GCEAS- 326
A Relationship Study of Residents Recognition, Preference and Acceptance for Green Building in Southern Taiwan

Jung-Fa Cheng, Yun-Yao Chi, Ya-Fen Lee, Hsien-Te Lin and Mei-Ting Liou

\(^a\)Department of Architecture, National Cheng Kung University, University Road, Tainan City, Taiwan
\(^b\)Department of Land Management and Development, Chang Jung Christian University, Changda Road, Guiren District, Tainan City, Taiwan
\(^c\)Department of Leisure and Recreation Management, Toko University, Xuefu Road, Puzi City, Chiayi County, Taiwan

Corresponding Author: yunyao@mail.cjctu.edu.tw

ABSTRACT

The green building has been promoted in recent twenty year, but green dwelling is sparse in the housing market in Taiwan. This study aims to investigate the recognition, preference and acceptance of residents for green building in southern Taiwan for pursuing the green building into the housing market. The residents’ questionnaire in two cities of Tainan and Kaohsiung, Taiwan are distributed and the structural equation modeling is used to understand the residents’ opinion about green building. The analysis results show that residents own positive recognition, preference and acceptance for green buildings. And residents’ recognition and preference have a positive influence on acceptance for green buildings.

Keyword: Green Building, Recognition, Preference, Acceptance, Structural Equation Modeling

1. Introduction

Because of the climate changes and the risk of the global warming, each country around the world that tries to resolve these problems decides to impulse the way to reduce carbon dioxide emissions. The construction industry annually consumes about 45% of the total energy and that produces 30% -40% emissions of greenhouse gases (carbon dioxide) in total (Butler, 2008). Therefore, in the life cycle of the buildings (production, planning, construction, building usage management section and demolition (or removal) process), to build the safest, healthiest, and the most efficient and comfortable living space is the best way of saving energy, using resources efficiently and the good way to ease the environmental burden; people and building living harmony with the environment and the goal of sustainability to create green buildings, have become a key strategy that every country promotes to save energy and reduce carbon dioxide emissions (Zhang, 2008; Huang and Hu,
In Taiwan, due to the carbon dioxide emissions from the construction industry, accounting 28.8% of the total emissions, as early as in 1999 that is suitable for the implementation of Taiwan's environment and climate evaluation of the green building rating system for EEWH (Ecology, Energy Saving, Waste Reduction, Health), contains the "biodiversity", "afforestation", "rainwater conservation ", "daily energy saving ", "CO₂ reduction ", "waste reduction ", "indoor environment ", "water ", "sewage waste ", the nine major indicators (TABRI, 2009). In 2001, but also to "Taiwan’s green building program(TGBP)" to promote the full implementation of green building policies, as the world's first public sector buildings to green building controls and building regulations laid down in the national green building special chapter (TRBRI, 2010).

In view of the green building has been developed twenty years nearly in Taiwan. In practice, there is a lot of public green building construction, but the green buildings are not implemented in the housing market in Taiwan. How the concept of green building practices to extend to the housing market? That is currently most need to break the bottleneck about the green buildings and carbon reduction implementation work. Based on the concept of consumer behavior in the housing market, this paper is aims to construct of a questionnaire on green building awareness, preference and acceptance, and the results of questionnaire investigation of Tainan and Kaohsiung residents is used to develop a structural equation model (SEM) and verify the adapted SEM model, the results of this article, will be available for future reference implementation of green building and research work.

2. Literature review

Green Building marketing strategy refers to a design or plan, In order to provide superior competitors practice, to meet the needs of specific target markets. Marketing strategy planning specification marketing is mixing that marketing science of 4P elements (products, price, spread, and path). These factors must be controlled and the needs of the target market and the external environment to do with to a certain extent, in order to obtain the best sales profit. There is consumption research in development of market and the formation of the marketing mix is very important, because both of them will influence consumers' decision-making process (Engel et al, 1995). Howard-Sheth Consumer Behavior Mode (Howard and Sheth, 1969) is composition by put in, cognitive, learning, and decision making four most. Baldejahn (1988) construction of green consumption behavior has causal model. Display individual consumer behavior of green product is by demographic variables, social, cultural and economic variables segmentation variables, personal preference.

