The Relationship between the Occupation of Residential Green Buildings and Pro-environmental Behavior and Beliefs

Author
Sara J. Wilkinson, Paul Van Der Kallen, and Leong Phui Kuan

Abstract
The United Nations strives to promote a healthier society and to develop sustainability, with initiatives such as the New Green Economy, which is part of the United Nations Environment Programme (UNEP). This paper uses a survey of owners and occupiers, using two conceptual frameworks known as the Four Myths of Nature and place theory to investigate whether living in “green” buildings induces behavioral changes leading to a greener society. The results show that it is not possible to conclude that green buildings are inhabited by green occupants, and that physical design and green development alone can harness the attitudes and behaviors associated with green citizenship. Thus, policymakers and developers should not exclusively rely on a green built environment to promote green behavior.

Conventional buildings, which are those constructed with an inefficient use of resources, are an indirect cause of disruption to the natural ecosystem and a way in which humans are inducing climate change (Daily, 1997). Sustainability issues that need to be addressed, which can be addressed in green building design, construction, and occupation, include a reduction in the world’s freshwater supply and natural resources, along with degraded energy flows (Yudelson, 2007). In addition, the political processes of many countries have been occupied with the introduction of the so-called ‘green equation,’ which posits that “environment plus green building equals sustainable future” (Thaler and Sustein, 2008). Over the last two decades green buildings have become a dominant political discourse in many countries (Carter and Ockwell, 2007), with policymakers and governments believing that green buildings create incentives for improved consumer knowledge with regard to low carbon living and green lifestyles (Chan, Qian, and Lam, 2009). Although this study explored occupiers of green and non-green residential stock in Malaysia, the findings may be replicated in other countries. Malaysia has a population around 30 million people, and is a federal constitutional monarchy. The gross national product of Malaysia has grown on average 6.5% per annum for the last 50 years. This strong economic growth and a mature property market
with green building rating tools made it worthwhile to examine occupier attitudes and behaviors in the Malaysian green residential property market. It is posited that research exploring the relationship between the occupation of green residential buildings and pro-environmental behavior and beliefs is important as it can assist policymakers in more targeted and effective decision making.

Research Questions

This paper evaluates the green citizenship characteristics of green homeowners and/or occupants. The variables used to measure these concepts are pro-environmental attitudes and behaviors as represented by environmental beliefs, attitudes, and actions. Although these variables represent a low number of predictors in a complex array of variables, measuring them is of interest because of their importance in predicting pro-environmental cognition and behavior. The research questions the paper seeks to answer are as follows: (1) Are the green citizenship characteristics of occupants of residential properties improved after buying and/or occupying a green building? (2) To what extent do occupants exhibit the characteristics of ‘green citizenship’ with high levels of pro-environmental beliefs, attitudes and behaviors?

The Relationship between Green Buildings and Occupant Behaviors and Attitudes

Green building involves the construction of resource-efficient buildings with innovative technologies to reduce energy and water consumption and improve waste management (Chan, Qian, and Lam, 2009). However, for green buildings to deliver sustainability, occupants need to possess pro-environmental awareness to recognize the ability of green buildings to address negative environmental impacts (e.g., the use of high embodied energy materials or the over consumption of energy leading to excessive building-related CO₂ emissions). Furthermore, these occupants need to be able to use the resource-efficient technical constructs of green buildings optimally (Hostletler and Noiseux, 2010), and therefore pro-environmental behavior is needed to complement these constructs (Dobson, 2007; Williams and Dair, 2007). For the purposes of this research, occupiers are deemed to include renters or buyers. In order to be perceived as ‘green citizens’ (Exhibit 1), occupants have to demonstrate a strong relationship between their pro-environmental cognitions and behaviors (Dobson, 2007; Martinsson and Lundqvist, 2010). According to Thaler and Sunstein (2000), when green buildings are occupied by green citizens, a ‘green’ living framework is realized and a successful ‘contractual relationship’ between the occupants and the environment is established. At this point, technological fixes can be reconciled with social transformation to realize the so-called ‘green equation.’ Conversely, if occupiers of green buildings are not green citizens, it is considered that green building will have fallen short of its implied socio-political objectives (Thaler and Sunstein, 2000).

