Original Research

SAGE Open
July-September 2023: 1–16

DOI: 10.1177/21582440231187583
journals.sagepub.com/home/sgo
Sage

Green Gardening Practices Among Urban Botanists: Using the Value-Belief-Norm Model

Abdullah Al Mamun[1], Naeem Hayat[2], Muhammad Mohiuddin[3], Anas A. Salameh[4], and Syed Shah Alam[1]

Abstract

Recently, the increase in urbanization has momentously intensified the climate issues in urban centres. A large number of the population is vulnerable to climate change living in urban areas all over the world. The decline in agricultural activities leads to food insecurity in urban areas. Urban gardening is promoted as a viable option to achieve food security and help reduce the climate impact in urban areas. Urban gardening can help reduce the carbon footprint, curtail food production's time and distribution costs, and offer food security and safety. Urban agriculture can be categorized as sustainable as it has economic, social, and climate impacts. The value-belief-norm framework is utilized to evaluate green gardening intentions and practices. The online survey collected cross-sectional data from 1,721 urban respondents in Malaysia. Based on the data analysis performed with structural equation modelling partial least square regression (SEM-PLS), it was found that the biospheric, egoistic, and altruistic values significantly influenced the new environmental paradigm. The environmental paradigm, awareness of consequences, and ascription of responsibility have significant positive effects on personal norms to engage in green gardening. The green trust and personal norms promote green gardening intention, subsequently leading to green gardening practices. A community-level effort is required to mitigate the climate change issue caused by urbanization and address food availability problems. Civic administration and residents should work together to protect the green spaces in urban centres, which promotes public well-being.

Keywords

urbanization, green gardening, value, belief, norms, Malaysia

Introduction

The recent increase in urbanization has taken place along with multi-faceted issues of disturbing larger ecosystems related to environmental quality, food security, air pollution, groundwater level, increased greenhouse gases, and general citizen health (Al-Mayahi et al., 2019; Zasada et al., 2020). Urbanization reduces the per-capita land available for food production and causes disturbance in civic life. The increase in urbanization has led to the emergence of sustainability and resilience issues, which makes it necessary to address these issues for sustainable and resilient urban living (Michael et al., 2018).

Urbanites in Malaysia should consider engaging in green production and consumption practices to address the environmental and food security challenges (Landon et al., 2018). The civic administration can motivate urbanites to grow their own food (Lewis et al., 2018). Meanwhile, commercial farming in sub-urban areas can help feed the growing urban population. Given the increasing popularity of gardening among urbanites, urban gardening offers promising prospects for attaining sustainable and resilient urban living (Al-Mayahi et al., 2019).

Compared to commercial farming, urban gardening comes in various shapes and sizes, necessitating the use of small gardening spaces. Rooftop gardening, kitchen or backyard gardening, and the municipal administration's

[1]Universiti Kebangsaan Malaysia, Malaysia
[2]Universiti Malaysia Kelantan, Malaysia
[3]Laval University, Québec, QC, Canada
[4]Prince Sattam Bin Abdulaziz University, Al-Kharj, Saudi Arabia

Corresponding Author:
Abdullah Al Mamun, UKM-Graduate School of Business, Universiti Kebangsaan Malaysia, 43600 Bangi, Selangor Darul Ehsan, Malaysia.
Emails: mamun7793@gmail.com; almamun@ukm.edu.my

open areas are all forms of urban gardening (Hashim et al., 2020). Urban gardening increases food supply, produces revenue, and aids urban dwellers in their efforts to address the sustainability concerns that heavy urbanization has created (Zadada et al., 2020). Urban gardening has improved food security, and people have reported more incredible biodiversity (Ramli et al., 2021). Gardening in the home enhances physical and mental health when used as a recreational activity for city dwellers (Chowdhury et al., 2018; Michael et al., 2018). However, urban gardening was overlooked and unsupported by government and non-government organizations (NGOs; Lewis et al., 2018). The government and NGOs arrange no training and awareness sessions to promote urban farming knowledge and support for the community to engage in urban farming (Chowdhury et al., 2018). Changes in building codes in urban areas, as well as coordinated efforts by city government, NGOs, and civic communities, can harness communities' positive proclivity to engage in urban farming (Al-Mayahi et al., 2019).

Urban gardening presents multiple ecological benefits for urban inhabitants. Besides, home gardens offer air purification, reduce the heat effects, allow the residents to use organic wastes, and help reduce GHG emissions (Zasada et al., 2020). Home gardens also serve as habitats for various creatures, while biodiversity aids in maintaining and mitigating urban climate challenges (Ramli et al., 2021). Urban farming, for example, helps with water efficiency (Chowdhury et al., 2018), energy conservation (Al-Mayahi et al., 2019), and communal cohesion (Al-Mayahi et al., 2019; Zasada et al., 2020). It boosts the community's economic and social well-being (Hashim et al., 2020).

With the growing economy in Malaysia, a rapid increase in urbanization has been witnessed in recent times. Malaysians are facing a sharp increase in food prices, given that Malaysia is becoming a net importer of food items and is in a highly vulnerable state (Hashim et al., 2020). To achieve national food security and safety, inclusive efforts are required to produce and process the local food the residents need (Ramli et al., 2021). Moreover, the self-adequacy of food production requires the production of agriculture in all possible methods, including home gardening, roof-top gardening, urban gardening areas, and small agriculture farming (Chowdhury et al., 2018). A collective approach is essential in addressing the issues of climate change, food security, and urbanization (Pahlevi & Suhartanto, 2020). Developing viable ways to use every possible green area or home for gardening can help mitigate climate change issues (Zhang et al., 2020). Recently, the Malaysian government allocated 10 million Malaysian Ringgit (USD 2.5 Million) for urban agriculture projects (MalayMail, 2020).

Green gardening requires a specific value set and realizing that the climate requires human help. Therefore, the present study explored the causal chain of the VBN model application on green gardening behavior among Malaysian residents in urban areas. Green trust was included in this study as Yildirim and Semiz (2019) claim that it enhances green intention and behavior. As a result, this research suggests that green trust can be used to motivate people to engage in green gardening.

Literature Review

Theoretical Foundation

Green behaviors are considered, while more efforts have been undertaken to understand and explore the development of green behaviors. These initiatives begin with advancing the Norm Activation Theory (NAT), which explores the role of personal moral inclinations that contribute to green behaviors (Fornara et al., 2020). Additionally, NAT proposed that the awareness of the danger or threat leads to acknowledging the responsibility to assist or mitigate the situation. Moral obligations build the personal norms (PLN) that build pro-social behaviors. Value-Belief-Norm (VBN) is an extension of the NAT that includes human values, suggesting the belief that generating the norms leads to green behaviors (Stern, 2000).

Values are the innate system of preferences that guide human behavior and are denoted by the degree of importance of something or an action (Fornara et al., 2020). Individuals' actions or behavior are guided by their values, which are broad preferences (Stern, 2000). Value-Belief-Norm postulates that the biospheric, egoistic, and altruistic values help develop a new mindset among the people, in which taking care of the environment is essential given that the climate is at risk (Wensing et al., 2019). Biospheric values (BCV) are based on the idea that prominent environmental factors are critical for human life (Ünal et al., 2019). Taking care of the environment is associated with caring for non-human species (Stern, 2000). Also, BCV builds around preventing pollution, protecting the environment, collectively working for nature and respecting the climate (Yildirim & Semiz, 2019). The altruistic values (ALV) epitomize the moral essentials among individuals to be engaged in pro-social behaviors for the benefit of society (Han et al., 2016). ALVs are based on equity, social justice, and contribution to the betterment of the world (S. H. Kim & Seock, 2019). Moreover, individuals with ALV lead to pro-environment behaviors, such as recycling clothes and exhibiting environmentally friendly behaviors (Landon et al., 2018). Egoistic values (EGV) represent individual engagement in estimating the cost and benefits of existing

behaviors regarding social power, authority, influence, or ambition (Kiatkawsin & Han, 2017). The cost and benefit estimation assist in developing green behaviors at multiple avenues, including human behaviors (Zhang et al., 2020).

The value system contributing to the new environmental paradigm (López-Mosquera & Sánchez, 2012) led to the realization that human actions cause climate change (Ünal et al., 2019). There is an awareness that human actions on climate create global warming and energy issues and intoxicate the climate (Zasada et al., 2020). The awareness of consequences (AOC) creates the instinct to be responsible for correcting climate issues at the individual level (Yildirim & Semiz, 2019). The realization of the environment paradigm, awareness, and ascription of responsibility (AOR) institute the PLN to protect the environment (Zhang et al., 2020).

The stimulation of norms permits the development of green intention and green behaviors (Stern, 2000). Specifically, green behaviors denote the cognizable activities to reduce the adverse effect of one's actions on climate, which improve the climate conditions and reduce the impact of the climate in all possible manners (Wolske et al., 2017). The development of PLN contributes to the commitment to change personal behaviors toward the environment and protect it (Choi et al., 2015).