Taiwan green building policy. In accordance with the point in time can be divided into three stages, as follows(Green Building, 2013; Wu, 2011):

(1) Green building concept of Enlighten and policy formation (1990~2001)
(2) Promote green building program period (2001 ~ 2007)
(3) Eco-city program to promote green building period (2008 ~ 2011)

Promote the implementation of green building program, although the result is outstanding, through green building mark who doubled, but there are also many problems. Lu (2012) pointed out that the implementation of green building in Taiwan more than ten years, mostly through the label of building public buildings. Lack of involvement of civil construction, costs for an important reason, and domestic research on green building costs are presented very little. Zhang (2010) presented that the building before the implementation of green building policies, the construction and planning agency of government, although proposed "green building incentives to improve civil demonstration operation points," but the scope is mainly for the public sector and more than more than 50 million project financing of construction projects. Chen (2011) presented that about 87 percent of domestic appraisers think theoretically green building on the real estate prices will have a positive impact, but because of domestic consumers still no clear preference for green building, only 66 percent of appraisers think the market will reflect this positive impact, and most appraisers think its impact is less than 10%.

3. Methodology

3.1 Questionnaire
In this paper, the research value and function based mainly in the public perception, namely research involves issues of public preference, therefore, this article through the now widely used in various research areas of marketing, social, psychological, educational and other Likert preference inventory, according to respondents to measure the characteristics of a certain behavior or potential constructs (Wu, 2008), to learn about the people in the study area for green buildings cognition. Table1 shows the question items in this paper. The target of questionnaire investigation is inhabitant in Tainan city and Kaohsiung city in Taiwan.

3.2 Analysis method
In this paper, the people in the study area were the heart of the green building awareness survey, people want to know the extent of the current green environment agree, and recommend acceptance of green building, and whether cognitive, preferences and decision-making, and there is a relationship model such as Figure 1. Therefore, the research article assumed the following:
(1) People understanding of green building related to the formation of their awareness of green building. Similarly, that is valid for the degree of recognition of a green environment, the formation of their preferences attitudes to green (hereinafter referred to as the preference), to green building acceptance and recommendation of the formation of the green building decisions.
(2) People significant valid cognitive, preferences and decision-making on green building.
(3) People on the green building cognition and preferences will influence mutually.
(4) People on green building awareness and preferences will influence the decision.

Structural equation model (SEM) is a testing manifest variables and latent variables between statistical methods, but also a combination of statistical methods of factor analysis and path analysis, its biggest advantages: We can understand the structure of the linear relationship between the variables through SEM (Wu, 2008). The SPSS and LISREL statistical software is used to develop the proposed SEM model of this paper.

<table>
<thead>
<tr>
<th>Code</th>
<th>Question items</th>
</tr>
</thead>
<tbody>
<tr>
<td>REC</td>
<td>Cognitive question’s items:</td>
</tr>
<tr>
<td>A1</td>
<td>I have a better understanding of green building than nearby friends</td>
</tr>
<tr>
<td>A2</td>
<td>Green buildings cost will be much higher than the general building</td>
</tr>
<tr>
<td>A3</td>
<td>Green building will improve the quality of the environment where I live</td>
</tr>
<tr>
<td>A4</td>
<td>Green Building resiliency of the Earth has a great contribution</td>
</tr>
<tr>
<td>A5</td>
<td>Green building will reduce the frequency and magnitude of floods</td>
</tr>
<tr>
<td>A6</td>
<td>Green buildings more earthquake-resistant than traditional buildings</td>
</tr>
<tr>
<td>PRE</td>
<td>Preferences question’s items:</td>
</tr>
<tr>
<td>B1</td>
<td>I think the way home with natural ventilation far better than use of air-conditioning home style.</td>
</tr>
<tr>
<td>B2</td>
<td>I compare like grass brick paved parking lot far better than the cement parking lot.</td>
</tr>
<tr>
<td>B3</td>
<td>I prefer to use regenerative material</td>
</tr>
<tr>
<td>B4</td>
<td>I prefer the natural landscape than artificial landscaping</td>
</tr>
<tr>
<td>DEC</td>
<td>Decisions question’s items:</td>
</tr>
<tr>
<td>D1</td>
<td>I’m more accepting of green building than my friends</td>
</tr>
<tr>
<td>D2</td>
<td>I strongly hope that I live in a house in line with green building standards</td>
</tr>
<tr>
<td>D3</td>
<td>Given the chance I would certainly recommend the advantages of green building to my friends</td>
</tr>
</tbody>
</table>
4. Results and discussion

In this paper, a total of 500 questionnaires were distributed, 420 copies were recovered, among which 346 copies of a complete answer were obtained, the response rate was 84%, and the total effective questionnaire rate was 69.2%.