To date, there has been little understanding of whether green building occupants were originally green citizens, and/or if green buildings act as a catalyst
Exhibit 1 | Theoretical Framework of Green Citizenship, Cognition, and Behavior

<table>
<thead>
<tr>
<th>Pro Environmental Cognition</th>
<th>Non-green Citizens</th>
<th>Green Citizens</th>
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<tr>
<td>Pro-environmental cognition is inconsistent with negative environmental behavior</td>
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<td>Pro-environmental cognition is consistent with pro-environmental behavior</td>
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<th>Non-green Citizens</th>
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<tr>
<td>Negative environmental behavior consistent with negative environmental cognition</td>
<td>Pro-environmental behavior inconsistent with negative environmental cognition</td>
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</table>

Source: Dobson (2007).

converting individuals to green citizens. Most literature does not examine the relationship between green buildings, occupants, and green behavior; although there are standalone studies that provide analytical concepts and theoretical insights into the above and these studies were the starting point for this research. In Kilbourne, Beckmann, and Thelen (2002), Youngentob and Hostetler (2005), Marris (2006), Hostetler and Noiseux (2010), and Wilk (2010), the emphasis is given to deriving an average score on the green attitudes and behavior of green building occupants. This literature illustrates ways to analyze green attitudes and behavior via the institutional framing implicit in the dominant environmental and social paradigms but does not relate pro-environmental attitudes and behavior to green citizenship.

Vaske and Kobrin (2001) proposed that green buildings may influence occupants’ green citizenship using place theory. Place theory posits that a person’s responses towards the surroundings will impact their subjective norms towards the formation of pro-environmental cognition and behavior (Vaske and Kobrin, 2001). As green buildings consist of architectural structures that are capable of suggesting positive environmental cues, a link will be formed between the occupant and the environment (Stokols and Shumacker, 1981). In place theory it follows that as the occupant becomes more attached to their green building, this affection is strengthened as positive cognitional, emotional, and behavioral responses are developed. Consecutively, the occupant subconsciously develops the characteristics of a green citizen (Stokols and Shumacker, 1981). Place theory proponents suggest that green citizenship is developed through the formation of a ‘green’ self-identity and the continual association with green building may cause occupants to distinguish themselves from the public (Berg and Nycander, 1997). Furthermore, occupants are likely to label themselves as ‘green citizens’ and to maintain a positive moral stance and ‘green citizen’ identity; and in this way, a
person who buys or lives in a green building is ‘transformed’ into a ‘green citizen’ (Berg and Nycander, 1997).

There are arguments contradicting the notion that buying a green building and being associated with green buildings increases pro-environmental attitudes and behaviors. Mazar and Zhong (2010) found that the pro-active effects of green buildings could be reversed and argued that, people engaged in pro-social and ethical behavior only when their ‘green’ identity was scrutinized. Though people preferred to have a positive moral self, maintaining it came at a cost, because social and ethical dilemmas involve conflicts of interest (Mazar and Zhong, 2010). This is because real life is made up of multiple interrelated constructs that literally disable people from living up to their stated commitments or consistently pursuing neither their own interests nor those of others. As a result, people’s cognitive abilities to make decisions are modified by other constraints (Merritt, Effron, and Monin, 2010). Thus, once an individual’s moral self has experienced the ‘lift’ from the good deed that comes with a moral credential (such as buying a green building), people perceive that they have acted virtuously towards the environment, which can license them for subsequent inaction (Bernabau and Tirole, 2011). Even if their green home purchase is not situational and may be motivated by certain norms and attitudes, people may counteract such a good deed by denying further social responsibilities once their perceived duty is accomplished; such a psychological response is called the licensing effect (Sachdeva, Iliev, and Medin, 2009).

According to Schwarz and Thompson (1990), green beliefs can be represented by individuals risk perception towards the environment. They propose four ordinal categories to represent four archetypal views on the vulnerability of the environment using interpretation on the cultural theories of risk (Exhibit 2). These views are labeled as the Four Myths of Nature: (1) nature benign (low risk perception); (2) nature capricious (neutral risk perception); (3) nature tolerant (moderate risk perception); and (4) nature ephemeral (high risk perception).