Green Trust (GNT) is a perception that encourages green behavior. Individual trust toward the green alternative as a viable solution to climate change is reflected in their trust (K. Chen & Deng, 2016). The "Green Trust" refers to a person's willingness to trust and rely on a product, service, or brand to deliver on its promises of dependable environmental performance. Green realization is defined as the desire to engage in environmentally friendly behaviors due to internal cognitive and emotional impulses (Han et al., 2016). The feeling of guilt refers to the knowledge that climate change requires action; the perception of guilt encourages proactive engagement in green activities, such as limiting environmental effects in public and private settings (G. Chen et al., 2020).

Hypotheses Development

Effect of Biospheric Values. Many individuals are compassionate toward the atmosphere and other living creatures that build the environment. The BCVs describe the essential individual concern for the environment and the system required to sustain life (Choi et al., 2015). Individuals' BCV shapes the necessary beliefs that protect the environment, and changes in perception about it are essential (Kiatkawsin & Han, 2017). Lind et al. (2015) highlighted that the BCV significantly influenced the Norwegian respondents' new environmental paradigm (NEP) for sustainable transport usage. Landon et al. (2018) have established that the BCV impacts the NEP of US tourists. Accordingly, the following hypothesis was developed for the study:

Hypothesis (H1a): *BCV positively affects the NEP among the urban botanists in Malaysia*

Effect of Altruistic Values. The ALV depicts equivalence, justice, and peace for all, where help is readily available for all parties. Individuals with ALV are more inclined toward environmental consciousness (Landon et al., 2018). Han et al. (2016) highlighted that ALV shapes the new ecological paradigm to exhibit eco-friendly behaviors. Kiatkawsin and Han (2017) argued that ALV among young travellers affects the new ecological paradigm. Therefore, the following hypothesis was developed:

Hypothesis (H1b): ALV *positively affects the NEP among the urban botanists in Malaysia*

Effect of Egoistic Values. EGV denotes the individuals' belief in assessing the cost and benefits of future behaviors. Individual EGVs shape the necessary advantages of the individuals' beliefs and the penalties associated with green behaviors (Liu et al., 2018). Besides, individuals are not interested in changing their existing behaviors unless the future behaviors contribute to more advantages (Stern, 2000). Jasson, Marell, and Nordlund (2011) stated that the EGV significantly influences the NEP for using alternative fuel vehicles among Swedish residents. Wensing et al. (2019) postulated that egoistic values positively instigate the individual's inclination to exhibit pro-environmental behaviors among farmers. Recently, Zhang et al. (2020) recognized that the EGV influences Chinese farmers' NEP to engage in environmentally friendly farming. Therefore, the following hypothesis was predicted for the study:

Hypothesis (H1c): *EGV positively affects the NEP among the urban botanists in Malaysia*

Effect of New Environmental Paradigm

Human attention and corrective actions are believed to be needed in the environment to preserve life on Earth (H. J. Kim et al., 2016). It is perceived that the environment is necessary for creating a sense of responsibility for reducing the human impact on the climate and taking every possible action to restore the climate (Landon et al., 2018). Individuals with a NEP actively consider the consequences of human actions on the environment and take practical actions to reduce the impact of humans on the environment (Han et al., 2016). Recently, Fornara et al. (2020) postulated that pro-environmental beliefs

influence the AOC among the European sample regarding nature-related issues. Based on this discussion, the following hypothesis was proposed:

Hypothesis (H_2): *NEP positively affects the AOC among urban botanists in Malaysia.*

Awareness of Consequences

Personal belief indicates many allied beliefs and behaviors, in which VBN suggests the underlying association between the AOC and AOR related to environmental behaviors (S. H. Kim & Seock, 2019). Currently, Fornara et al. (2020) recognized a substantial impact of the AOC on the AOR toward the nature-associated behaviors to maintain the bio-diversity amongst the European populations. Accordingly, Zhang et al. (2020) postulated that the awareness of the consequences of environmental problems has a significant impact on the AOR for adopting environment-friendly farming practices among Chinese growers. Therefore, the following hypothesis was developed:

Hypothesis (H_3): *AOC positively affects the AOR among the urban botanists in Malaysia.*

Development of Personal Norms

The VBN theory demonstrates that the natural chain links the beliefs, significantly influencing individual norms. Developing a NEP allows PLN to protect the environment and reduce human impact on climate (Ünal et al., 2019). Landon et al. (2018) postulated that developing a new ecological worldview influences PLN. There is a personal view in which the environmental viewpoint is crucial in building PLN and environmental behavior. Wensing et al. (2019) demonstrated that pro-environmental attitudes shape environment-related personal norms. Accordingly, the following hypothesis was presented:

Hypothesis (H4a): *NEP positively affects PLN among the urban botanists in Malaysia.*

Zhang et al. (2020) demonstrated that the AOC influences the PLN to conduct environment-friendly agriculture practices. However, Choi et al. (2015) recorded a significant influence of the AOC on the PLN among the USA respondents who visited green hotels. Fornara et al. (2020) suggested that the AOC empowers PLN, which could assist individuals in reducing the climate impact among European residents. The following hypothesis was suggested:

Hypothesis (H4b): *AOC positively affects PLN among the urban botanists in Malaysia.*

The VBN schemes for the ascription of responsibilities contribute to the progress of PLN (Han et al., 2016). Kiatkawsin and Han (2017) suggested that the AOR impacts the PLN among young travellers. However, the AOR among Chinese farmers provides substantial help in developing the PLN to commence the use of environmentally friendly farming (Zhang et al., 2020). The related hypothesis was suggested as follows:

Hypothesis (H4c): *AOR positively affects PLN among the urban botanists in Malaysia.*

Development of Green Gardening Intentions (GGI)

GNT influences attitudes toward green products and practices (Pahlevi & Suhartanto, 2020). The development of the GNT suggests the intention for green behaviors (Gill & Jacob, 2018). Wang et al. (2019) postulated that GNT harnesses the green purchase intention of Chinese consumers. Also, using PLN builds personal preferences to engage in green behaviors (Riper & Kyle, 2014). On the other hand, Ünal et al. (2019) suggested that PLN motivates individuals to develop green behavioral intentions. Fornara et al. (2020) highlighted a significant positive impact of the PLN among the European respondents on the intention of green behavior. Meanwhile, a recent study by Zhang et al. (2020) demonstrated that the PLN among Chinese agriculture professionals indicated the intention to employ environmentally friendly farming practices. Based on this discussion, the following hypothesis was formulated:

Hypothesis (H5a): *PLN positively affects GGI among the urban botanists in Malaysia.*
Hypothesis (H5b): *GNT positively affects GGI among the urban botanists in Malaysia.*

Green Gardening Practices (GGP)

The intention is the prominent antecedent of actual behavior, and it substantially explains an individual's propensity to engage in a prospective behavior in voluntary contexts. Yildirim and Semiz (2019) highlighted that the behavioral intention to engage in green behavior significantly predicts voluntary participation in green behaviors. Therefore, the following hypothesis was presented:

Hypothesis (H_6): *GGI positively affects GGP among the urban botanists in Malaysia.*

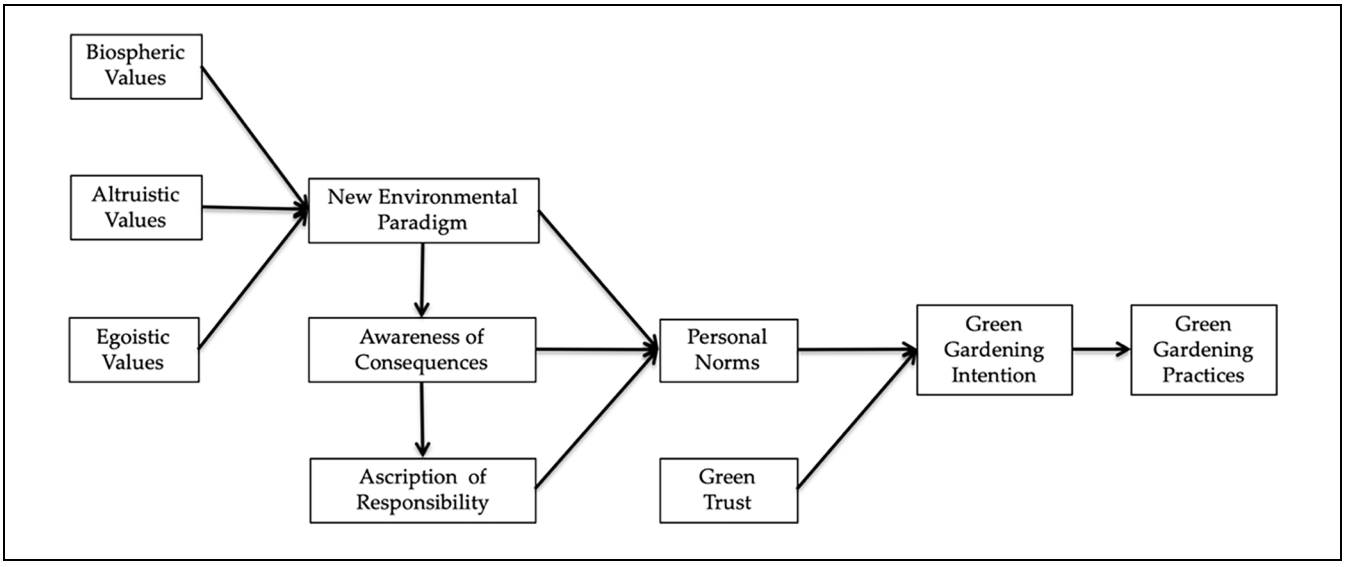

Figure 1. Research framework.

