Jurnal Teknologi

Full Paper

OCCUPANTS' EVALUATION OF GREEN FEATURES IN GREEN COMMERCIAL OFFICE BUILDINGS: ESTABLISHING THE VALIDITY AND RELIABILITY OF THE SURVEY INSTRUMENT

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Article history
Received
8 June 2015
Received in revised form
21 August 2015
Accepted
20 October 2015

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Abstract

Property owners and end-users (tenants and owner-users) have an important role in the development of sustainable real estate assets. This is due to the fact that they experience the benefits of sustainability in their buildings, which would promote the development of more sustainable buildings in the industry. The aim of this paper is to discuss the procedure of developing and validating an instrument to examine the occupants' evaluation of green features in green commercial office building based on three basic steps; (1) item development and judgement, (2) designing and conducting a pilot study, and (3) finalizing the survey. The 56-item instrument which comprises of 10 points Likert scales was developed prior to performing the Exploratory Factor Analysis (EFA). The results of this study highlight the instrument to better understand the green factors and their attributes for commercial office building under the environment, social and economic sustainability features.

Keywords: Green commercial office building; green features, occupants; exploratory factor analysis

Abstrak

Pemilik harta dan juga pengguna akhir (penyewa dan pemilik-pengguna) adalah dibahaskan mempunyai peranan penting dalam evolusi pasaran hartanah dan merupakan pengguna mampan kerana fakta menunjukkan bahawa mereka merasai faedah menduduki bangunan hijau dan akan menyebabkan peralihan dalam industri untuk membangunkan bangunan lestari. Tujuan kertas ini adalah untuk adalah untuk membincangkan proses membangunkan dan mengesahkan instrumen untuk menyiasat penilaian penghuni terhadap ciri-ciri bangunan pejabat hijau komersial berdasarkan tiga langkah asas (1) Pembangunan item dan penghakiman, (2) mereka bentuk dan menjalankan kajian rintis, dan (3) memuktamadkan kajian. Instrumen yang mengandungi 56 item telah dibangunkan berdasarkan kepada 10 Likert skala sebelum melaksanakan Analisis Faktor Eksploratori (EFA). Hasil kajian ini akan mengetengahkan instrument bagi lebih memahami faktor hijau dan sifat-sifat mereka untuk bangunan pejabat komersial di bawah ciri-ciri mampan yang terdiri daripada alam sekitar, sosial dan ekonomi.

Kata kunci: Bangunan pejabat komersil hijau; faktor hijau; penghuni; analisis faktor exploratory

1.0 INTRODUCTION

Green buildings incorporate a wide range of sustainability features which endeavors to rationalize development. The aims of green buildings are to disseminate economic growth besides sustains social inclusion and reduces environmental impact. Social aspect can be theorized that green buildings are healthier for people due to the non-chemical materials that have been used which can be risky to health. While the economic aspects of green building would be the notion that green buildings result in higher productivity, thereby increasing the profitability of the business occupier. For example, the environmental aspects of green property development are where a green property has an efficient heating ventilation air conditioning (HVAC) system. It was resulting in the lowers energy

consumption and decreases the greenhouse gas emissions, which effect to global warming and climate transform. All of these sustainable features presently, through the plenty of studies, both theoretical and applications, have shown to have an impact on the value of the property [1][2].

As the sustainability issue becomes increasingly prominent in the world nowadays, hence, it is significant to discover the influence of sustainability on property value. There is a need to precisely determine the sustainability impact on the market value to ensure that green building continues to rise in the market [4] [5].In terms of property valuation, the information such as health impacts and environmental of green building cannot be acquired over an individual inspection of the property except by valuation specialists. It can be done through revealing latest and also additional information sources in the most effective method. Consequently, valuation specialists depend greatly on the information that can be supplied by other property market players [6].

Market players are claimed to have an essential role in the adoption of sustainability, and so the evolution of the real estate market. Accordingly, the actions of market players are eventually will affect the identification of any relationship between sustainability and market value [7]. In other words, the value of real estate should be reflected indirectly due to the recognition of sustainability in real estate market. The market players classified into three groups: policy makers (government and non-government organizations, or NGOs), property holders (landlords), and end users (tenants and owner-users) [8]. However, the information pertaining the sustainability issues can only be obtained by relevant market players, namely property holders and also end user (tenants and owner-users). This is due to the fact that they experience the benefits of sustainability in the building and will give influence to the development of sustainable building [9].

In this research, the green factors and their attributes in commercial office building have been gathered through the variation of acceptable factors and attributes globally from literature review (involving the use of multiple instruments in a previous study) and initial interview from the experts. The applicability of globally established factors and attributes need to be revised and will be tailored to the Malaysian context as there are geographical differences like geographical area [10], water scarcity, or variation in market uptake of sustainability [8][11]. It is also highly depends on the conditions of the local and regional market, the property type, conventions, applied valuation method [12], different rating system approaches [13] and climatic conditions [14].

According to Creswell, in a study, when there is any modification on one or combine instruments, the previous validity and reliability may not applicable for the new instrument. Accordingly, it has become significant to established new validity and reliability for the new instrument during data analysis stage [15].

Hence, the purpose of this paper is to emphasize the steps of developing and validating a new instrument in order to investigate the occupants' evaluation of green features in green commercial office building based on 10 points Likert scale. The emphasis is on reliability and validity, since these two criteria are most broadly used to determine whether an instrument is valid or not.

