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Green Building Pro-Environment Behaviors: Are Green Users Also Green Buyers?

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Abstract: Pro-environment behaviors play a key role in advancing the development of green buildings. This study investigated the link between two green building pro-environment behaviors that require dissimilar resources: energy savings that do not require money in order to be more environmentally friendly and willingness to pay that involves economic resources including spending money in order to be more environmentally friendly. This study points out that the two pro-environment behaviors can be positively linked to each other. People who behave in an environmentally friendly manner at work would also be likely to pay an extra cost for a green building when buying a new home. The consistency of the two pro-environment behaviors can be explained by their common environmental beliefs: limits to growth and eco-crisis. The green building movement should prioritize pro-environmental behaviors and associated environmental beliefs to support green building policies, guidelines, and tools.

Keywords: green building; pro-environment behaviors; energy saving; willingness to pay; environmental belief

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1. Introduction

1.1. Green Buildings

The building sector accounts for a large portion of greenhouse gas emissions and therefore represents opportunities for emissions reductions [1]. In past decades, the building sector has witnessed a green building revolution, driving design and construction toward sustainability [2]. One of the most significant parts of this movement is the launch of a series of green building rating systems, standards, guidelines, and certifications, such as U.S. LEED (Leadership in Energy and Environmental Design), U.K. BREEAM (Building Research Establishment Environmental Assessment Method), and China GBL (Green Building Label) [3]. The green building concept is based on a life cycle perspective during a building's design, construction, and operation, so that its negative impact on the natural environment and human health is minimized [4]. In practice, green buildings require special considerations in terms of site selection, public transit connection, facilities accessibility, urban heat islands, landscape irrigation, indoor air quality, natural ventilation, daylighting, and material selection [5]. Despite the momentum of the environmental movement, green building is facing significant doubts and challenges which are rooted in non-environmentally friendly habits and require a change in behavior [6].

Green buildings may actually consume more energy than non-green buildings due to users' practices. Newsham et al. [7] conducted an analysis of building energy uses of 100 LEED-certified commercial and institutional buildings, using the dataset provided by the New Buildings Institute and the U.S. Green Buildings Council. On average, LEED buildings used 18–39% less energy per floor area than their conventional counterparts. However, 28–35% of LEED buildings used more energy than their conventional counterparts. The studies pointed out that differing occupancy hours and loads were the main factors that caused LEED buildings to not perform well. Gill et al. [8] conducted a post-occupancy evaluation of the highest-rated U.K. EcoHomes site. The detailed post-occupancy evaluation investigated the energy performance of the buildings, water consumption, and the comfort and satisfaction of users. Results indicated that energy-efficiency behaviors account for 51%, 37%, and 11% of the variance in heat, electricity, and water consumption, respectively, between dwellings. Scofield [9] investigated energy consumption, greenhouse gas emissions, and Energy Performance Rating data for 953 office buildings in New York City. Twenty-one of these office buildings were identified as LEED-certified, providing the opportunity for direct comparison of energy performance data for LEED and non-LEED buildings of the same type, time frame, and geographical and climate region. The LEED-certified buildings, collectively, showed no savings compared to non-LEED buildings. LEED Silver and Certified office buildings underperformed other office buildings, suggesting that the LEED building certification is not moving the city toward its goal of climate change mitigation. Increasing concern and controversy surrounding the actual performance of green or sustainable buildings exists [10]. These studies also suggested that the gap arises not because green building design, tools, techniques or technologies are ‘wrong’, but because of what happens in reality; buildings do not use energy, but people do [11]. A green building becomes greenwash if it relies on technological solutions, such as solar panels and thermal insulation, while maintaining intensive energy use habits. Good use behaviors can significantly reduce energy consumption [12].