All associations hypothesized above are presented in Figure 1.

Research Methodology

Research Design

The current study employed the quantitative method to explore the factors influencing the intention and green gardening behavior among Malaysian urban respondents. Urbanites account for about 77.16% of Malaysia's total population, representing the current study's target population. This rate was found to be relatively higher than that of the neighboring countries, including Indonesia (56.64%), Thailand (51.43%), Philippines (47.41%), Vietnam (37.34%), Laos (36.29%), India (34.93%), Burma (31.14%), and Cambodia (24.23%; The Global Economy, 2022). Only Brunei and Singapore recorded a higher percentage of urbanites (The Global Economy, 2022). Such urban migration contributes to the shortage of agricultural labor inputs, which may eventually lower agricultural productivity. Malaysia is still coping with the labor shortage to allow low-skilled foreign workers in the agricultural sector. However, that may change in the next few years due to the continuous economic growth in countries that currently supply low-skilled foreign workers to Malaysia. Considering the large population of urbanites in Malaysia, it is critical to assess their intention and adoption of green gardening practices to deal with food insecurity, the rising prices of food and food products, and the health risk from conventional commercial agricultural methods. The data were collected in a cross-sectional manner, followed by implementing the causal-predictive data analysis technique PLS-SEM for the study hypothesis testing based on the VBN model.

Population and Sample

The current study's target population was the general population living in Malaysia's urban areas. The sample size calculation was conducted with G-Power 3.1 with a chosen power of 0.95 and an effect size of 0.15, which comprised nine predictors. The required sample size was 166 (Faul et al., 2007), while a minimum threshold of 200 samples was suggested for PLS-SEM (Hair et al., 2019). The study employed the second generation of statistical analysis and structural equation modeling techniques. The convenience sampling technique was utilized in the current study; we added a few qualifying questions to the survey to assess the suitability of the respondents. The respondents' consent was obtained before they participated in the study. Data was collected by uploading the online survey form (Google Form) on social media platforms, including Facebook and WhatsApp groups, during the first 2 weeks of July 2021. The final analysis was performed with the 1.721 valid sample data collected.

Survey Instrument

In the current research, pre-validated and corroborated scales were used. The BCV was evaluated by four items extracted from Han et al. (2016), while the ALV was assessed with four question items adapted from Han et al. (2016); EGV was estimated with five-item borrowed from Han et al. (2016). The NEP was assessed with five items taken from López-Mosquera and Sánchez (2012).

The AOC was estimated with six items borrowed from López-Mosquera and Sánchez (2012) and Choi et al. (2015). The ascription of responsibility was gauged with five items adapted from López-Mosquera and Sánchez (2012) and Ünal et al. (2019). PLN was then evaluated with five items extracted from Choi et al. (2015) and Ünal et al. (2019). GNT was gauged with five items borrowed from Y.-S. Chen (2010), while six items were obtained from K. Chen and Deng (2016). Maichum et al. (2016) assessed the intention toward GGP. The adoption of GGP was evaluated with five items taken from Sanchezm Lopezz-Mosquera and Lera-Lopez (2015) and Walton and Austin (2011). All items used in this study presented in Supplementary materials (Supplementary Table 1. Survey Instrument).

Common Method Bias (CMB)

According to Podsakoff et al. (2012), measuring different constructs with the same method yields biases, as sharing the same measurement method may contribute to certain cases of covariation between the constructs. Therefore, this study applied Harman's one-factor test as a diagnostic technique to determine the CMB effect. The single factor accounted for 36.8%, which was below the recommended threshold of 40% in Harman's one-factor test. Subsequently, the inconsequential influence of CMB in this study was approved (Podsakoff et al., 2012). Additionally, CMB evaluated the current study by testing the full collinearity of all study constructs (Kock, 2015). While the study constructs regressed on the common variable, the variance inflation factor (VIF) values amounted to ALV (1.997), BCV (2.182), EGV (1.486), NEP (2.890), AOC (2.405), AOR (3.207), PLN (2.089), GNT (1.000), GGI (1.000), and GGP (1.000). All VIF values were less than 3.3, indicating the absence of bias from the single-source data (Kock, 2015).

Multivariate Normality

Hair et al. (2019) suggested the evaluation of multivariate normality before the use of SmartPLS. Therefore, multivariate normality for the study data was assessed with the Web Power online tool (*source*. https://webpower.psychstat.org/wiki/tools/index). The calculated Mardia's multivariate *p*-value indicated a non-normality issue in the study data, given that the *p*-values were below .05 (Cain et al., 2017).

Data Analysis Method

With the multivariate non-normality in the study data, partial least square–structural equation modelling (PLS-SEM) was employed. Hair et al. (2019) suggested using variance-based structural equation modelling (CB-SEM) to analyze the current exploratory-natured study. SmartPLS 3.1 program was employed to analyze the data collected for the current study. The PLS-SEM is a multivariate exploratory method for analyzing integrated latent construct path structure (Hair et al., 2019). Also, PLS-SEM empowers the researcher to exhibit proper function with non-normal and small data sets. Despite the absence of specific assumptions regarding the goodness-of-fit static requirements, it is also a casual-predictive analytical tool for executing complex models with composites (Ringle & Sarstedt, 2016). The PLS-SEM analysis was conducted in two phases. Specifically, the first phase was performed on the model estimation, where the model construct reliability and validity were evaluated (Hair et al., 2019). Following that was phase two, which was performed to evaluate correlations of the models and systematic testing of the study path model (Ringle & Sarstedt, 2016). The study analysis with r^2, Q^2, and effect size f^2 could explain the endogenous construct change caused by the exogenous constructs (Hair et al., 2019).

The importance-performance map analysis (IPMA) specifies the study constructs into relatively high to low through the corresponding importance and performance of the endogenous construct (Hair et al., 2019). Besides, it differentiates the possible area of improvement from the practice and scholarly standpoints. As an unstandardized method, the IPMA analysis alters the total effect into total rescaled variables (Ringle & Sarstedt, 2016), which are rescaled and documented for the range of every latent construct from 0 to 100. The latent construct mean score signifies the performance of the latent construct, where 0 indicates the smallest score and 100 indicates the highest importance in the performance of the endogenous construct (Hair et al., 2019).

Results

Respondents Demographic

According to the current study's analysis of the respondents, 55.4% of the total sample of 1,721 were female. Regarding marital status, 50.1% of the study samples were single, while 49.2% of the respondents were married. The remaining respondents were divorced or windowed. The majority of the respondents were aged between 26 and 35 years old (33.6%), while 33.5% of the respondents were aged between 18 and 25 years old, 20% of the study respondents were aged between 36 and 45 years old and the rest of the respondents aged above 46 years old (Tables 1 and 2).

Of the 1,721 respondents, 50.7% of the respondents obtained a bachelor's level of education or other equivalent levels, 31.3% obtained master-level education, 8% fulfilled secondary school level education, 9.6% fulfilled

Table 1. Demographic Characteristics.

	N	%
Gender		
Female	953	44.6
Male	768	55.4
Total	1,721	100.0
Age group (years)		
18–25	576	33.5
26–35	579	33.6
36–45	344	20.0
46–55	203	11.8
More than 55	19	1.1
Total	1,721	100.0
Average monthly income (RM)		
Below 2,500	415	24.1
2,501–5,000	236	13.7
5,001–7,500	726	42.2
7,500–10,000	145	8.4
More than 10,000	199	11.6
Total	1,721	100.0
Marital status		
Single	863	50.1
Married	846	49.2
Divorced	7	0.4
Widowed	5	0.3
Total	1,721	100.0
Education		
Secondary school certificate	137	8.0
Diploma certificate	166	9.6
Bachelor's degree or equivalent	873	50.7
Master's degree	539	31.3
Doctoral degree	6	0.3
Total	1,721	100.0
Employment		
Full-time employment	1,227	71.3
Part-time employment	154	8.9
Unemployed	307	17.8
Retired	33	1.9
Total	1,721	100.0

diploma level education, and the remaining respondents achieved the doctorate level education. Among the respondents, 42.2% of respondents received a monthly income of between RM5,000 to RM7,500. In comparison, 24.1% of respondents received a monthly income of under RM2500, 13.7% received a monthly income of RM2,501 to RM5,000, and 8.4% of respondents were provided with a monthly income of RM7,500 to RM10,000. The remaining respondents received a monthly income of more than RM10,000. Regarding employment, most respondents (71.3%) had full-time employment.