The myths of nature are founded in theoretical reasoning and include views on nature, views on resources, views on how to make ends meet, environmental risk perception, and preferences for strategies to manage environmental risks (Schwarz and Thompson, 1990). For the nature benign group, the individualists’ myth of nature, the system is robust and resilient: The ball always finds its way back to the bottom of the basin (Exhibit 2). Nature is perceived as a stable and global equilibrium, and resources are expected to be abundant. This is associated with the belief that resources as well as needs are controllable. Environmental risks are seen as opportunities; individuals adhering to nature benign thinking believe new technological solutions will arise to solve environmental problems, which is the techno-centric approach discussed by Wilkinson (2013) that invariably leads to weak sustainability. On this basis, individuals are less troubled by environmental problems and furthermore they do not feel responsible for the problems and their solutions by changing their behaviors. Those holding this worldview (individualists) are believed to be risk seeking (concerning the environment). According to Schwarz and Thompson (1990), the nature benign stance justifies individualistic social relations. Individualists tend to create social sanctions that
Category 1: Nature Benign
(Low environmental risk perception)

Ball is difficult to roll away and therefore the natural environmental system is robust.

Category 2: Nature Capricious
(Neutral environmental risk perception)

Ball is neither easy nor difficult to roll away. The natural environmental system is neither vulnerable nor invulnerable to changes.

Category 3: Nature Tolerant
(Moderate environmental risk perception)

Ball is moderately easy to roll away therefore the natural environmental system is moderately vulnerable to changes.

Category 4: Nature Ephemeral
(High environmental risk perception)

Ball is extremely easy to roll away and therefore the natural environmental system is extremely fragile and is extremely vulnerable to changes.


defend their freedom to bid and to bargain in self-regulated networks with few prescriptions (Paton, 2011). They are opposed to collective control. Therefore, their risk management strategy is the market system (as opposed to government regulation); they strongly believe in market forces and in equal opportunity for all (Paton, 2011).

The fatalists or nature capricious myth captures those who view nature as an unmanageable system. In this paradigm, the ball will roll in any direction with unknown consequences (Exhibit 2). Nature is unpredictable, with needs and resources being controllable. Their risk perception is predicated on the belief that ‘what you don’t know cannot harm you’ and since all events occur inadvertently, learning and managing them is impossible. Consequently, humans have to cope with erratic events as they occur, and not surprisingly a nature capricious worldview justifies fatalistic social relations. The fatalists perceive life as a game of chance and their attitude to risk management is: Why make an effort? It follows that this worldview validates isolation and resignation to behavioral control. Fatalists are not consistent in thought and action as the modus operandi is focused on coping.

The nature perverse or nature tolerant is the so-called hierarchists’ myth of nature (Schwarz and Thompson, 1990), which is a more robust system to some extent.
In this model nature will take as much destruction as the authorities and experts say, with the ball finding its way to the base of the basin provided people respect the limits set by the authorities and experts (Exhibit 2). In this worldview, nature is seen as an unstable equilibrium with scarce resources. Where risks are concerned, the experts state what the acceptable risks are. In summary, hierarchists consider environmental problems can be controlled by government regulations based on experts’ knowledge on the limits to growth. As such the nature perverse or tolerant paradigm justifies hierarchical social relations. Sustainable growth is acceptable; for example, a policy that takes advantage of the perceived resilience of nature but respects the ‘known’ limits (Brundtland, 1989; Wilkinson, 2013). Their sustainable growth policy controls resources, as hierarchists contend that needs per se cannot be controlled. In addition, since only the experts understand the limits of growth, the hierarchical myth of nature justifies having regulations.

The nature ephemeral myth is an egalitarian myth characterizing a precarious, subtle equilibrium where the least nudge could result in disastrous consequences (Exhibit 2). Here nature has a limited equilibrium, dominated by the view that natural resources are depleting. The nature ephemerals do not hold that resources are controllable, whereas needs are. Overall it a risk-averse position as the perceived risks are inequitable, irreversible, and hidden, and consequently those holding this worldview are very concerned with environmental problems. They believe reducing their needs will contribute to the solution of environmental problems (Schwarz and Thompson, 1990). In this paradigm, egalitarian social relations are accepted. For egalitarians nature is sufficiently delicate to justify equal sharing of our one finite planet. Egalitarians prefer risk management strategies that advance equality of outcomes for present and future generations, thus adhering to the sentiments of the Bruntland definition of sustainable development (WCED, 1997). Given their belief that resources are depleting and are uncontrollable, the only solution available is to control needs and on this basis they seek radical changes in behavior and society. Overall, they have an ecocentric worldview sharing many characteristics with ecologists identified by Cook and Golton (1994) and Wilkinson (2013).