The green building market share is still small due to the extra cost incurred by building green. Notwithstanding the numerous benefits associated with green buildings, the issue of upfront cost is a frequently cited obstacle which precludes the widespread adoption of green buildings [13,14]. In the most widely cited investigation of the costs and benefits of green buildings, Kats et al. [15] compared the cost of 33 LEED certified green buildings to a conventional design for the same buildings, and found the cost of the green buildings was 1.84% higher, on average. In a later study, Kats [16] conducted a survey about the green premium on more than 170 green buildings and concluded that the premium on green buildings ranged from 0% to 18%. Langdon [17] indicated that the cost premium for constructing green office buildings in Australia ranged from 3% to 5% higher for 5-Star certified buildings, and this ratio went beyond 5% for 6-Star buildings. Kim et al. [18] reported an increase of 10.77% in the construction costs due to incorporating the green building code for residential project development. Steven Winter Associates [19] investigated the cost implications associated with achieving different levels of LEED certification and found that the green cost premium ranged from 1% to 8.1% depending on the level of certification. Dwaikat and Ali [20] reviewed 13 green building costs studies and found significant variations. Out of the 13 studies, eight studies recorded a cost premium of greater than 5%, and out of these eight studies, five studies recorded a premium greater than 10%, and out of the five studies, only two recorded a green cost premium greater than 20%. Uğur and Leblebici [21] categorized two major costs related to a green building project: construction costs and soft costs. The construction costs refer to expenses for construction of the building by the contractor according to the design features. More than half of the construction costs consist of green features, such as alternative systems, applications, and materials, which are converted into credits under the green building rating system. Costs other than the construction costs, referred to as soft costs, include certificate application and approval costs, consultancy and commissioning costs, and additional design costs. The extra cost significantly handicaps the large scale adoption of green buildings [22].

1.2. Pro-Environment Behavior

Human behaviors are the root, as well as the solution, for today’s environmental challenges [1,23]. Pro-environment behaviors have been encouraged in the design of energy and climate policies [24].

Encouraging pro-environmental behavior has become a research hot spot. Steg and Vlek [25] defined pro-environmental behaviors as a range of behaviors that benefit the natural environment, enhance environmental quality, or harm the environment as little as possible. Lindenberg and Steg [26] argued that environmental behaviors often involve a conflict between the different goals a person pursues and suggested a value belief norm model to help understand a person's environmental behaviors. Stern et al. [27] suggested that individuals who accept a movement's basic values believe that valued objects are threatened, and believe that their actions can help restore those values, experience an obligation for pro-movement action that predisposes them to provide support. A number of studies have applied the theory to predict various types of pro-environment behaviors, such as acceptability of household energy conservation behaviors [28], travel mode choices [29], and workplace energy use behaviors [30].

Studies of pro-environmental behaviors are going beyond the singular linear process of behavioral activation and looking at the complexity between two or more pro-environmental behaviors. Larson [31] argued that understanding the multi-dimensional structure of pro-environmental behaviors would be of great importance and that pro-environmental behaviors contain multiple domains that cannot and should not be measured using an aggregated scale. Kaiser and Kibbe [32] suggested that pro-environmental behaviors could be approached from either an observer's outside or an actor's inside viewpoint: when behavior is defined from the outside by its ecological consequences, even seemingly similar behaviors, such as recycling paper and plastics, would fall into distinct categories; while, when behavior is defined from the inside by the actor's environmentally protective intentions, even diverse acts such as recycling and willingness to pay for solar panels would appear to belong to one class of actions. Another complexity between pro-environmental behaviors is behavioral spillover: when performing one pro-environmental behavior increases the likelihood of performing another [33,34]. For example, people are more likely to recycle plastics when they already practice recycling paper. On the other side, when people perform one pro-environmental behavior, the successful performance of that behavior might be perceived as having achieved the goal or having done enough to move toward the goal. The person may then see no need to perform any additional pro-environmental task [34]. For example, people may buy organic foods and perceive that action as satisfying the goal of being a green consumer, and therefore may not subsequently consider buying local products because buying organic foods is seen as a substitute for buying locally produced foods [35]. A number of studies pointed out that resources and cost of behaviors could play a significant role in the link between two pro-environmental behaviors [36] and the consistency of two pro-environmental behaviors [37].

