implementation positively influences the incentive model.
H12: The comfortability of green building implementation positively influences the incentive model.
H13: The manageability of green building implementation positively influences the incentive model.

2. METHODS

This study used the qualitative and quantitative methods to develop a survey process to address the local government perspective on the green building incentive model, particularly in the capital city of Indonesia. Based on the literature review above, five variables (economic uncertainty, environment development, knowledge improvement, regional policy, and green building implementation) are observed in this study, and 40 variable indicators are specified. After, semi-structured interviews were conducted to allow green building experts in Indonesia the freedom to engage actively in sharing their views on their own terms. Six experts have been successfully interviewed, consisting of green building council members, green building practitioners, and academics, to validate this research constructively.

This second part, a pilot study, was applied at the beginning of the implementation of the quantitative method through the distribution of a structured self-administered questionnaire to

30 respondents as the minimum number of data processes in the partial least squares structural equation modeling (PLS-SEM) operation (Chin, 1998). All measures were rated on a six-point Likert-type scale, ranging from 1 (very low effect) to 6 (very high impact) without a moderate option. After the pilot study and validation process, a structured self-administered questionnaire was distributed to 36 members of three local government services in the capital city of Indonesia who are responsible for mandatory green building policies and implementation, such as One Stop Integrated Service and Investment Service, Human Settlements Service, and Public Housing Service. Data were collected mostly from the staff of the Capital City of Indonesia, which focuses on three services with responsibility for being the first and only region in Indonesia to implement the green building concept. Out of 40 distributed questionnaires, 36 operating responses were obtained, representing a 90.0% response rate for all respondents.

2.1 DEMOGRAPHIC INFORMATION

Based on the received questionnaire, Table 2 is created. The majority of the respondents were males, representing 61.11%, followed by females, representing 38.89%. In addition, more than half are under the age of 25 years, at 63.90%, while 27.80% are 25 to 35 years and 8.33% are above 50 years. Regarding education, 55.60% of respondents have bachelor's degree and 44.40% have a master's degree, and concerning working experience, 58.33% of respondents have under five years, while 27.78% have 5 to 10 years, 2.78% have 10 to 15 years, and 11.11% have 15 years or more.

Table 2 Respondents' demographic features (90% response rate)

Variable		Frequency	%
Gender	Female	14	38.89
	Male	22	61.11
Age (years)	<25	23	63.89
	25–35	10	27.78
	>35–50	3	8.33
Educational level	Degree	20	55.60
	Master's	16	44.40
Working experience	Below 5 years	21	58.33
	5–10 years	10	27.78
	Above 10–15 years	1	2.78
	Above 15 years	4	11.11

2.2. DATA ANALYSIS

This paper aims to examine and establish the purposes and impact of green building implementation on creating an incentive structure from the local government perspective. The PLS-SEM procedure was applied for the analyses of the proposed study model using the SmartPLS 3.0 software. According to previous research, PLS-SEM analysis procedures are implemented a two-stages, the first method of analysis to test the measurement model that serves as a tool of validity and reliability test. The second stage of this analysis procedure is the structural model analysis that the function conduct the hypothesis testing.

SEM is a second-generation multivariate data analysis technique useful for theoretical model structures with "high complexity but low theoretical information". SEM is a method that researchers can analyze the relationship of variables in visualization things. The benefit of this method is in the data character such as non-normal data, small sample sizes and uses formative indicators. On the other hand, this method is easier in implementation even it run in a complex model structure. In addition, SEM is recommended for the research with minimum data adequacy and data heterogeneity.

3. RESULTS AND DISCUSSION

3.1. MEASUREMENT MODEL

The measures for latent constructs in reliability and validity were implemented in two phases.

The first phase of the convergent validity and discriminant validity analysis was checked by using the data from the pilot study. Based on the test of load factor and average variance extracted (AVE) values, eight construct indicators must be eliminated because they are below the parameter limit value specified in Table 5.4. The eight indicators are Effi3, KSE1, KSE2, KSE5, RP1, Sust1, TK4, and TMI7. In total, 32 of the 40 variable indicators were analyzed in the second phase.