The myths of nature have been used to describe variations in environmental risk perception, risk judgments, and preferences for risk management strategies on a societal level (Schwarz and Thompson, 1990). These Four Myths of Nature refer to general beliefs toward environmental issues, influencing specific beliefs, attitudes, and norms; however, they are unrelated to behavior (Stern, Dietz, and Guagnano, 1995). In reality, people accept situations in contradiction of their myth of nature because this relation is mediated by other factors, such as the situational constraints (Dietz, Stern, and Guagnano, 1998).

**Research Method**

This is qualitative research that follows an inductive approach to generating research questions with a view to gaining a greater understanding of a concept or issue rather than hypothesis testing (Silverman, 2000). Subsequently, the formulation of research questions follows an inductive and not a deductive
approach. The inductive approach is derived from the literature review whereby a picture of the knowledge gaps, problems, and issues emerge as the researcher becomes more familiar with the topic area. The literature review identified which areas needed to be addressed in the surveys and enabled the researcher to compare whether practice and theory followed closely. The researchers commenced with the view that green building occupation and/or ownership and green behavior may be related. A further characteristic of qualitative research is the preference for meaning, trying to understand the world from the perspective of those studied (Silverman, 2000). One of the limitations of the questionnaire survey technique and this approach is that the questions may be interpreted differently by participants and that no clarification is possible. Furthermore a balance needs to be struck between open and closed questions; too many open questions extend the time required to complete the survey and may result in some participants partially completing the survey or providing superficial responses. Conversely if the survey is too short, the results may be limited in breadth and depth (Moser and Kalton, 1971). The advantages of the survey technique are that due to the standardization of the questions, bias is reduced and generally they are a relatively quick way of gathering data (Yin, 2003). However, response rates can be variable and, if low, it can be difficult for researchers to gather sufficient data to produce statistically reliable results (Robson, 2011). To minimize the issue of low response rates, the research population was identified before a sampling strategy was adopted to provide a representative sample. The research focused on an economically developed Asian nation with an established green building movement and a green building rating tool. Kuala Lumpur, the capital city of Malaysia, was selected, with a population comprised of 30% Chinese, 41% Bumiputera (native Malays), 10% Indian, 9% Euro-Asians, and 10% Middle Eastern, expatriates, and indigenous natives (Anon, 2010).

Malaysia has green building legislation and a rating tool, the Green Building Index (GBI), which was developed for Malaysia’s tropical climate, environmental and development context, and cultural and social needs. The GBI is the only rating tool for tropical zones other than Singapore’s Green Mark rated Scheme (BCA Green Mark) (Lijun and David, 2011) and is used interchangeably with the Singaporean BCA Green Mark to rate green buildings in Malaysia (Jamaludin, Inangda, Ariffin, and Hussein, 2011).

Two study sites, Mont Kiara and the Bangsar Townships, were chosen as a green and a conventional community, respectively. Both are exclusive, highly affluent residential suburbs, with many high value Green Mark rated and conventional apartments. From each site, a sub-division of green rated and non-green rated apartments was selected. The Mont Kiara subdivision contained one block of Green Mark rated apartments, 11 Kiara, and comparable conventional apartments. In Bangsar, the Bukit Bandaraya subdivision was selected with a Green Mark rated apartment block, and the remainder of the subdivision comprising conventional apartments. The conditions of the Green Mark rated apartments were similar, which rendered these apartments comparable controls that could be matched against the conventional apartments. The conventional apartments were control cases with comparable home values and a sufficient number of new home occupiers with a similar profile of socio-demographic backgrounds.
Newly occupied dwellings were selected because participants were required to remember when they first moved into their apartment. New home occupiers were those listed as owners of an apartment unit with a value between USD $573,400 and $3,170,000 and a sale date between December 2009 and June 2010. Participants were selected randomly through the developer’s sale database. One hundred surveys for each township, 200 in total, were distributed by the developer and returned by mail to the researchers. An overall response rate of 30% was achieved, with 59 useable surveys.