4.1 SEM model

Figure 2 is a showed the SEM model constructed with 346 questionnaires. In the figure, the facets (latent variables) and their relationships in the model represent the arrow factors (observed variables). The line of value represents the relationship among the factors and the influence of factor loadings. Positive impact signifies a positive impact minus a negative impact; in this model, all the symbols are expected positive signs. The figure number and line vector between numerical dimensions, on behalf of its causality, namely mutual influence direction, value indicates the size of the direct effect.

Table 2 shows the impact of green building decision (DEC) on the facet effects value, which can be divided into direct effects, indirect effects, and total effects. Visible: (1) Green Building Decision (DEC), the total effect (absolute value) from large to small of attitude toward green building (0.71), to green building awareness (0.35), which shows "attitude" of the "decision-making" in effect, clearly greater than the impact of "cognitive" to "decision-making"; and "attitude" in addition to the direct effect, in addition, also through the perception "of the" decision-making "an indirect effect. (2) The table is also a direct result of the value of the coefficient table multiplexing transmitter loop return equation, T values of the coefficients of the equation are greater than 1.96, with a significant level, and it's $R^2=0.55$, showing the variables have explanatory power of 51%, so the proposed model can be expressed as:

$$DEC=0.37 \times PRE + 0.39 \times REC, \quad R^2=0.55$$  \hspace{1cm} (1)
Where,
REC = 0.88 × PRE, \[ R^2 = 0.77 \]  (2)

It shows the acceptance of green building = 0.37 × degree of preference for green + 0.39 × awareness of green building. And the awareness of the green building = 0.88 × degree of preference for green.

Figure 2 the proposed SEM for Green building (the value of completely standardized coefficient, and the T-value in parentheses)

Table 2 the effect value that accepts a degree (DEC) factor to the green building

<table>
<thead>
<tr>
<th>Factor name</th>
<th>Direct effect</th>
<th>Indirect effect</th>
<th>Total effect</th>
</tr>
</thead>
<tbody>
<tr>
<td>To cognition of the green building (REC)</td>
<td>0.39</td>
<td>0</td>
<td>0.39</td>
</tr>
<tr>
<td>To Preferences of green building (PRE)</td>
<td>0.37</td>
<td>0.88 × 0.39 = 0.34</td>
<td>0.71</td>
</tr>
</tbody>
</table>

DEC = 0.39 × REC + 0.37 × PRE, \[ R^2 = 0.55 \]
REC = 0.88 × PRE, \[ R^2 = 0.77 \] ; DEC = 0.71 × PRE, \[ R^2 = 0.51 \]

4.2 Discussion
This proposed SEM model (Fig. 3) through the statistical test, show this article consistent data model and the survey sample, the pattern may be accepted; Hereby herein pattern (Fig. 3) as compared with the aforementioned preliminary model(Fig. 1), the set of visible research
assumed herein results established or not is as follows:
(1) Understanding of green building related to the formation of their awareness of green building. Similarly, the degree of recognition of a green environment, the formation of their preferences attitudes to green (hereinafter referred to as the preference), to green building acceptance and recommendation of the formation of the green building decisions; this assumption is valid.
(2) Significant valid cognitive, preferences and decision-making on green building; this assumption is valid.
(3) On the green building cognition and preferences will influence mutually; this assumption is only set up preferences affect cognitive hypothesis; but the cognition will influence the assumption of preferences is invalid.
(4) On green building awareness and preferences will influence the decision; this assumption is valid.

5. Conclusion
In this paper, the concept of consumer behavior, construct a green building awareness of the public's attitude questionnaire and use of Tainan and Kaohsiung city residents findings, structural equation modeling analysis, the proposed model, from the obtained results of this paper, it found that respondents were self-understanding of the extent of green building, level of acceptance of recycled materials, and the decision-making level of acceptance of green buildings are there to strengthen the space. In addition, the paper obtained causal model validation after the survey data, presented the following three:
(1) The visitor to the formation of green building awareness of green building, green environment recognition preferences and acceptance (decisions on green buildings) to green building.
(2) The public's preference for green will influence perceptions of green building.
(3) The public awareness of green building and green preferences will affect the acceptance of green buildings and other assumptions established; the future will be available for future reference implementation of green building and research work.

REFERENCES
[3] Chen, I Hsuan(2011),*Green Value-A Valuation Point of View*, *Department of Real Estate & Built Environment*, College of Public Affairs, National Taipei University, Master's
thesis.


