



Promoting green residential buildings: Residents' environmental attitude, subjective knowledge, and social trust matter



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ABSTRACT

The importance of psychological factors is increasingly being recognized in driving the green building (GB) movement. However, few empirical studies have gone deeper to explore specific psychological factors and their impacts on residents' acceptance of green labeled residential buildings (GLRBs). This study develops an extended Technology Acceptance Model (TAM) to explain residents' intention to adopt GLRBs, and examine it in a survey ($N = 342$) conducted in Tianjin City, China. The results show that subjective knowledge about GLRBs, social trust in organizations responsible for GLRBs, perceived usefulness from GLRBs, attitude towards GLRBs, and general environmental attitude measured by the New Ecological Paradigm (NEP) scale, are the significant psychological determinants of intention to adopt GLRBs. It is also found that lacking subjective knowledge and social trust among our surveyed residents could be the psychological barriers to their acceptance of GLRBs. The psychological factors we identified provide references for policymakers to effectively develop residents' behavioral intervention strategies and allocate resources in GB promoting schemes. It is highly necessary to equip residents with more knowledge about GLRBs and improve their social trust in organizations responsible for delivering GLRBs.

1. Introduction

Green building (GB) emerges as part of a larger social movement towards environmental sustainability (Hoffman and Henn, 2008). It is regarded as one effective way to mitigate greenhouse gas emissions and solve the global energy crisis (World GBC, 2013; Zhao et al., 2015). Eco-label scheme has been regarded as an important element for promoting the GB movement and also for other environmental sustainability programs (Shi, 2014). Many countries around the world have developed GB label programs (Mao et al., 2009), including the Leadership in Energy and Environmental Design (LEED) in US, Building Research Establishment Environmental Assessment Method (BREEM) in UK, Comprehensive Assessment System for Built Environment Efficiency (CASBEE) in Japan, and Green Mark (GM) in Singapore and so on. In China, the launch of *Evaluation Standard for Green Building* (ESGB) in 2006 marks the inauguration of China's Green Building Label program. Building projects that apply for Green Building Label and meet the corresponding evaluation standards and requirements will be conferred with Green Building Label. Residential buildings account for 47.7% of the 3979 Green Building Label projects by the end of 2015

(Chinese Society for Urban Studies, 2016). Most of them are urban residential buildings. Besides, LEED certification is available in China and many projects have been conferred with green building labels under the LEED green building certification system. Green Labeled Residential Buildings (GLRBs) refer to residential buildings that have been conferred with China Green Building Label, LEED or other green building labels.

In terms of promoting Green Building Label among urban residential buildings, there are still many problems ahead (Li et al., 2014; Ye et al., 2015, 2013). The biggest problem is the low level of awareness and market demand for GBs. Price and location are Chinese residents' most concerned elements, rather than the buildings' green features when they choose residences (Li et al., 2014). Without strong market demand, developers would not have motivation to develop GBs (Persson and Grönkvist, 2015). One prerequisite to market demand is the acceptance of residents, who are the final buyers and consumers of the residential buildings and hence would have a large influence on the future development of more GLRBs (Darko and Chan, 2017). To increase the residents' acceptance of GLRBs, several studies (Cole et al., 2010; Hoffman and Henn, 2008; Zuo and Zhao, 2014) have highlighted

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the importance of psychological and social factors (e.g., perceived benefit from GLRBs and social trust in organizations responsible for GLRBs). As stated by Hoffman and Henn (2008): "obstacles faced by the green building movement are no longer primarily technological and economic. Instead, they are social and psychological." (p. 391) However, few empirical studies have examined the relationship between socio-psychological factors and residents' acceptance of GLRBs (Zhao et al., 2015; Zuo and Zhao, 2014). We have insufficient knowledge on what factors really shape residents' acceptance of GLRBs, and which could hinder the effective promotion of GLRB movement in society. For developing nations like China, lacking residents' awareness and residents' acceptance might be more serious. Thus, as suggested by Darko and Chan (2016), it is more meaningful to examine the residents' acceptance of GBs and its psychological determinants, and the barriers to successful adoption of GB in developing countries.

As stated before, there exists an increasingly recognized need to understand what psychological factors could affect the residents' acceptance of GLRBs. The Technology Acceptance Model (TAM) (Davis, 1989; Davis et al., 1989) was used to explain user acceptance of information and computer technologies and now is a widely-used theory for explaining and predicting users' acceptance of technological innovations or new products. Behind it is the belief-attitude-intention-behavior causal relationship. In TAM (see Fig. 1), people's beliefs of usefulness and ease of use related to a technology (i.e., perceived usefulness and perceived ease of use) are assumed to predict their attitude towards such technology, then attitude establishes possible usage intentions, and finally influence their actual usage of the technology. Perceived usefulness and perceived ease of use may be influenced by external factors, such as training and user supports. Usually, usage intention is taken as a proxy of actual usage behavior, when actual usage behavior is difficult to assess. Because GLRB is a combination of various new green technologies integrated into residential buildings, it is possible for us to base on TAM to explain and predict residents' acceptance of GLRBs in the early stages of GB movements in China.