In line with best practices and prior to distribution, the survey was piloted on ten home occupiers to improve the final survey instrument. Different questionnaires were sent to individuals from green and conventional apartments. Survey A was given to green building occupants and survey B was given to conventional apartment occupants. Survey A had three parts. Section one investigated environmental beliefs, attitudes and behavior. Section two asked the participant to self-report perceived changes on their environmental beliefs, attitudes, and behavior before and after occupation. The third section comprised a background check where the participants were asked to provide their gender. No other background checks such as income and education were required as it was assumed that individuals who could afford to live in the communities were of similar socio-economic backgrounds. Survey B had similar questions to Survey A, except the second section questions were omitted as no examination on before-after effects would be conducted on the control group. The surveys were undertaken in 2011.

**Data**

Three variables were investigated: green beliefs, attitudes, and behavior. The green beliefs variable is represented by the ‘risk perception towards the environment.’ Direct and indirect measurements were used to measure this item, as posited by Schwarz and Thompson (1990). The participants were asked to self-report their risk perception by identifying which of the four statements about the vulnerability of the environment best represented their beliefs. The four statements correspond to four ordinal categories in implied orders of 1, 2, 3, and 4. The categories represent the four archetypal myths on the vulnerability of the environment proposed by Schwarz and Thompson (1990) using interpretation on the cultural theories of risk and shown in Exhibit 2. In order to improve the reliability and objectivity of this measurement, an indirect measurement is used to indicate these myths of nature, so that every participant has the same indication on their level of risk perception. The vulnerability of the environment to threats was represented by the ease with which a ball can roll away from a landscape. Such measurement would result in higher degree of correspondence between the concept and the observed responses, because those who selected the same category will have the same level of risk perception. The level of deviation from one category to another category would be unambiguous (Schwarz and Thompson, 1990).

‘Concern towards the environment’ was used to represent the environmental attitude variable. The New Environmental Paradigm (NEP) scale measured environmental concern (Dunlap and Van Liere, 1978). This scale measured a broad
Exhibit 3 | The Five Survey Questions Representing Environmental Concerns

Environmental Attitudes as Measured by the New Environmental Paradigm
1. We are approaching the limit of the number of people the earth can support.
2. Human ingenuity will insure that we do NOT make the earth unlivable.
3. Humans were meant to rule over the rest of nature to fulfill their interest.
4. The balance of nature is very delicate and easy to upset.
5. If things continue on their present course, we will soon experience a major ecological catastrophe.

Exhibit 4 | Pro-environmental Actions

1. Use energy-efficient light bulbs.
2. Use less air conditioning.
3. Segregates household waste to identify reusable items and dispose non reusable items.
4. Avoid using toxic detergent.
5. Buy organic food.
6. Recycle newspapers.
7. Walk short distances (<3 miles).
8. Take short showers (<15 minutes).

Environmental worldview, which incorporated the norms and beliefs of justice and equality. NEP encompassed five underlying dimensions and facets of environmental concern, which included the extent of environmental limits to growth for human beings, the extent of human ingenuity to prevent natural catastrophe, the extent to which human beings regard themselves as the central and most significant entities in the universe (an anthropocentric worldview), human ability to upset the balance of nature, and the possibility of an eco-crisis. Five items, each representing a theme, were used and are shown in Exhibit 3. The participants indicated to what extent they agreed with each of the five statements, with answers given on a five-point scale, from 1 (strongly disagree) to 5 (strongly agree).

Environmental behavior was measured by ‘pro-environmental action,’ which covered multiple domains, frequencies, and impacts of actions (Stern, 2000). The Department for Environment, Food and Rural Affairs identified 12 ‘headline environmental impact actions,’ which involved both one-time and regular decisions made domestically and non-domestically (DEFRA, 2007). These actions related to three behavioral domains: energy use, water consumption, and waste behavior. As these headline actions are too broad to be measured, multiple measures were used to disaggregate these actions. These measures were derived from previous studies (Kreiger, 1998; Beatley, 2000) and addressed all environmentally-friendly lifestyles pertaining to the headline actions above. The pro-environmental actions that were measured in the survey are listed in Exhibit 4.
Exhibit 4 shows the pro-environmental measures that were used in the survey. Participants were asked to rate their frequency of involvement with these actions using a five-point scale, ranging from 1 (very rarely) to 5 (very often). It is noted that some green measures may vary from country to country. For example, the duration of a shower is based on the supply of water, cultural conventions, and norms. A 15-minute shower may appear long, for example, in Australia under the drought of 2002–2007; 3-minute showers were advocated by the federal and state governments to conserve water supplies (ABARES, 2012). Similarly local total daily water consumption targets during the drought were based on local and state water levels and varied from state to state.