Reliability and Validity

Following Hair et al.'s (2019) suggestions, a two-step evaluation process was adopted for the study. In the first stage, the study latent construct reliabilities and validities were achieved and evaluated with Cronbach's alpha (CA), Dijkstra-Hensele's ρ, and composite reliability (CR). The Cronbach's alpha scores for each construct were over the .7 threshold, while the minimum value of Cronbach's alpha value amounted to .98 (Hair et al., 2019). The results are presented in Table 3. Additionally, all the Dijkstra-Hensele's ρ scores for the study constructs were higher than the .7 threshold, with the minimum value of Dijkstra-Hensele's ρ amounting to .802 (Hair et al., 2019). Similarly, the CR scores were higher than the .70 thresholds, with the lowest CR value of .861 (Kock, 2015). These results indicated that the latent constructs achieved appropriate reliabilities and good performance in the subsequent analysis stage.

The average value extracted (AVE) for each construct was above 0.50, establishing the suitable convergent validity to attain each construct's uni-dimensionality

Table 2. Reliability and Validity.

Variables	No. items	*M*	*SD*	Cronbach's α	Dijkstra-Hensele's ρ	Composite reliability	Average variance extracted	Variance inflation factors
BCV	4	5.892	0.923	.882	.867	.909	.714	2.182
ALV	6	5.979	0.887	.802	.804	.870	.627	1.997
EGV	5	5.508	0.888	.801	.802	.862	.557	1.486
NEP	5	5.783	0.875	.798	.802	.861	.553	2.890
AOC	4	6.022	0.871	.881	.881	.910	.628	2.405
AOR	5	5.869	0.935	.883	.883	.914	.680	3.207
PLN	5	5.660	0.983	.887	.887	.917	.689	2.089
GNT	5	5.535	0.998	.891	.891	.920	.697	1.000
GGI	6	5.433	1.027	.896	.897	.920	.658	1.000
GGP	5	5.072	1.266	.918	.918	.939	.753	—

Source. Author's Data Analysis.

Note. BCV = biospheric values; ALV = altruistic values; EGV = egoistic values; NEP = new environmental paradigm; AOC = awareness of consequences; AOR = ascription of responsibility; PLN = personal norms; GNT = green trust; GGI = green gardening intention; GGP = green gardening practices.

Table 3. Discriminant Validity: Fornell-Larcker Criterion.

	BCV	ALV	EGV	NEP	AOC	AOR	PLN	GNT	GGI	GGP
Fornell-Larcker criterion										
BCV	0.845									
ALV	0.695	0.792								
EGV	0.491	0.552	0.746							
NEP	0.618	0.609	0.480	0.744						
AOC	0.628	0.652	0.478	0.738	0.792					
AOR	0.582	0.600	0.482	0.704	0.788	0.825				
PLN	0.597	0.542	0.481	0.637	0.646	0.696	0.830			
GNT	0.505	0.470	0.472	0.532	0.562	0.616	0.715	0.835		
GGI	0.510	0.448	0.470	0.521	0.535	0.586	0.731	0.755	0.811	
GGP	0.385	0.272	0.407	0.345	0.314	0.381	0.569	0.646	0.755	0.868
HTMT ratios										
BCV	—									
ALV	0.833	—								
EGV	0.581	0.680	—							
NEP	0.741	0.756	0.594	—						
AOC	0.718	0.775	0.562	0.857	—					
AOR	0.664	0.711	0.567	0.833	0.829	—				
PLN	0.681	0.641	0.564	0.756	0.730	0.785	—			
GNT	0.577	0.556	0.553	0.630	0.634	0.695	0.804	—		
GGI	0.582	0.530	0.551	0.619	0.604	0.661	0.821	0.845	—	
GGP	0.433	0.317	0.472	0.349	0.424	0.492	0.630	0.714	0.831	—

Source. Author's Data Analysis.

Note. BCV = biospheric values; ALV = altruistic values; EGV = egoistic values; NEP = new environmental paradigm; AOC = awareness of consequences; AOR = ascription of responsibility; PLN = personal norms; GNT = green trust; GGI = green gardening intention; GGP = green gardening practices.

(Hair et al., 2019). Each construct comprised adequate convergent validity (see Table 3). The variance inflation factor (VIF) values for each construct were under the threshold of 3.3, proving that no multicollinearity issue was present (Kock, 2015). The item loading and cross-loading were described to confirm the discriminant validity of the constructs, as shown in Tables 3 and 4.

The study constructs achieved the discriminant validities (refer to Table 3). The Fornell and Larcker (1981) criterion measured the constructs' discriminant validity of the study and was assessed with the square root of the individual construct AVE. The square root of AVE for the construct should be higher than the correlation among other constructs (Hair et al., 2019). The HTMT ratio required less than 0.90 to establish the discriminant validity for each construct (Henseler et al., 2015). It could be seen from Tables 3 and 4 that a discriminant validity was present for each construct.

Path Analysis

The study model measurement evaluation was performed in the second stage to appraise the study hypotheses. The adjusted r^2 score for the input constructs of BCV, ALV, and EGV on the NEP illustrated the 46.0% of changes in the NEP for green gardening. The predictive relevance (Q^2) score for the part of the model amounted to 0.251, representing a medium predictive relevance (Kock, 2015). The adjusted r^2 score for the NEP on the AOC demonstrated the 54.5% variations in the AOC. The predictive relevance (Q^2) score for this part of the model was 0.339, indicating a medium predictive relevance (Hair et al., 2019).

The adjusted r^2 score for the AOC on the AOR clarified the 62.1% variations in the AOR. The predictive relevance (Q^2) score for this part of the model amounted to 0.418, indicating a high predictive relevance (Hair et al., 2014). The adjusted r^2 score for the three exogenous constructs (e.g., NEP, AOC, and AOR) on the PLN illustrated the 53.3% variations in the PLN. Furthermore, the predictive relevance (Q^2) score for this part of the model was 0.364, indicating high predictive relevance (Hair et al., 2019). The adjusted r^2 score for the two exogenous constructs (e.g., PLN and GNT) on the GGI clarified the 64.5% variations in the GGI. The predictive relevance (Q^2) score for this part of the model was 0.421, indicating a high predictive relevance (Kock, 2015). The adjusted r^2 score for the GGI on the GGP clarified the 57.0% variations in the GGP. The predictive relevance (Q^2) score for that part of the model was 0.427, indicating a high predictive relevance (Hair et al., 2019).

The model's standardized path scores, *t*-values, and significance scores are presented in Table 6. The path

Table 4. Loadings and Cross-Loading.