1.3. Objective

The next stage of the green building movement needs to address pro-environmental behaviors to overcome the abovementioned habitual barriers. The movement should especially encourage energy and resource saving to reduce the energy consumption of the green buildings in use and should also cultivate the consumers' willingness to buy green buildings to increase the market share [38]. Although a number of environmental studies have investigated different pro-environmental behaviors, and their complexity and intricacy [39,40], few have focused on green building-associated pro-environment behaviors to provide information for the development of green buildings. This research aims to link the two types of pro-environment behaviors in relation to green buildings. Specifically, the research has two research questions to answer.

The first question is, "Are green building users also green building consumers?" In other words, would people who behave in an environmentally friendly manner in using green buildings be likely to pay for the extra cost of green buildings? The literature about pro-environment behaviors discloses the complexity and intricacy of different behaviors and the spill-over effect. One element that is not often discussed in the pro-environment literature is the role that resources play in the performance of behavior, the extent to which its performance requires tangible and intangible resources [41]. This research aimed to investigate the spillover effects related to green building pro-environment behaviors that require dissimilar resources: energy and resource saving behaviors in using green buildings that do not require money in order to be more environmental friendly and willingness to pay for the extra cost of green building that involves financial resources, meaning spending money in order to be more environmentally friendly.

The second question is, "What environmental belief can predict the two pro-environment behaviors?" Environmental belief refers to a person's worldviews about the relationship between humans and their natural surroundings, which underlies a system of attitudes and beliefs that determine behavior toward the environment [42]. Environmental beliefs have been mentioned as a potential predictor of energy and resource conservation behaviors, such as water conservation [43], organic food production [44], and other pro-environmental behaviors [29,45]. For the first time, this research correlated environmental beliefs with two key green building pro-environment behaviors, aiming to provide evidence and guidelines to push the green building movement toward the next stage. This next step is how the green building movement can promote building users' pro-environmental behaviors and encourage them to pay the extra cost of green building by using different kinds of green technologies.

2. Materials and Methods

The data were mainly collected from a green buildings users' survey in China. The survey was conducted in developed areas in China, including Shenzhen, Shanghai, and Guangzhou, where green buildings have been constructed, supported by governments, and adopted by developers. LEED and GBL are currently the most popular rating systems in China. GBL is similar to LEED in that it uses checklist scoring of green buildings in five categories: sustainable site, energy and atmosphere, water efficiency, materials and resources, and indoor environmental quality. Seven green buildings and their 412 users were involved in this survey (Table 1). Among the 7 green buildings, 4 are GBL buildings and 3 are LEED buildings. They are the first-generation green buildings in China, representing cutting-edge green design and technologies. On average, the respondents worked at least 5 days per week and 8 hours per day in these buildings, and most had worked in the buildings for more than a year.

Table 1. Surveyed green buildings and participants.

No.	Location	Rating System	Year Built or Certified	Number of Participants	Main Green Features
1	Shenzhen	GBL	2009	82	Green roofs, atrium, water cooling system, photovoltaic panels, indoor plants, operable windows
2	Shenzhen	GBL	2009	75	Atrium, independent temperature-humidity control air conditioning system, intelligent blinds
3	Shanghai	LEED	2010	55	Wetland ecological system, photovoltaic panels, heat pumps, silicon cooling system, indoor greenery, electrical fans, operable windows
4	Shanghai	GBL	2007	42	Green roofs, grey water recycling, solar hot water, ground cooling system, indoor greenery, electrical fans, operable windows
5	Guangzhou	GBL	2009	60	A courtyard, pervious pavement, grey water recycling, photovoltaic panels, heat pumps, operable windows
6	Shenzhen	LEED	2008	50	Green roofs, grey water recycling, rain water harvesting, photovoltaic panels, task lights, movable louvers
7	Shanghai	LEED	2010	48	Water-saving appliances, Energy Star labelled office appliances, certified low VOC (Volatile organic compounds) materials, indoor greenery