**Analysis**

The reliability of the questionnaire was tested using Cronbach’s alpha, a coefficient between 0 and 1 that is used to rate internal consistency, the correlation of items or a measure to confirm the reliability of multi-item scale (Peterson, 1994). A Cronbach alpha between 0.70 and 0.90 shows strong internal consistency and moderate correlation; if it is lower, the indication is that the variables are not correlated. The overall Cronbach’s alpha for all items was 0.843, while the individual Cronbach’s alpha of reliability for ‘risk perception towards the environment,’ ‘concern towards the environment,’ and ‘pro-environmental action’ were 0.80, 0.70, and 0.77, respectively. As they were greater than or equal to 0.70, the validity of the scale in the questionnaires was high.

In this study, responses from participants were measured using nominal and ordinal scales. Such measurement resulted in non-normal distribution of data, which deviated from normality. This anomaly in distribution was visible on the skew, kurtosis, and detrended normal plot measures from the frequency output from SPSS (see the Appendix). The Lilliefors Significance Correlation analysis was used to verify the non-normality in distribution. In this analysis, the Kolmogorov-Smirnov test and Shapiro-Wilk test were indicators of normality from the Lilliefors significance correlation analysis and were used to examine if the distribution deviated from normality. The Appendix shows significant values from both tests for all distributions were greatly below 0.05, indicating non normal distribution. Therefore, non-parametric tests were required to analyse the data without error in interpretation.

The Wilcoxon-Mann-Whitney test is a suitable non-parametric test that compares two paired groups. The test calculates and analyses the differences between the pairs to ascertain if significant differences exist. In this case, the results showed there were no significant differences on the basis of gender. These two statistical tests confirm the robustness and statistical reliability of the research findings. The Wilcoxon-Mann-Whitney test was used to analyze the difference in distribution of data for the three variables. This test can be used to verify the validity of the proposition that occupiers in the green apartments in the sample have greater levels of pro-environmental cognition and behavior than residents in the non-green apartments. To prove that the distribution of the ‘green’ group was larger than the distribution of the ‘non-green’ group, the p-value test statistic of the Wilcoxon-
Mann-Whitney Test must be less than or equivalent to 0.05, with an upper tail critical value of 5%. That is, should there be a random drawing of a larger observation, there would be non-symmetry between populations in terms of their level of pro-environmental cognition and behavior.

A cluster analysis was used to classify the participants from green apartments into three groups. The first group comprised those who agreed buying into a green building had positive effects on their pro-environmental cognition and behavior. The second group agreed that buying into a green building had neutral effects, while the third group was participants who agreed that buying an apartment in a green building had negative effects on their pro-environmental cognition and behavior. This analysis tested the second question and segmented participants into a smaller number of groups for further examination of their environmental cognition-environmental behavior consistencies.

Finally, the three variables were converted into dichotomous variables by splitting the measurement scales at the sample median point. Participants whose minimum scores on all three variables were above the median score were classified as green residents; below they were classified non-green residents. However, not all participants had consistency in their minimum score on all three variables. For instance, people who scored high on belief might not score high on attitude and behavior; in other words, a respondent with green beliefs may not be green in attitude and behavior. Thus, it was important to examine the consistency between the minimum scores of all three variables amongst participants. The Kruskal-Wallis test was used because it was a robust test for non-normal distribution (Green and Salkind, 2008). The level of consistency would be reflected by the chi-square statistic for the Kruskal-Wallis test. A close approximation to 1 at a significant p-value of less than or equal to 0.05 represents high consistency between these three variables. The Kruskal-Wallis test result reflects the pattern of correlation between the minimum scores of all the variables. By understanding this pattern of correlation, participants could be classified into categories as per the green citizenship quartet shown in Exhibit 4.