Code	BCV	ALV	EGV	NEP	AOC	AOR	PLN	GNT	GGI	GGP
BCV1	*0.846*	0.534	0.392	0.503	0.502	0.458	0.507	0.428	0.442	0.348
BCV2	*0.873*	0.614	0.408	0.544	0.533	0.503	0.492	0.400	0.408	0.295
BCV3	*0.820*	0.573	0.447	0.507	0.507	0.495	0.510	0.467	0.474	0.388
BCV4	*0.839*	0.623	0.411	0.534	0.576	0.508	0.510	0.415	0.404	0.274
ALV1	0.472	*0.768*	0.358	0.606	0.506	0.618	0.483	0.398	0.376	0.191
ALV2	0.461	*0.772*	0.386	0.558	0.486	0.601	0.506	0.462	0.431	0.290
ALV3	0.466	*0.759*	0.419	0.563	0.478	0.647	0.548	0.511	0.481	0.329
ALV4	0.539	*0.815*	0.351	0.604	0.539	0.621	0.489	0.409	0.391	0.205
ALV5	0.535	*0.829*	0.371	0.600	0.556	0.626	0.504	0.422	0.410	0.204
ALV6	0.508	*0.807*	0.386	0.577	0.529	0.630	0.537	0.468	0.453	0.274
EGV1	0.440	0.502	*0.743*	0.394	0.394	0.383	0.429	0.410	0.400	0.358
EGV2	0.288	0.340	*0.692*	0.333	0.331	0.298	0.253	0.236	0.242	0.201
EGV3	0.338	0.375	*0.779*	0.324	0.320	0.339	0.365	0.363	0.364	0.343
EGV4	0.339	0.358	*0.784*	0.324	0.311	0.341	0.350	0.354	0.376	0.330
EGV5	0.399	0.453	*0.730*	0.397	0.406	0.418	0.376	0.380	0.358	0.278
NEP1	0.456	0.451	0.377	*0.730*	0.517	0.488	0.438	0.357	0.355	0.230
NEP2	0.473	0.433	0.327	*0.708*	0.486	0.467	0.477	0.388	0.403	0.270
NEP3	0.424	0.430	0.332	*0.757*	0.555	0.522	0.452	0.363	0.363	0.239
NEP4	0.427	0.403	0.380	*0.735*	0.508	0.509	0.487	0.441	0.436	0.328
ENP5	0.515	0.536	0.371	*0.787*	0.662	0.616	0.513	0.430	0.385	0.226
AOC1	0.543	0.476	0.430	0.466	*0.777*	0.447	0.397	0.338	0.341	0.217
AOC2	0.582	0.548	0.380	0.489	*0.811*	0.490	0.416	0.349	0.322	0.162
AOC3	0.544	0.531	0.468	0.515	*0.815*	0.511	0.486	0.417	0.389	0.249
AOC4	0.532	0.507	0.472	0.456	*0.764*	0.448	0.414	0.382	0.365	0.232
AOR1	0.510	0.536	0.370	0.613	0.712	*0.802*	0.567	0.502	0.457	0.272
AOR2	0.479	0.476	0.409	0.551	0.633	*0.831*	0.589	0.525	0.489	0.349
AOR3	0.450	0.454	0.405	0.542	0.604	*0.832*	0.579	0.526	0.489	0.350
AOR4	0.466	0.497	0.409	0.585	0.628	*0.823*	0.550	0.470	0.473	0.288
AOR5	0.490	0.506	0.398	0.606	0.667	*0.836*	0.584	0.517	0.509	0.314
PLN1	0.494	0.438	0.410	0.509	0.521	0.568	*0.820*	0.572	0.590	0.465
PLN2	0.526	0.462	0.375	0.549	0.568	0.608	*0.815*	0.627	0.633	0.487
PLN3	0.478	0.468	0.398	0.523	0.536	0.586	*0.838*	0.575	0.591	0.440
PLN4	0.487	0.426	0.413	0.522	0.512	0.553	*0.854*	0.607	0.625	0.516
PLN5	0.489	0.453	0.399	0.539	0.541	0.569	*0.822*	0.586	0.594	0.450
GNT1	0.435	0.406	0.394	0.465	0.499	0.531	0.607	*0.843*	0.630	0.545
GNT2	0.436	0.418	0.400	0.468	0.500	0.534	0.613	*0.838*	0.626	0.518
GNT3	0.432	0.392	0.393	0.458	0.478	0.538	0.604	*0.858*	0.645	0.553
GNT4	0.404	0.379	0.407	0.411	0.407	0.476	0.569	*0.822*	0.630	0.560
GNT5	0.402	0.367	0.378	0.419	0.464	0.494	0.593	*0.812*	0.621	0.520
GGI1	0.375	0.324	0.353	0.375	0.374	0.420	0.585	0.624	*0.825*	0.634
GGI2	0.404	0.342	0.377	0.413	0.426	0.482	0.608	0.642	*0.833*	0.602
GGI3	0.455	0.415	0.375	0.467	0.493	0.526	0.629	0.619	*0.810*	0.561
GGI4	0.459	0.421	0.382	0.478	0.506	0.541	0.602	0.589	*0.790*	0.540
GGI5	0.360	0.297	0.394	0.360	0.354	0.419	0.569	0.588	*0.822*	0.676
GGI6	0.436	0.386	0.407	0.448	0.462	0.475	0.569	0.612	*0.786*	0.655
GGP1	0.316	0.217	0.348	0.283	0.248	0.324	0.486	0.551	0.662	*0.880*
GGP2	0.346	0.249	0.350	0.296	0.287	0.346	0.524	0.587	0.670	*0.872*
GGP3	0.297	0.198	0.345	0.268	0.232	0.305	0.481	0.550	0.649	*0.882*
GGP4	0.334	0.224	0.352	0.303	0.258	0.317	0.496	0.561	0.648	*0.878*
GGP5	0.376	0.291	0.369	0.349	0.339	0.363	0.481	0.552	0.647	*0.827*

Source. Author's Data Analysis.

Note. The Italic values in the matrix above are the item loadings, and others are cross-loadings. BCV = biospheric values; ALV = altruistic values; EGV = egoistic values; NEP = new environmental paradigm; AOC = awareness of consequences; AOR = ascription of responsibility; PLN = personal norms; GNT = green trust; GGI = green gardening intention; GGP = green gardening practices.

coefficient for the BCV and NEP (β = .346, t = 10.086, p = .000) denoted a positive and significant effect, suggesting that BCV significantly influenced the NEP and led to the acceptance of H1a. The path score between ALV and NEP (β = .283, t = 8.582, p = .000) signified the significant positive influence of the ALV on the NEP.

Table 5. Path Coefficients.

Hypothesis	β	*t*	*p*	r^2	f^2	Q^2	Decision
H1a							
BCV → NEP	.346	10.086	.000		0.111		Accept
H1b							
ALV → NEP	.283	8.582	.000	.461	0.068	0.251	Accept
H1c							
EGV → NEP	.154	5.945	.000		0.030		Accept
H2							
NEP → AOC	.738	48.603	.000	.545	1.198	0.339	Accept
H3							
AOC → AOR	.788	69.874	.000	.645	1.642	0.418	Accept
H4a							
NEP → PLN	.241	8.289	.000		0.052		Accept
H4b							
AOC → PLN	.140	4.336	.000		0.013		Accept
H4c							
AOR → PLN	.415	12.942	.000	.533	0.128	0.364	Accept
H5a							
PLN → GGI	.392	13.371	.000		0.221		Accept
H5b							
GNT → GGI	.475	16.219	.000	.645	0.310	0.421	Accept
H6							
GGI → GGP	.755	62.338	.000	.570	1.327	0.427	Accept

Source. Author's Data Analysis.

Note. BCV = biospheric values; ALV = altruistic values; EGV = egoistic values; NEP = new environmental paradigm; AOC = awareness of consequences; AOR = ascription of responsibility; PLN = personal norms; GNT = green trust; GGI = green gardening intention; GGP = green gardening practices.

Overall, the result provided significant statistical support for accepting H1b. Additionally, the path coefficient for the EGV and NEP (β = .154, t = 5.945, p = .000) symbolized the influence of a positive and significant effect of EGV on the NEP, leading to the support for H1c.

The path from NEP to AOC (β = 0.738, t = 48.603, p = .000), which demonstrated the impact of the NEP on the AOC, was recorded as positive and significant. Overall, this result led to the support for accepting H2. The path value for the AOC and AOR (β = .788, t = 69.874, p = .000) indicated that the AOC affected the AOR, which provided the support to accept H3.

The path between NEP and PLN (β = .241, t = 8.289, p = .000), which indicated the influence of NEP on the PLN, was recorded as positive and significant. This result presented support for accepting the H4a. The path between AOC and PLN (β = .140, t = 4.336, p = .000), which demonstrated the influence of the AOC on the PLN, was recorded as positive and significant. Therefore, the support to accept H4b was present. The path between AOR and PLN (β = .415, t = 12.942, p = .000), which showed the influence of the AOR on the PLN, was positive and significant. This result showed support for accepting H4b.

The path between PLN and GGI (β = .392, t = 13.371, p = .000), which demonstrated the influence of PLN on GGIs, was recorded to be positive and significant. This result provided support for accepting H5a. The path between GNT and GGI (β = .475, t = 16.219, p = 0.000), which indicated the influence of the GNT on the GGIs, was positive and significant and showed support for the acceptance of H5b. Meanwhile, the path coefficient for the GGI and GGP (β = .755, t = 62.338, p = .000) presented a positive and significant effect, which offered support for accepting H6. Table 5 presents the path coefficients.

Importance-Performance Factors

The importance-performance matrix (IPMA) outcome (presented in Table 6) has demonstrated that the AOC is the most critical factor in the performance of GGP, with a score of 83.786, followed by ALV, with a score of 83.027. The third most important factor for the performance of the GGP included the BCV, with a score of 81.621. The fourth important factor was the AOR, with a score of 81.230. Following that, the fifth significant factor for the performance of GGP was the NEP.

Multi Group Analysis

The measurement invariance of composite models (MICOM) portrayed the results of the compositional invariance assessment. The permutation's p-values for all

Table 6. Importance-Performance Matrix.