The survey used was a standard questionnaire. The questionnaire had several parts: demographics, pro-environment behaviors including energy and resource saving at work and willingness to pay for green building when buying new homes, and environmental beliefs. For energy and resource use behaviors, respondents were required to indicate their habits in their green office buildings, including "switch off electricity", "take shorter shower", "use half flush", "reuse paper", "use stairs instead of lifts", "use public transport instead of private", "use recycle bins", and "reuse paper" on a Likert-scale: never, seldom, sometimes, often, or always. For willingness to pay, participants were required to indicate their preference for paying an additional cost of a green building development, from 0% to above 9%, when buying new homes. These figures originated from an analysis of green building costs conducted by the government [46]. The three cities in which the survey was conducted are the most affluent areas in China; their housing prices are comparable. The related information was provided with the specific question. Moreover, they were also required to indicate their willingness to pay for specific green technologies when they buy their new homes including LED (light-emitting diode) lighting, high performance air-conditioning, green roof, thermal insulation, noise insulation, photovoltaics, solar hot water, rainwater collection, indoor air quality monitoring, and energy smart control. A part about environmental beliefs, using New Environment Paradigm (NEP), was also included. The NEP requires participants to provide a score on 15 statements showing their environmental belief about humans' relationship with nature [47]. In this research, NEP was used to account for the consistency of the different types of pro-environment behaviors which require dissimilar resources. The 15 NEP statements contained at least four basic environmental beliefs [48,49]. The first was anthropocentrism, which accepts the idea that nature exists primarily for human use and has no inherent value of its own, and humans have the right to modify the natural environment to suit their needs. The second was exemptionalism, which assumes that humans are exempt from the constraints of nature. The third was limits to growth, which is concerned with equity and development issues, limits to human interference with nature, and limits to population growth with regard to the carrying capacity of the earth. The fourth was eco-crisis that stresses the human dependence on nature and the disastrous outcomes of human interference in nature. Microsoft Excel 2010 and IBM SPSS 2.2 were used to analyze the data.

3. Results

3.1. Pro-Environmental Behaviors

Figure 1 shows participants' practices with respect to the eight behavioral items. Participants had excellent habits in terms of switching off lights and their computer when not in use. These are the two saving behaviors that are most commonly found in office building energy use studies [30,50]. They also demonstrated the good habits of using stairs instead of elevators, and using public instead of private transportation. These two behaviors, which are not only related to energy saving but also to health and physical well-being, are increasingly encouraged in workplace settings [51]. Reusing paper and using recycle bins were the third type of resource saving behaviors frequently practiced by participants. Office reusing and recycling have been investigated in other studies which found that prior experience was shown to be an excellent predictor of office-based conservation behavior; in other words, prior experience with household recycling was effective at predicting office recycling behavior [52]. The least practiced resource saving habits were using half flush and taking short showers. Although little research has been conducted on these two behaviors, water savings contribute to a significant portion of the credits and performance of green buildings [53].