**Results**

**Environmental Beliefs: Risk Perception on the Environment**

The participants were measured on the four myth perspective and could be either nature benign, nature capricious, nature tolerant or nature ephemeral. Nature benign people see the natural environment as robust and have low risk perceptions. Nature capricious individuals hold a neutral risk perception where nature is neither vulnerable nor invulnerable to risks. Nature tolerant people have a moderate level or risk awareness based on the view that natural environments are vulnerable to changes. Finally, nature ephemeral individuals perceive the natural environment to be very fragile and therefore facing high levels of risk. The results of the surveys showed most participants from green apartments subscribed to the nature ephemeral view (54.3%) or the nature tolerant view (45.7%) (Exhibit 5). No green building participants had nature benign or nature capricious views. Here, the
median split of sample that separated believers from non-believers was the third ordinal category of myth of nature. All participants from green homes were green believers. According to the cluster analysis, six people (17.1%) from green homes agreed that buying into a green building had positive effects on their environmental beliefs; the remaining 29 (82.9%) reported that buying into a green building had neutral effects on their beliefs. No one from green homes reported negative impacts. All who agreed about the positive effect of green building on their beliefs were green believers.

Fewer participants from non-green homes had the nature ephemeral (45.8%) or nature tolerant views (41.7%). Of the 24 participants from conventional apartments, there were a few outliers who had low or neutral risk perception on the environmental. Two (8.3%) participants thought that the environment was robust and not vulnerable to changes; one person (4.2%) did not have particular views about the vulnerability of the environment. Most (87.5%) were green believers while few (13%) were non-green believers (Exhibit 6).

All participants came to close agreement in terms of environmental beliefs. There were slightly more green believers from green homes compared to conventional homes; however, the Wilcoxon-Mann-Whitney test statistic with a $p$-value of 0.300 > 0.05 showed the difference was not statistically significant.

**Environmental Attitude: Concern Towards the Environment**

All participants had very close NEP score means above 4. Most participants from Green Mark rated homes had higher NEP scores across all NEP items as compared to participants from conventional (non-green) homes (Exhibit 7). The median split of sample that separated green attitude from non-green attitude was an average NEP score of 4. All those with average NEP scores above or equal to 4 were regarded as having a green attitude, whereas those scoring below 4 were regarded
as having a non-green attitude. Exhibit 8 shows there were more individuals with green attitudes occupying green buildings compared with conventional apartments.

According to the cluster analysis, six participants (17.1%) from green buildings agreed that buying into a green building had a positive effect on their environmental attitude; 82.9% reported that a green building purchase had neutral effects on their attitude. No respondents from green homes reported negative impacts of a green building on their attitude.
Although participants from the green apartments had a slightly higher NEP score, the result was significant for two items only: ‘the extent of human ingenuity to prevent natural catastrophe’ 
\[ p = 0.034 < 0.05 \] and ‘human’s ability to upset the balance of nature’ 
\[ p = 0.024 < 0.05 \]. There were no statistical significant differences for the remaining items: ‘the extent of environmental limits to growth for human beings’ 
\[ p = 0.156 > 0.05 \], ‘the extent to which human beings regard themselves as the central and most significant entities in the universe’ 
\[ p = 0.815 > 0.05 \], and ‘the possibility of an eco-crisis’ 
\[ p = 0.326 > 0.05 \].

**Environmental Behavior: Pro-environmental Action**

The combined scores on pro-environmental behaviors for both groups of participants were high. Both groups had high average scores on the eight headline pro-environmental actions. The average scores for each item were close without statistically significant differences, except for two items: ‘use energy-efficient light bulbs’ 
\[ p = 0.004 < 0.05 \] and ‘walk short distances as an alternative for short trips’ 
\[ p = 0.000 < 0.05 \] (Exhibit 9).

Exhibit 10 shows the participants from conventional apartments with green behavior equaled those from conventional apartments with non-green behavior. Conversely, the participants from green apartments with green behavior outnumbered those from green apartments with non-green behavior.

The cluster analysis showed six participants (17.1%) from green homes agreed that buying into a green building had a positive effect on their environmental behavior. Twenty-nine participants (82.9%) reported neutral effects on their environmental behavior and none reported negative impacts on their environmental behavior.