Factors effects green gardening practices	Total effect	Performance
BCV	0.082	81.621
ALV	0.070	83.027
EGV	0.038	75.281
NEP	0.251	79.928
AOC	0.201	83.786
AOR	0.166	81.230
PLN	0.380	77.700
GNT	0.454	75.590
GGI	0.931	73.957

Source. Author's data analysis.
Note. BCV = biospheric values; ALV = altruistic values; EGV = egoistic values; NEP = new environmental paradigm; AOC = awareness of consequences; AOR = ascription of responsibility; PLN = personal norms; GNT = green trust; GGI = green gardening intention; GGP = green gardening practices.

constructs in gender and education of more than .05 indicated the establishment of compositional invariance. However, the permutation's *p*-values for "biospheric values" across four categories (i.e., age, income, employment, and marital status) did not exceed .05. As only one construct (out of 10 constructs) recorded *p*-values of less than .05, the fulfilment of compositional invariance in four categories (i.e., age, income, employment, and marital status) was assumed. Therefore, this study proceeded to compare the standardized path coefficients across the groups through MGA in PLSPM. The results of the MGA analysis revealed that the significant effect of GGI on GGP among male respondents was more significant than that of female respondents. Moreover, the influence of BCV on NEP and PLN on GGI among the low-income group (average monthly income of below RM 7,500) was found to be significantly higher than that of the high-income group (average monthly income of more than RM 7,500; Table 7).

Discussion

This study examined the GGI and adoption of GGP with the VBN framework among Malaysian residents. As a result, it was found that the biospheric, altruistic, and egoistic values significantly influenced the NEP. Notably, the result of this study was in line with the study by Zhang et al. (2020), in which Biospheric, egoistic, and ALV strongly promoted the NEP among Chinese agriculture producers. People with the right value system, who see the environment as essential and conservation as the best strategy, would reassess their views on the environment, support the NEP, and actively participate in environmental conservation.

According to the current research, the NEP significantly impacted the AOC. Overall, the study outcomes corroborated Fornara et al. (2020) hypothesis that people with NEP caused an AOC among European respondents. Based on the VBN causal path, the AOC promoted the AOR toward green gardening. Moreover, these study results were in line with the result by Zhang et al. (2020), in which the awareness of the consequences occurring to the climate due to urbanization created the AOR to engage in green gardening actively.

It was proposed in this study that the new environment paradigm, AOC, and the AOR impacted the personal norm. This result agreed with Zhang et al.'s (2020) findings that the NEP among farmers and AOR was linked to the establishment of PLN. Also, it was suggested that the personal norm and GNT contributed to the GGI. Notably, this finding was in line with the finding by Hiratsuka et al. (2018), where environmental values strongly represented the intention to use environment-friendly cars among the Japanese respondents. The GNT also highly influenced the GGI. Overall, this study supported the result by Wang et al. (2019) that GNT developed the intention of exhibiting green behaviors. As suggested in this study result, GGI initiates green gardening behavior. This study agreed with Kim and Seock's (2019) study, in which the intention to be involved in environmental behavior affected pro-environmental behaviors.

Conclusions

Urbanization extensively destroys green areas and creates ecological problems. The current research aims to empirically explore green gardening intentions and practices with the extended VBN model. The research results offered pieces of empirical evidence that the biospheric, egoistic, and ALV influence the NEP, which builds the AOC and AOR. Furthermore, the NEP, AOC, and AOR significantly influence the PLN in protecting a neighborhood environment. The research also suggested that the PLN and GNT contributed to the intention of practising green gardening among urban residents. However, GGP requires further support, given that this intention may not be translated into GGP. Social support and inclusive exertions require individuals and urban centre administrations to initiate protection over the green gardens in private and public spaces. NGOs can also play a significant role by working as a bridge between the urban centre administration and urban residents to engage in urban farming practices. In this case, mutual efforts are needed to mitigate the climatic issues by utilizing the open spaces available to reduce food security and climatic issues, given that urban centre

Table 7. Multi Group Analysis.

Measurement of invariance MICOM Procedure (permutation p-value)	Associations	Multi-group analysis		Decision
		Difference (β value, between groups)	*p*-Value	
Gender (Group 1. male. *N* = 768; Group 2. Female, *N* = 953)				
Biospheric values (.638)	BCV → NEP	.048	.241	No difference
Altruistic values (.295)	ALV → NEP	−.072	.131	No difference
Egoistic value (.521)	EGV → NEP	.032	.259	No difference
New environmental paradigm (.275)	NEP → AOC	−.012	.346	No difference
Awareness of consequences (.705)	AOC → AOR	−.035	.056	No difference
Ascription of responsibility (.223)	NEP → PLN	.035	.278	No difference
Personal norms (.274)	AOC → PLN	−.060	.184	No difference
Green trust (.834)	AOR → PLN	.067	.148	No difference
Green gardening intention (.452)	PLN → GGI	−.009	.446	No difference
Green gardening practices (.401)	GNT → GGI	.042	.243	No difference
	GGI → GGP	.048	**.029**	**Sig. difference**
Age (Group 1. Less than or equal to 35 years. *N* = 1,155; Group 2. More than 35 years. *N* = 466)				
Biospheric values (.001)	BCV → NEP	.075	.146	No difference
Altruistic values (.615)	ALV → NEP	−.053	.214	No difference
Egoistic value (.801)	EGV → NEP	−.010	.420	No difference
New environmental paradigm (.683)	NEP → AOC	.019	.277	No difference
Awareness of Consequences (.940)	AOC → AOR	.005	.427	No difference
Ascription of responsibility (.462)	NEP → PLN	−.023	.366	No difference
Personal norms (.055)	AOC → PLN	.029	.345	No difference
Green trust (.531)	AOR → PLN	.067	.172	No difference
Green gardening intention (.462)	PLN → GGI	.074	.106	No difference
Green gardening practices (.411)	GNT → GGI	−.073	.116	No difference
	GGI → GGP	−.007	.396	No difference
Education (Group 1. School certificate and diploma. *N* = 303; Group 2. Bachelor degree and above. *N* = 1,418)				
Biospheric values (.293)	BCV → NEP	.078	.173	No difference
Altruistic values (.381)	ALV → NEP	−.029	.365	No difference
Egoistic value (.935)	EGV → NEP	.014	.410	No difference
New environmental paradigm (.599)	NEP → AOC	.054	.075	No difference
Awareness of Consequences (.422)	AOC → AOR	.027	.155	No difference
Ascription of responsibility (.396)	NEP → PLN	.013	.431	No difference
Personal norms (.730)	AOC → PLN	.115	.082	No difference
Green trust (.878)	AOR → PLN	−.081	.171	No difference
Green gardening intention (.856)	PLN → GGI	.054	.212	No difference
Green gardening practices (.422)	GNT → GGI	−.047	.258	No difference
	GGI → GGP	−.003	.479	No difference
Income (Group 1. Less than or equal to RM7500. *N* = 1,377; Group 2. More than RM7500. *N* = 344)				
Biospheric values (.006)	BCV → NEP	.145	**.034**	**Sig. difference**
Altruistic values (.732)	ALV → NEP	−.108	.079	No difference
Egoistic value (.487)	EGV → NEP	−.014	.417	No difference
New environmental paradigm (.551)	NEP → AOC	.051	.071	No difference
Awareness of consequences (.341)	AOC → AOR	−.010	.350	No difference
Ascription of responsibility (.389)	NEP → PLN	−.028	.345	No difference
Personal norms (.377)	AOC → PLN	.107	.097	No difference
Green trust (.540)	AOR → PLN	−.020	.412	No difference
Green gardening intention (.247)	PLN → GGI	.135	**.031**	**Sig. difference**
Green gardening practices (.681)	GNT → GGI	−.106	.066	No difference
	GGI → GGP	−.005	.407	No difference
Employment (Group 1. full-time. *N* = 1,227; Group 2. part-time, unemployed, retired. *N* = 494)				
Biospheric values (.044)	BCV → NEP	−.098	.104	No difference
Altruistic values (.595)	ALV → NEP	.086	.112	No difference
Egoistic value (.461)	EGV → NEP	−.013	.414	No difference
New environmental paradigm (.842)	NEP → AOC	−.006	.418	No difference
Awareness of consequences (.216)	AOC → AOR	.043	.052	No difference
Ascription of responsibility (.965)	NEP → PLN	−.047	.256	No difference
Personal norms (.869)	AOC → PLN	.050	.231	No difference
Green trust (.126)	AOR → PLN	−.052	.233	No difference
Green gardening intention (.394)	PLN → GGI	.052	.192	No difference
Green gardening practices (.516)	GNT → GGI	−.067	.132	No difference
	GGI → GGP	.041	.106	No difference

(continued)

Table 7. (continued)

Measurement of invariance MICOM Procedure (permutation p-value)	Associations	Multi-group analysis		Decision
		Difference (β value, between groups)	*p*-Value	
Marital status (group 1. single. *N* = 863; Group 2. married. *N* = 846)				
Biospheric values (.015)	BCV → NEP	.064	.162	No difference
Altruistic values (.094)	ALV → NEP	−.070	.133	No difference
Egoistic value (.788)	EGV → NEP	−.038	.229	No difference
New environmental paradigm (.381)	NEP → AOC	−.016	.299	No difference
Awareness of consequences (.768)	AOC → AOR	−.018	.203	No difference
Ascription of responsibility (.434)	NEP → PLN	−.008	.438	No difference
Personal norms (.461)	AOC → PLN	−.020	.384	No difference
Green trust (.646)	AOR → PLN	.049	.230	No difference
Green gardening intention (.104)	PLN → GGI	−.020	.365	No difference
Green gardening practices (.958)	GNT → GGI	.014	.402	No difference
	GGI → GGP	−.016	.284	No difference

residents realize the need to correct the ecological issues caused by high urbanization.