3.1.1. RELIABILITY ANALYSIS

The reliability of the latent construct is tested by a comparison of the amount of Cronbach's composite reliability and alpha values, where both values must be greater than 0.70. Table 3 indicates that the Cronbach's alpha and composite reliability values for all constructs surpassed the threshold value of 0.70, except "sustainability," thereby establishing strong reliability among the measures, but not for "sustainability." However, this construct could not be deleted automatically before the validity test was conducted.

3.1.2. CONVERGENT AND DISCRIMINANT VALIDITY

Means of standardized factor loadings and AVE are examined for convergent validity with a bootstrapping analysis of 500 subsamples. The result demonstrated that the standardized loadings of all measurement items, as presented in Table 3, were greater than of 0.60, with no cross-loadings, except indicators "Sust3". In total, 15 of the 36 significant variable indicators ($p<.001$) had a strong confirmation of convergent validity, and the measurement items were well loaded on their own constructs. In addition, convergent validity was also achieved when the AVE values of each construct in the model were found to be larger than 0.50.

Table 4 shows the results of a discriminant validity examination by comparing the shared variances between factors with the individual factor AVE. All shared variances between factors in the model were lower than the square root of the individual factor AVE, confirming the satisfactory discriminant validity and that the constructs were both conceptually and empirically dissimilar from each other. Indeed, all associations between the 10 constructs are below 0.70, postulating that there are two constructs in which the appropriate degree of discriminant validity is not achieved. An internal incentive was found to have the strongest correlation with sustainability in green building implementation ($r = 0.551$, $p<0.01$), followed by knowledge improvement ($r = 0.331$, $p<0.01$) and regional policy ($r = 0.222$, $p<0.01$). Thus, each factor was statistically distinct.

The goodness of fit (GoF) index for this study was 0.364, which indicates a large index (GoF > 0.36) and which shows the model has better explaining power in comparison with the baseline above-defined values. Thus, the model provides adequate support to validate the PLS model globally.

Table 3 Reliability and validity analysis

Constructs	Indicators	Standardized loadings	Cronbach's alpha	Composite reliability	AVE
Sustainability	Sust2	0.995	-0.799	0.306	0.566
	Sust3	-0.376			
Efficiency	Effi1	0.856	0.374	0.757	0.611
	Effi2	0.699			
Comfortability	Comf1	0.893	0.668	0.857	0.749
	Comf2	0.837			
Manageability	Mang1	0.785	0.856	0.911	0.774
	Mang2	0.938			
	Mang3	0.909			
Economic uncertainty	KSE3	0.893	0.765	0.895	0.810
	KSE4	0.907			
Environment development	ED1	0.568	0.665	0.775	0.426
	ED2	0.793			
	ED3	0.716			

	ED4	0.311			
	ED5	0.755			
Knowledge improvement	TK1	0.997	0.827	0.763	0.538
	TK2	0.533			
	TK3	0.580			
Regional policy	RP2	0.899	0.768	0.855	0.667
	RP3	0.882			
	RP4	0.646			
Internal incentive	TMI1	0.752	0.744	0.828	0.461
	TMI2	0.509			
	TMI3	0.861			
	TMI4	0.787			
	TMI5	0.663			
	TMI6	0.379			
External incentive	TME1	0.844	0.920	0.944	0.809
	TME2	0.846			
	TME3	0.954			
	TME4	0.947			

3.2. STRUCTURAL MODEL

In this section, a review was conducted featuring an evaluation of the intensity of the PLS-SEM model as the objective of the study. R2 value and the corresponding t-value measurements have been performed at this stage to determine the significance of the indicator variables. Furthermore, the model was verified to have predictive relevance, as the cross-validated redundancy result (the Stone-Geisser test Q2) was 0.765, which is greater than 0. The R2 value for the endogenous variable was 0.394, which exceeded the minimum level of 10% suggested, signifying a strong explanatory power for the model (i.e., all independent variables accounted for 40% of the total variance in the internal green building incentive).