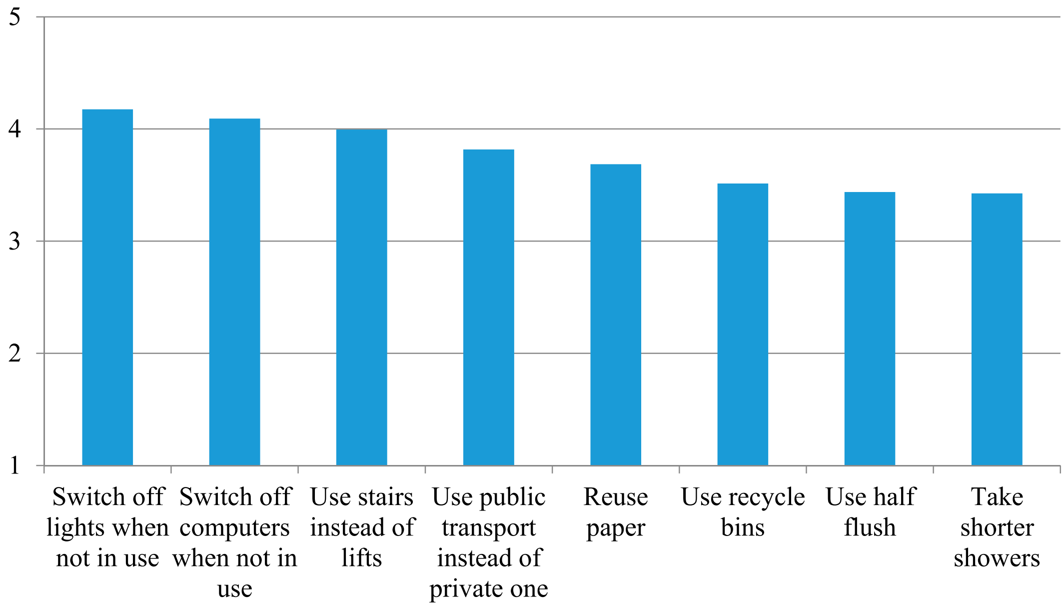

Figure 1. Energy and resource saving behaviors in green buildings. The response values ranged from 1, which meant "never", to 5, which meant "always".

Figure 2 shows the responses for willingness to pay for green technologies when buying new homes. Among all the technologies, garbage classification was mentioned as the green technology they were most willing to pay for. There is no systematic garbage classification policy in China; although some cities were selected for piloting garbage classification, the outcomes were not positive due to existing practice and habits [54]. People are willing to pay for technologies that could help them classify garbage, recycling, and landfills. The second technology people are willing to pay for is air quality monitoring, followed by high efficient air-conditioning. In recent years, air pollution has become an urgent issue in China. The responses indicated the priority of green technologies that improve air quality when purchasing new homes. Other green technologies that can save energy costs, such as green roofs, thermal insulation, photovoltaics, and solar hot water, were next after garbage classification and air quality associated technologies. Other green technologies, such as LED, rainwater, and noise control, were sparsely chosen. The technology the respondents were least likely to pay for was smart control. Although a smart home is arguably more energy efficient in an intelligent way, the social barriers, such as violations of privacy, have not yet made the technology popular or acceptable [55].

Figure 3 shows the responses about the extra cost people are willing to pay when buying new homes. Dwaikat and Ali [20] reviewed green building cost studies and found that more than half the studies recorded a cost premium of greater than 5%. This research used 5% as a medium value to categorize the responses. The result showed that most people are willing to pay less than 5% of a premium for green homes. Above that premium level, the responses sharply dropped. Figure 4 juxtaposes the responses on the number of green technologies people are willing to pay for and the extra cost they are willing to pay for a green building. A positive relationship was seen between them, which means that people who are more willing to pay higher green building costs tend to be willing to pay for a higher number of green technologies.

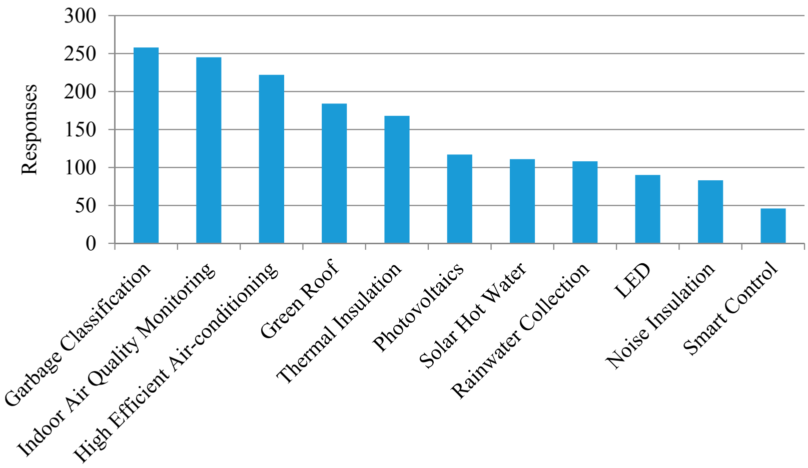

Figure 2. Willingness to pay for green technologies.