The results showed that the overall consistency of pro-environmental cognition and pro-environmental behavior was stronger amongst participants from green
Exhibit 9 | Environmental Behavior of Green and Conventional Apartment Occupants

Environmental Behavior

Exhibit 10 | Green and Non-green Behavior

apartments as compared to conventional participants (Kruskal Wallis test for internal consistency of green apartments; chi-square = 4.719; p-value = 0.03 < 0.05) was greater than that of conventional apartments (chi-square = 2.629; p-value = 0.105 > 0.05). This consistency was translated into a greater amount of green citizens (34.3%) from green compared to conventional apartments (29.2%),
Exhibit 11 | Green Citizenship Amongst All Occupants

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<tr>
<th>Non-Green Citizens</th>
<th>Green Citizens</th>
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<td><strong>Green Cognition and Non-Green Behavior</strong></td>
<td><strong>Green Cognition and Green Behavior</strong></td>
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<td><strong>Non-Green Cognition and Non-Green Behavior</strong></td>
<td><strong>Non-Green Cognition and Green Behavior</strong></td>
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<td>◆ 37.5%</td>
<td>◆ 14.3%</td>
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<tr>
<td>□ 34.3%</td>
<td>□ 20.8%</td>
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Green Rated Apartment | Conventional Apartments

Adapted from Dobson (2007).

as shown in Exhibit 11; however, non-green people from both groups were significantly greater.

Discussion

Participants from the green apartments did not outscore those from the conventional apartments significantly in terms of pro-environmental cognition and behavior. This may be due to the similarity of their socio-economic background. The results confirmed findings from previous studies showing that a high level of socio-economic background is positively correlated with pro-environment views (Mourato, Saynor, and Hart, 2004; Menges, Schroeder, and Traub, 2005).

The results did show that there were a higher proportion of participants from green apartments conforming to the characteristics of green citizenship. Therefore, there was stronger pro-environmental cognition and behavior amongst green building occupants. Nonetheless, a high proportion (65.7%) of green building occupants exhibited a disconnection between their pro-environmental cognition and behavior; the results do not support the proposition that green building occupants were ‘greener’ than conventional building occupants. In answer to the research questions, there is no conclusive evidence to confirm that occupants’ green citizenship characteristics improve after occupying or purchasing an apartment in a green building; however, there is evidence that there could be green benefits. The second question asked to what extent participants’ exhibit green citizenship.
In this case, marginally more people in green apartments displayed green citizenship, although the green citizens were a minority group in both green and non-green apartments.

One limitation of the study is that some of the actions recorded as pro-environmental may also be driven by economic drivers such as use of low energy light bulbs to reduce energy bills and this was not distinguished in the data collection. However, given that the properties were located in affluent residential areas, economic drivers are not believed to be high priorities for these individuals.

**Conclusion**

Overall, it is not possible from this study to conclude unequivocally that green buildings are inhabited by green occupants. As in previous studies (Kreiger, 1998; Beatley, 2000), this research could not confirm that physical design and green development alone can precipitate green behaviors and green citizenship. Even so, the study showed that a green built environment laid a foundation for green citizenship, given that no green home owners reported negative effects of green built environment on their pro-environmental cognition and behavior.

The research demonstrates that policymakers and developers should not rely on a green built environment alone to promote green behavior. Progressive educational programs and functional management systems should be implemented into the green built environment to ensure that the foundation for green citizenship laid down by green buildings can be enhanced in the long term. Government and policy leaders need to support the green building movement so that a genuinely green society can evolve for the purpose of a transition to a new green economy. One limitation of this research is that it does not follow the occupants over time and a longitudinal study could ascertain whether occupiers’ attitudes and beliefs change over time. In addition, the study could be replicated in other countries to determine whether levels of belief and attitudes towards green and non-green residential stock vary.
## Appendix

### The Lilliefors Significance Correction Analysis of Normality

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The Lilliefors Significance Correction Analysis of Normality

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References


The views or opinions in this paper are those of the authors and not those of the Bank Negara Malaysia nor are they endorsed by the institution. The paper is based on the research of Leong Phui Kuan while at the University of Technology Sydney.

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Sara J. Wilkinson, University of Technology Sydney, Ultimo, NSW Australia or sara.wilkinson@uts.edu.au.

Paul Van Der Kallen, University of Technology Sydney, Ultimo, NSW Australia or Paul.VanDerKallen@uts.edu.au.

Leong Phui Kuan, Central Bank of Malaysia (Bank Negara Malaysia), 50480 Kuala Lumpur, Malaysia or leong1831@gmail.com.