Table 4 Inter-construct correlations and the square root of the AVE along the diagonal

	Comf	Effi	ED	TK	KSE	Mang	TME	TMI	RP	Sust
Comf	0.866									
Effi	0.053	0.782								
ED	0.053	0.523	0.653							
TK	-0.027	0.319	0.477	0.734						
KSE	-0.443	-0.039	0.258	0.206	0.900					
Mang	0.553	0.262	0.238	0.153	-0.452	0.880				
TME	-0.103	0.326	0.378	0.415	0.391	-0.038	0.899			
TMI	0.149	0.349	0.288	0.268	-0.096	0.248	0.224	0.679		
RP	-0.109	0.232	0.338	0.561	0.293	-0.123	0.583	0.337	0.817	
Sust	0.016	0.150	0.148	0.331	-0.029	0.133	-0.064	0.551	0.222	0.752

Specifically, the results of the path coefficients and t-values were itemized, as outlined in Table 5, whereby the efficiency in green building implementation is seen to have a significant and positive link with the external green building incentive, which is well within expectations (β11.2 = 0.376, T-value = 2.161, P-value<0.031). Hence, H11.2 is therefore supported. In a similar vein, environmental development had a significant influence on efficiency in green building implementation (β3 = 0.502, T-value = 2.919, P-value<0.004), inferring that H3 is also retained. A further examination of the path coefficient shows that economic uncertainty is significant and positively relates to comfortability in green building implementation (β2 = 0.490, T-value = 3.218, $p<0.001$), as posited by H3. Thus, H3 is reinforced. Furthermore, the other hypotheses were found to be insignificant, as depicted in Table 5.

Table 5 Structural model analysis results

Hypothesis	Independent variable	Path	Dependent variable	Path coeff.	T-value	P - values	Decision
H12.2	Comfort	->	Inc_Ext	-0.078	0.341	0.733	Not Supported
H12.1	Comfort	->	Inc_Int	0.092	0.336	0.737	Not Supported
H11.2	Efficiency	->	Inc_Ext	0.367	2.161	0.031	Supported
H11.1	Efficiency	->	Inc_Int	0.252	1.044	0.297	Not Supported
H4	Envi_Dev	->	Comfort	0.180	0.794	0.427	Not Supported
H3	Envi_Dev	->	Efficiency	0.502	2.919	0.004	Supported
H6	Know	->	Manageable	0.323	1.090	0.276	Not Supported
H5	Know	->	Sustainable	0.351	1.225	0.221	Not Supported
H2	Unc_Eco	->	Comfort	-0.490	3.218	0.001	Supported
H1	Unc_Eco	->	Sustainable	-0.101	0.473	0.636	Not Supported
H13.2	Manageable	->	Inc_Ext	-0.077	0.280	0.780	Not Supported
H13.1	Manageable	->	Inc_Int	0.063	0.203	0.839	Not Supported
H7	Reg_Pol	->	Efficiency	0.063	0.304	0.762	Not Supported
H8	Reg_Pol	->	Manageable	-0.304	1.139	0.255	Not Supported
H10.2	Sustainable	->	Inc_Ext	-0.108	0.435	0.664	Not Supported
H10.1	Sustainable	->	Inc_Int	0.503	1.674	0.095	Not Supported

4. CONCLUSION

This study's findings provide some important practical implications for research and green building implementation. Notably, this research confirms that resource efficiency is the most critical factor that could sway green building incentive modelling. Consequently, the government should provide an external incentive formulation to anticipate environmental development. The application of the green building concept to determine the form of incentives is considered based on the categories of buildings, the effectiveness of buildings, the level of importance of incentives in a region, and strategies undertaken to maintain the sustainability of concept implementation. The previous case study provides a relatively large incentive in the early stages of development in that it aims to introduce and to awaken the use of this concept among building stakeholders. Ensuring the sustainability of this concept's implementation, building stakeholders must consider building comfort. In fact, building comfort has a high effect on sustainable economic growth, which a regional community welfare indicator, because it can support all levels of society. In addition, building has a responsibility to ensure energy availability and carbon emission reductions by using the most effective and efficient technology.

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