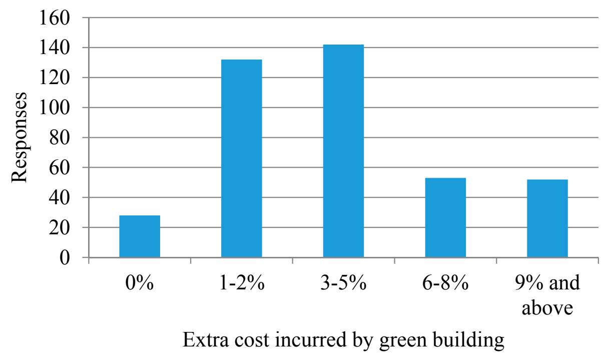

Figure 3. Willingness to pay an extra premium for a green building.

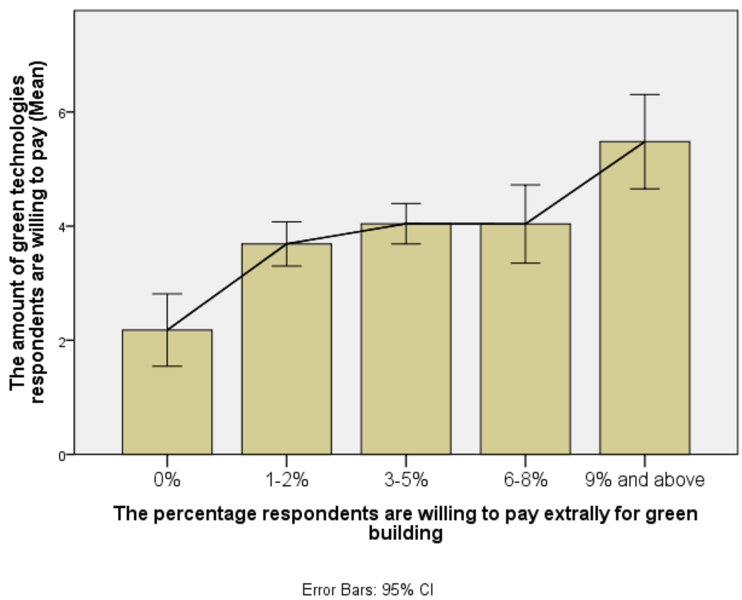

Figure 4. Willingness to pay for green technologies and for the extra cost of a green building.

Table 2 is the Pearson correlation analysis for the three subjects for which the responses were collected. For energy saving behaviors, the nine items were loaded on one potential variable that represented the energy saving behaviors. Correlation analysis was conducted between the three subjects and they were found to be significantly correlated with each other. People who behaved more environmentally in their green office buildings are more willing to pay for the extra cost of a green building and to pay for green technologies.

Table 2. Correlation table.

Pro-environment Behaviors		V1	V2	V3
Willingness to pay for green technologies V1	Pearson Correlation Sig. (2-tailed)	1	0.247 ** 0.000	0.241 ** 0.006
Willingness to pay for extra cost of green building V2	Pearson Correlation Sig. (2-tailed)	0.247 ** 0.000	1	0.0.232 ** 0.004
Energy saving behaviors V3	Pearson Correlation Sig. (2-tailed)	0.241 ** 0.006	0.232 ** 0.004	1

** Correlation is significant at the 0.01 level (2-tailed).

3.2. Environmental Beliefs

We also investigated environmental beliefs, which is an important predictor for pro-environment behavior. Factor analysis, which is a statistical method used to describe variability among observed, correlated variables in terms of a potentially lower number of unobserved variables, was conducted to reduce the 15 NEP items. Table 3 shows the factorial loadings on the two most common factors. The two most common factors accounted for 60.947% of the variability. Based on previous research [56], the two common factors are limits to growth and eco-crisis, and anthropocentrism and exemptionalism. Limits to growth and eco-crisis possibility stress human dependence on nature and the belief in a disastrous outcome as a result of human interference with nature. It also involves the idea that the balance of nature is quite fragile and human interference endangers this balance. Anthropocentrism and exemptionalism accept the idea that nature exists primarily for human use and has no inherent value of its own, and that humans have the right to modify the natural environment to suit their needs. It also assumes that humans are exempt from the constraints of nature, and supports human domination over nature.