Theoretical Implications

The present study can offer two theoretical contributions. Firstly, the current work utilized the VBN model to examine urban gardening intention and adoption among Malaysian urban residents. The present work, among a few studies, explored urban gardening with the VBN model and extended the use of the VBN model. Secondly, the present work extended the VBN model with the green trust, which can help nurture the intention and adoption of urban gardening among the study samples. Our study confirms a positive relationship between green trust and the intention to adopt urban farming.

Policy and Managerial Implications

The current study highlighted that green gardening in urban centres could be achieved by promoting the NEP using endorsing the BCV, ALV, and EGV. An individual with the NEP understands environmental issues and humans as the sole party to mitigating climate issues (Wolske et al., 2017). Here, the role of education policy in building awareness and knowledge about urban gardening is necessary. The city administration and NGO can significantly promote awareness toward urban gardening, harnessing the personal values necessary to nurture the new environmental paradigm. The government can allocate funds to educate and build the need to adopt urban gardening among individuals and corporations. Green gardening can take many forms, like an individual using their house, backyard, rooftop, or a community-provided specific area designed for urban gardening. Our study findings demonstrated that PLN and GNT are essential for promoting GGI. GNT represents the trust in the effectiveness of urban gardening and the role of the local administration in providing the space and support for urban gardening. A community-based participatory learning approach that focuses on the purposes and methods of green gardening and its economic, psychological and environmental benefits can foster the development of GNT among urban residents.

Moreover, the provision of space or a reduction in gardening input costs may help to shape the intention toward green gardening (Lewis et al., 2018). This aspect also addresses the issue, given that many individuals are interested in urban gardening, although the actual GGP remains significantly lower than the intention. Here, the issue of trust and resource provision is necessary to inculcate personal resourcefulness and social support to engage in urban farming in all possible forms. Besides, the role of urban gardening as a source of food supply should be addressed to achieve food security and safety for urban inhabitants (Al-Mayahi et al., 2019). Similarly, community leaders, environmental and development organizations, and policymakers can develop a comprehensive framework to promote environmental values and norms among communities to empower society to address social, economic, and environmental issues. At the same time, the implementation of strategic community-based promotional activities and participatory learning approaches can significantly increase the intention and adoption of green gardening practices among urban residents in Malaysia.

Four relevant limitations were present in this study. Firstly, this study focused on green gardening intention and behavior at an individual level. However, in urban centres, most green gardening takes place in the green spaces offered by the city administration. Social control and influence are necessary for the success of green gardening in urban areas. Therefore, it would be noteworthy to apply social influence in future studies that may affect

the PLN and GGP. Secondly, this study used the VBN model to explore green gardening intention and behavior. It was suggested that future research utilizes value-based adoption, given that many values are associated with green gardening. The role of specific and general knowledge about climate change and home gardening also needs exploration. Future studies may adopt the knowledge-belief-norm model to explore urban gardening adoption.

Additionally, the continuous intention to engage in home gardening is associated with fulfilling expectations from home gardening. Thirdly, the current study collected data from Malaysian urban residents, suggesting that future studies incorporate samples from other areas and different geographic locations. Communities in Malaysia grow many kinds of food, as reflected by the diverse usage of plants in daily food. Moreover, Malaysians tend to plant medicinal and edible species in their gardens. Adnan and Othman (2012) concluded the significant roles of plants in healing, therapeutic aid, and functions, such as consumption, beautification, utilities, and rituals in Malaysia. The impact of national culture can enhance our understanding of green gardening behavior and improve the generalization of the study's results. It is recommended for future research incorporate factors of national climate behavior and the influence of national green policies on the adoption of urban gardening. Lastly, the current study intended to highlight the complexity and diversity of human behavior. The obtained findings suggest a simplified linear relationship between a few selected variables based on the average values—for instance, GGI positively affected GGP, suggesting that, on average, a higher degree of intention potentially leads to a higher degree of adoption. However, most of the respondents in this study demonstrated a higher degree of intention with a low level of adoption (or no adoption). Therefore, it is recommended that future research consider the influence of cultural and human diversity on the intention and adoption of urban gardening.

Author Contributions

Muhammad Mohiuddin, Anas A. Salameh, and Syed Shah Alam: Conceptualization, Investigation, Methodology, Writing—Original Draft Preparation. Abdullah Al Mamun and Naeem Hayat: Conceptualization, Methodology, Formal Analysis, and Writing—Review & Editing

Declaration of Conflicting Interests

The author(s) declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

Funding

The author(s) disclosed receipt of the following financial support for the research, authorship, and/or publication of this article: This study was supported by Ministry of Higher Education, Malaysia (Grant Code: FRGS/1/2020/TK0/UCSI/02/5) and Prince Sattam bin Abdulaziz University (PSAU/2023/R/1444). The funders had no role in study design, data collection and analysis, decision to publish, or preparation of the manuscript.

Ethical Approval

The local ethics committee ruled that no formal ethics approval was required in this particular case because this research because (a) the data is completely anonymous with no personal information being collected; (b) the data is not considered to be sensitive or confidential in nature; (c) the issues being researched are not likely to upset or disturb participants; (d) vulnerable or dependant groups are not included; and (e) there is no risk of possible disclosures or reporting obligations.

Consent to Participate

Written informed consent for participation was obtained from respondents who participated in the survey. No data was collected from anyone under 18 years old.

Consent to Publish

All authors approved the manuscript and gave their consent for submission and publication in this journal.

ORCID iDs

Abdullah Al Mamun https://orcid.org/0000-0002-9713-742X
Muhammad Mohiuddin https://orcid.org/0000-0003-2009-027X
Anas A. Salameh https://orcid.org/0000-0002-4694-3771

Availability of Data and Materials

Research data submitted as supporting material.

Supplemental Material

Supplemental material for this article is available online.

References

Adnan, N., & Othman, N. (2012). The relationship between plants and the malay culture. *Procedia—Social and Behavioral Sciences*, *42*, 231–241. https://doi.org/10.1016/j.sbspro.2012.04.186

Al-Mayahi, A., Al-Ismaily, S., Gibreel, T., Kacimov, A., & Al-Maktoumi, A. (2019). Home gardening in Muscat, Oman: Gardeners' practices, perceptions, and motivations. *Urban Forestry & Urban Greening*, *38*, 286–294.

Cain, M. K., Zhang, Z., & Yuan, K.-H. (2017). Univariate and multivariate skewness and kurtosis for measuring non-normality: Prevalence, influence, and estimation. *Behaviour Research Methods*, *49*(5), 1716–1735.

Chen, G., Li, X., Liu, X, Chen, Y., Liang, X., Leng, J., Xu, X., Liao, W., Qiu, Y., Wu, Q., & Huang, K. (2020), Global projections of future urban land expansion under shared socioeconomic pathways. *Nature Communications*, *11*, 537. https://doi.org/10.1038/s41467-020-14386-x

Chen, K., & Deng, T. (2016). Research on the green purchase intentionas from the perspective of product knowledge. *Sustainability*, *8*(9), 943. https://doi.org/10.3390/su8090943

Chen, Y.-S. (2010). The drivers of green brand equity: Green brand image, green satisfaction, and green trust. *Journal of Business Ethics*, *93*(2), 307–319.

Choi, H., Jang, J., & Kandampully, J. (2015). Application of the extended VBN theory to understand consumers' decisions about green hotels, *International Journal of Hospitality Management*, *51*, 87–95.

Chowdhury, M. H., Eashat, M. F. S., Sarkar, C., Purba, N. H., Habib, M. A., Sarkar, P., & Shill, L. C. (2018). Rooftop gardening to improve food security in Dhaka city: A review of the present practices. *International Multidisciplinary Research Journal*, *10*(4), 17–21. https://doi.org/10.25081/imrj.2020.v10.6069

Faul, F., Erdfelder, E., Lang, A.-G., & Buchner, A. (2007). G*power 3: A flexible statistical power analysis program for the social, behavioral, and biomedical sciences. *Behaviour Research Methods*, *39*(2), 175–191.