TAM with its key variables (i.e., perceived usefulness, perceived ease of use, attitude and intention) is confirmed to successfully explain user behaviors of various information and computer technologies (Davis, 1989; Davis et al., 1989; Gefen et al., 2003). We also base on TAM as the theoretical foundation to explain and predict the residents' acceptance of GLRB projects. When the residents perceive more usefulness (e.g., energy saving and promoting health) and more ease of use (e.g., ease to operate the technologies in green buildings) from GLRBs, they would have higher degree of intentions to adopt green buildings. In the GB context, we argue that other psychological factors deserve particular attention in explaining the GLRB acceptance. Three factors attract us, including the residents' knowledge about GLRBs, social trust in organizations responsible for GLRBs, and environmental attitude. Firstly, the residents' knowledge about GLRB features (e.g., benefits and usefulness of GLRBs) is essential to their attitudes and intentions to adopt GLRBs. People with greater knowledge about advantages of a technology would be expected to be more likely to accept this technology. Secondly, the concept of social trust will have a specific role in the decision making process of accepting GLRBs. Different from the

users of information and computer technologies, the public might have not enough experience and knowledge about green buildings, because GBs have not gained sufficient popularity and GLRB projects are not yet widely developed in China. In such cases, people will use trust as a strategy to reduce cognitive complexity in risky decisions (Earle and Cvetkovich, 1995), e.g., in accepting or rejecting a technology. High social trust in organizations responsible for green buildings can convince the public to adopt green buildings and reduce the complexity of the public's decision processes for accepting green buildings. Compared to other kinds of green products, the delivery of GLRBs involves many sub-processes, multiple stakeholders and much longer delivery time than traditional buildings. The complexity of the delivery process brings much uncertainty and risk to consumers. Social trust in responsible organizations is one of the most effective tools to reduce consumers' perceived uncertainty and risks (Suh and Han, 2002), and then generate a sense of security to purchase and use the related products. Therefore, social trust might play a critical role in shaping residents' attitude and intention to use GLRBs. Thirdly, the residents' environmental attitude may also play a critical role in the decision making process of adopting GLRBs, because GLRBs are pro-environmental products and thus adopting GLRBs is a specific pro-environmental behavior. We suggest that general environmental attitude can guide the public's intention to accept green buildings. In sum, we think it is interesting and also valuable to consider these psychological factors within TAM.

Our study will integrate three psychological factors (i.e., social trust, subjective knowledge, and environmental attitude) into TAM as antecedents to explain residents' attitude towards and behavioral intention to use GLRBs. It is expected to make three contributions to theory and practice. First, as stated before, few empirical studies in social science have been conducted to examine the relationship between various psychological factors and residents' acceptance of GLRBs. Filling such research gap could facilitate deep understanding of human dimensions of GLRBs. Second, we investigate what factors could be the psychological barriers to GLRB adoption. Possessing such knowledge and also the knowledge on the predictors of residents' acceptance of GLRBs will provide policymakers with the insights of targeted factors to further promote the green residential building movement in practice. Last but not the least, we check the application of TAM in the GB context and integrate specific socio-psychological factors (e.g., social trust and environmental attitude) into it, to increase its explanatory power. Of note is environmental attitude in TAM for explaining pro-environmental behaviors. To the authors' best knowledge, there are no studies examining the impact of general environmental attitude in shaping specific attitudes towards and intention to adopt pro-environmental products within TAM. Thus, our work might also contribute to TAM in explaining pro-environmental technologies.

The left part of the article is organized as follows: Section 2 reviews the literature and develops the extended TAM framework for explaining residents' behavioral intention to adopt GLRBs. Section 3 delineates the methodology issues, which includes measure design, data collection, reliability and validity test, and data analysis method. Section 4 presents the results and Section 5 discusses the results and derives policy

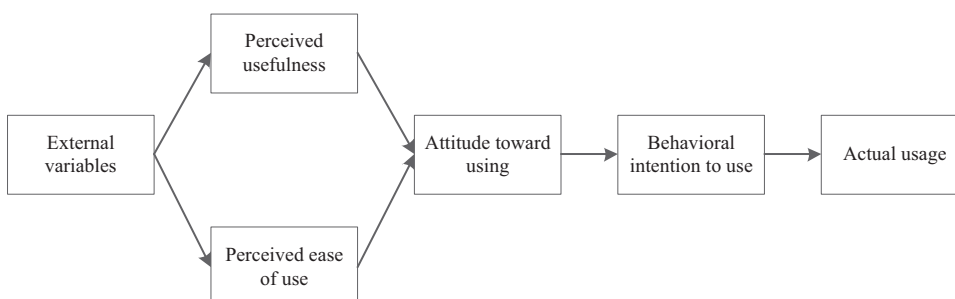


Fig. 1. Technology Acceptance Model (TAM).

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