Table 3. Factor analysis of the 15 New Environment Paradigm (NEP) statements.

NEP Statements	Loading	
	Limits to Growth/Eco-Crisis	Anthropocentrism/ Exemptionalism
1: We are approaching the limit of the number of people the earth can support.	0.635	−0.159
2: Humans have the right to modify the natural environment to suit their needs.	−0.078	0.691
3: When humans interfere with nature it often produces disastrous consequences.	0.797	0.041
4: Human ingenuity will insure that we do not make the earth unlivable.	0.066	0.752
5: Humans are seriously abusing the environment.	0.727	0.023
6: The earth has plenty of natural resources if we just learn how to develop them.	−0.182	0.623
7: Plants and animals have as much right as humans to exist.	0.609	0.016
8: The balance of nature is strong enough to cope with the impacts of modern industrial nations.	0.215	0.695
9: Despite our special abilities, humans are still subject to the laws of nature.	0.771	0.164
10: The so-called "ecological crisis" facing humankind has been greatly exaggerated.	0.258	0.648
11: The earth is like a spaceship with very limited room and resources.	0.744	0.161
12: Humans were meant to rule over the rest of nature.	0.178	0.732
13: The balance of nature is very delicate and easily upset.	0.697	0.001
14: Humans will eventually learn enough about how nature works to be able to control it.	−0.019	0.755
15: If things continue on their present course, we will soon experience a major ecological catastrophe.	0.764	0.115

The factor analysis also extracted the two most common factors as separate variables to predict the pro-environment behaviors for green buildings. Table 4 shows the regression results using the two NEP common factors as independent variables and the pro-environment behaviors as dependent variables. Collinearity was assessed by examining two factors: tolerance and the Variance Inflation Factor (VIF). As rule of thumb, the tolerance should be above 0.20 and the VIF should be greater than one. All models met the criteria, ensuring that these variables are moderately correlated. The limits to growth and eco-crisis factors consistently explain all pro-environment behaviors related to green buildings investigated in this study.

Table 4. Regression models.

Title	Limits to Growth and Eco-Crisis (Standard Coefficient)	Anthropocentrism and Exemptionalism (Standard Coefficient)	R2	Sig.
Willingness to pay for green technologies	0.585 ***	0.140	0.352	0.000
Willingness to pay for green buildings	0.233 ***	0.081	0.223	0.000
Switch off electricity after leaving homes	0.268 ***	0.039	0.367	0.000
Take quick shower	0.225 ***	0.007	0.220	0.001
Use half flush	0.177 ***	80.039	0.209	0.001
Choose most energy efficient appliances	0.227 ***	−0.015	0.306	0.000
Use your own shopping bags	0.238 ***	−0.068	0.340	0.000
Use public transport	0.201 ***	0.005	0.302	0.000
Recycle used items	0.165 **	−0.021	0.220	0.001
Sort garbage before disposing	0.164 **	−0.107*	0.237	0.000

* $p < 0.05$; ** $p < 0.01$; *** $p < 0.001$.

4. Discussion

This research investigated two green building pro-environment behaviors: energy saving and willingness to pay. These two pro-environment behaviors play key roles in the development of green buildings which will lead the next revolution in green buildings. The findings can be summarized as follows.

Firstly, the results show a gradient of energy saving behaviors: electricity use behaviors, such as turning off lights and computers, are most frequently practiced; the next most popular were the mobility related behaviors, such as using stairs and public transport; after that were the reusing and recycling behaviors; and the least practiced behaviors surrounded water saving habits. The ranking of these behaviors was not focus of this research. However, this result echoes the argument that energy and resource saving behaviors that require a degree of personal sacrifice are less acceptable [57]. For example, people may be unwilling to endure a reduction in comfort by turning off the water when soaping up, or any perceived reduction in hygiene by reducing toilet flushes [58].