Fornara, F., Molinario, E., Scopelliti, M., Bonnes, M., Bonaiuto, F., Gicero, L., Admiraal, J., Beringer, A. L., Dedeurwaerdere, T., de Groot, W., Hiedanpaa, J., Knights, P., Knippenberg, L., Ovenden, C., Horvat, K. P., Popa, F., Porras-Gomez, G., Smrekar, A., Soethe, N., Vivero-Pol, J. L., Van den Born, R., & Bonaiuto, M. (2020). The extended value-belief-norm theory predicts committed action for nature and biodiversity in Europe. *Environmental Impact Assessment Review*, *81*, 106338. https://doi.org/10.1016/j.eiar.2019.106338

Fornell, C., & Larcker, D. F. (1981). Evaluating structural equation models with unobservable variables and measurement error. *Journal of Marketing Research*, *18*(1), 39–50.

Gill, M. T., & Jacob, J. (2018). The relationship between green perceived quality and green purchase intention: A three-path mediation approach using green satisfaction and green trust. International *Journal of Business Innovation and Research*, *15*(3), 301–319.

The Global Economy. (2022). *Percent urban population in South East Asia*. Retrieved June 25, 2022, from https://www.theglobaleconomy.com/rankings/Percent_urban_population/South-East-Asia/

Han, H., Hwang, J., & Lee, M. J. (2016), The value–belief–emotion–norm model: Investigating customers' eco-friendly behavior. *Journal of Travel & Tourism Marketing*, *34*(5), 590–607.

Hair, J. F., Hult, G. T. M., Ringle, C. M., & Sarstedt, M. (2014). *A Primer on Partial Least Squares Structural Equation Modeling (PLS-SEM)*. Sage.

Hair, J. F., Risher, J. J., Sarstedt, M., & Ringle, C. M. (2019). When to use and how to report the results of PLS-SEM. *European Business Review*, *31*(1), 2–24.

Hashim, N. H., Hussain, N. H. M., & Ismail, A. (2020). Green roof concept analysis: A comparative study of urban farming practices in cities. Malaysian *Journal of Sustainable Environment*, *7*(1), 115–132.

Henseler, J., Ringle, C. M., & Sarstedt, M. (2015). A new criterion for assessing discriminant validity in variance-based structural equation modelling. *Journal of the Academy of Marketing Science*, *43*(1), 115–135.

Hiratsuka, J., Perlaviciute, G., & Steg, L. (2018). Testing VBN theory in Japan: Relationships between values, beliefs, norms, and acceptability and expected effects of a car pricing policy. *Transportation Research Part F: Traffic Psychology and Behaviour, 53*, 74–83. https://doi.org/10.1016/j.trf.2017.12.015

Kiatkawsin, K., & Han, H. (2017). Young travellers' intention to behave pro-environmentally: Merging the value-belief-norm theory and the expectancy theory. *Tourism Management*, *59*, 76–88.

Kim, H. J., Kim, J. Y., Oh, K. W., & Jung, H. J. (2016), Adoption of eco-friendly faux leather: Examining consumer attitude with the value–belief–norm framework. *Clothing and Textiles Research Journal*, *34*(4) 239–256.

Kim, S. H., & Seock, Y. K. (2019). The roles of values and social norms on personal norms and pro-environmentally friendly apparel product purchasing behaviour: The mediating role of personal norms. *Journal of Retailing and Consumer Services*, *15*, 83–90.

Kock, N. (2015). Common method bias in PLS-SEM: A full collinearity assessment approach. *International Journal of e-Collaboration*, *11*, 1–10.

Landon, A. C., Woosnam, K. M., & Boley, B. B. (2018). Modelling the psychological antecedents to tourists' pro-sustainable behaviours: An application of the value-belief-norm model. *Journal of Sustainable Tourism*, *26*(6), 957–972. https://doi.org/10.1080/09669582.2017.1423320

Lewis, O., Home, R., & Kizos, T. (2018). Digging for the roots of urban gardening behaviours. *Urban Forestry & Urban Greening*, *34*, 105–113. https://doi.org/10.1016/j.ufug.2018.06.012

Lind, H. B., Nordfjaern, T., Jorgensen, S. H., & Rundmo, T. (2015). The value-belief-norm theory, personal norms, and sustainable travel mode choice in urban areas. *Journal of Environmental Psychology*, *44*, 119–125.

Liu, X., Zou, Y., & Wu, J. (2018). Factors influencing public-sphere pro-environmental behaviour among Mongolian college students: A test of Value-Belief-Norm theory. *Sustainability*, *10*, 1384. https://doi.org/10.3390/su10051384.

López-Mosquera, N., & Sánchez, M. (2012), Theory of Planned Behavior and the Value-Belief-Norm Theory explaining willingness to pay for a suburban park. *Journal of Environmental Management*, *113*, 251–262. https://doi.org/10.1016/j.jenvman.2012.08.029

Maichum, K., Parichatnon, S., & Peng, K. (2016). Application of the extended theory of planned behavior model to investigate purchase intention of green products among Thai consumers. *Sustainability*, *8*(10), 1077.

Michael, H., Lovemore, C., Hangwelani, M., Peter, L., Alister, S., & Rischard, A. (2018). Guerrilla gardening and green activism: Rethinking the informal urban growing movement. *Landscape and Urban Planning*, *170*, 6–14.

MalayMail. (2020). *Govt allocates RM10m for urban agriculture project, says deputy minister 10.00*. https://www.malaymail.com/news/malaysia/2020/08/23/govt-allocates-rm10m-for-urban-agriculture-project-says-deputy-minister/1896354

Pahlevi, M. R., & Suhartanto, D. (2020). The integrated model of green loyalty: Evidence from eco-friendly plastic products. *Journal of Cleaner Production*, *257*, 120844. https://doi.org/10.1016/j.jclepro.2020.120844

Podsakoff, P. M., Mackenzie, S. B., & Podsakoff, N. P. (2012). Sources of method bias in social science research and recommendations on how to control it. *Annual Review of Psychology*, *63*(1), 539–569.

Ramli, M. R., Milow, P., & Malek, S. (2021). Species composition, diversity, and traditional uses of plants in home garden in Kampung Masjid, Perak, Malaysia. *Biodiversitas*, *22*(4), 1902–1911.

Ringle, C. M., & Sarstedt, M. (2016). Gain more insight from your PLS-SEM results. The importance-performance map analysis. *Industrial Management & Data Systems*, *116*(9), 165–1886.

Riper, C. J. V., & Kyle, G. T. (2014). Understanding the internal processes of behavioral engagement in a national park: A latent variable path analysis of the value-belief-norm theory. *Journal of Environmental Psychology, 38*, 288–297. https://doi.org/10.1016/j.jenvp.2014.03.002

Stern, P. C. (2000). New environmental theories: Toward a coherent theory of environmentally significant behavior. *Journal of Social Issues*, *56*, 407–424.

Ünal, A. B., Steg, L., & Granskaya, J. (2019) "To support or not to support, that is the question." Testing the VBN theory in predicting support for car use reduction policies in Russia. *Transportation Research Part A*, *119*, 73–81.

Wang, H., Ma, B., & Bai, R. (2019). How does green product knowledge effectively promote green purchase intention? *Sustainability*, *11*, 1193. https://doi.org/10.3390/su11041193

Walton, T., & Austin, D. (2011). Pro-environmental behavior in an urban social structural context. *Sociological Spectrum*, *31*(3), 260–287.

Wensing, J., Carraresi, L., & Broring, S. (2019). Do pro-environmental values, beliefs, and norms drive farmers' interest in novel practises fostering the bio-economy? *Journal of Environment Management*, *232*, 858–867.

Wolske, K. S., Stern, P. C., & Dietz, T. (2017). Explaining interest in adopting residential solar in the United States: Towards an integration of behavioral theories. *Energy Research & Social Science*, *25*, 134–151.

Yildirim, B. C., & Semiz, G. K. (2019). Future teachers' sustainable water consumption Behavior: A test of the value-belief-norm theory. *Sustainability*, *11*, 1558. https://doi.org/10.3390/su11061558

Zasada, I., Weltin, M., Zoll, F., & Benninger, S. L. (2020). Home gardening practice in Pune (India), the role of communities, urban environment, and the contribution to urban sustainability. *Urban Ecosystems*, *23*, 403–417. https://doi.org/10.1007/s11252- 019-00921-2

Zhang, L., Ruiz-Menjivar, J., Luo, B., Liang, Z., & Swisher, M. E. (2020). Predicting climate change mitigation and adaptation behaviours in agricultural production: A comparison of the theory of planned behaviour and the value-belief-norm theory. *Journal of Environmental Psychology*, *68*, 101408. https://doi.org/10.1016/j.jenvp.2020.101408