Secondly, the results show that most respondents were willing to pay less than a 5% additional premium for a green building; beyond that, the willingness dropped significantly. This figure is the median according to green building cost studies and is also the maximum extra cost consumers are willing to pay. As per specific green building technologies and environmental features, the result shows that green building technologies related to air quality are preferred over energy efficiency related technologies. This is somewhat different from the findings in a different green building pro-environment behavior study by Chau et al. [38] who pointed out that Hong Kong residents were willing to pay more for energy conservation, than other green features, such as indoor air quality improvement, noise level reduction, landscape area enlargement, or water conservation.

Thirdly, the two pro-environment behaviors are consistent and have positive spillover effects. People who behave in an environmentally friendly manner at work are also likely to pay for the extra cost of green buildings and green technologies when they are buying new homes. Köpetz et al. [59] used a "goal" to explain the links connecting different behaviors: the activation of one pro-environment behavior facilitates the activation of another pro-environment behavior, linked by a common goal.

Truelove et al. [34] suggested that resource requirements play a significant role in the spillover of pro-environment behaviors within the theoretical goal framework. When behaviors draw on the same type of resources, this may strengthen the perceived similarity between these behaviors. Thøgersen and Ölander [60] reported that pro-environmental behaviors, similar in terms of the time and place of their performance, the resources employed, etc., tended to be more strongly correlated than behaviors within different categories. However, this theoretical goal framework might not fit well for explaining the two green building pro-environment behaviors we examined. Saving energy requires fewer economic resources than paying for the extra cost of green buildings. Moreover, saving energy at work might be considered altruistic, because often no personal benefits accrue, while buying green buildings and technologies might be beneficial for cutting energy costs and improving indoor air quality. Leygue et al. [50] considered the possibility that energy saving at work could be a form of impure-altruism, and based on motivation measurement, they found that environmental concern and the desire to help one's organization predicted energy savings.

Lastly, the consistency of the two green building pro-environment behaviors can be explained by the environmental beliefs of limits to growth and eco-crisis. This study used 15 NEP statements to predict the two pro-environment behaviors. The 15 NEP statements potentially contain at least four environmental beliefs: anthropocentrism, exemptionalism, limits to growth, and eco-crisis. Previous studies have found separate effects of the four environmental beliefs [48,49]. This study found two polarized effects of the four beliefs. The two beliefs of limits to growth and eco-crisis were found as proactive environmental beliefs that predicted the pro-environmental behaviors toward green buildings investigated in this study.

5. Conclusions

This research has important implications for the development of green buildings. The green building revolution, which started in the 2000s, has now come to a stage where many certified green projects have been found to be greenwash, since many LEED projects were found to be energy intensive and expensive, and many green building incentives were short-sighted [61,62]. Pro-environment behaviors are the key to moving forward the green building movement to the next stage, and to ensure lasting beneficial environmental impacts.

This research highlights that there is consistency in green building pro-environment behaviors. Green building development should address this cycle: green buildings cultivate green users and green users become green buyers. Although the pro-environment behaviors of using green buildings and buying green buildings require different financial resources, they share common environmental beliefs of limits to growth and eco-crisis. The green building movement, therefore, should prioritize this belief in the green building rating systems and their related incentives, in addition to the existing guidelines, tools, techniques, and technologies.

This research attempted to link different green building pro-environment behaviors. The study has some limitations, especially in the study design. The data about willingness to pay and use behaviors were mainly based on public opinion surveys of green building users. There is a lack experimental elements which could more rigorously assess their willingness and practice [63]. Because of this limitation, we recommend that decision makers for green buildings exercise caution when interpreting and using willingness to pay and behavioral results from this study. A future study should be tailored to link specific green building elements and technologies with the two pro-environment behaviors to generate more evidence to inform the green building movement. A future study should also adopt experimental methods to observe users' behaviors and their willingness to buy. Normalizing the spending power of the respondents is also required.

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