This paper established three fundamental steps in order to develop a valid survey instrument: (1) item development and judgement, (2) designing and conducting a pilot study, and (3) finalizing a survey – Exploratory Factor Analysis (EFA). The paper concludes with a conclusion and suggestions.

2.0 STEP ONE: ITEM DEVELOPMENT AND JUDGEMENT

Item development and judgment are two stages in establishing the content validity. Burn and Groove have identified three sources of content validity, which is obtained from the literature, representatives of the related populations and expert opinion [16]. Content validity is described as the degree to which an instrument sufficiently samples the domain of interest of research when attempting to evaluate phenomena [17][18].

Content validity should also be addressed begin with instrument development [16]. In instrument development stage, identification of 'what domain of construct should be measured' should be the first step to be taken. This can be ascertained through literature reviews, interviews and focus groups. Hence, in this study, the initial information is needed for understanding about the whole concept regarding the sustainable building and green building, green building rating tool, the valuation of green building and also the sustainability and market value. In the first phase, the literature is reviewed to focus on areas related to sustainable development and more specifically on green building issues. This eventually leads to the identification of the green building concept which often perceived based on the sustainability concept consists of social, economic and environmental factors [13].

Thus, since green buildings take into consideration of environment, social and economic features throughout the whole building life cycle, all these features has been adopted as three major construct in this study.

The literature review result describes the conceptual of green building factors and their attributes. This initial finding was established through the association of all green factors and their attributes addressed by various authors and organization (Table1). A total 51 attributes (unevenly distributed among the 11 green building factors) were identified and all of them will be tested in a survey of the validation purpose.

Table 1 Green factors and their attributes addressed by various authors and organizations under the sustainability features.

Features	Factors	Attributes
Environment	Sustainable design features	Office layout, office comfort, designated area, informal interaction point, accessibility, waste management, water management, less pollution, energy efficiency, functionality, flexibility and adaptability and green building services
	Indoor Environment	Natural light and view, access to sufficient air, thermal comfort, indoor air quality, ventilation, worker controlled temperature, less toxic building material d furnishing, reduction of glare, noise level and renewable energy.
	Longer building life cycle	Lower level of environmental risk and minimize site impact
Social	Occupant satisfaction and well being	Confident level of employee and company, attract higher profile tenant, retain high quality worker, less complaints about comfort related problems, short-term letting up period
	Productivity	Increased health, comfort and safety, reduce illness symptom, less sick leave, reduce absenteeism, less claim on health cost
	Marketing advantage	Enhance brand and market edge, increase public perception, increase market share, higher prestige.
Economic	Rental growth	Lower building operating and maintenance expenses, efficient asset management team, secure higher rents, higher occupancy rate.
	Depreciation	Reduce depreciation and obsolescence
	Cash flow	Less risk of disclosure to instability in price
	Duration to let	Ease of rent, secure tenant more quickly, higher tenant retention
	Duration to sale	Ease of sale, improve marketability

In judgment stage, the content validity needs to be examined by the experts. Professional judgment is needed in particular to verify the extent to which the scale was constructed to assess an attributes. This is in accordance with Darus and Hashim who revealed that content validity depends on subjective or professional judgment about the degree of relevant construct in an evaluation of the instrument [10].

Yaghmaie argued that there are invalid and unacceptable statements such as "content validity was concluded through a literature review or panel of experts" or "the content validity of the instrument had been examined via comments by experts" [14]. In this research, the inclusion of at least three experts in the research area is applicable as advised by Creswell, but suggested that greater than 10 was probably needless would be useful to evaluate the instrument and rates item relevant to the domain of the survey content [15]. Therefore, there are a total of five qualified panel of experts involved in this study including two Green Building Index (GBI) accredited facilitators, two experts from Greentech Malaysia (formerly known as Pusat Tenaga Malaysia) and one academician who is involved in green building research.

The panel of content experts was requested to rate every scale item, whether it represented the underlying constructs and if the items were understandable or not.

Throughout this evaluation, the experts use a Likert-type ordinal scale with four possible responses. Using the 4-point scale as according to Burns and groove is to prevent having a neutral and indecisive midpoint. The responses comprise a rating of 1=not relevant, 2=somewhat relevant, 3=quite relevant and 4=very relevant. Researchers supporting the use of this method specify that rating of 1 and 2 is considered as "content invalid," whereas ratings of 3 and 4 are considered to be "content valid" [21][24][25].

The Content Validity Index (CVI) has been used as a content validity quantitative measure for proportion of experts who are in agreement about the relevance of the item [21]. CVI calculations were performed for each of the items of the survey instrument (I-CVI). The following is the formula to calculate the I-CVI.

$$\textbf{I-CVI} = \frac{\text{Number of respondents scoring an item with a 3 \& 4}}{\text{Total respondents}}$$

The items with an I-CVI value greater than 0.75 are remained and the items that had CVI value less than 0.75 was thrown away. Since all panels accepted all factors and attributes of green commercial office building under environment, social and economic features, there are no item was deleted. All items showed the CVI value more than 0.75. However, all panel provided comments and recommendations towards the items in the questionnaire in order to improve the instrument. Prior to pilot testing, the remaining items were adjusted according to the specialists' thoughts and criticisms to further revise the survey. Accordingly, the final number of items

increased from 51 to 56 items after taking into consideration of experts' comments and recommendations. Results from the content validity procedure could contribute to support the next stage of construct validity of an instrument in the following steps of conducting pilot study.

3.0 STEP TWO: DESIGNING AND CONDUCTING PILOT STUDY

The survey instrument was revised and finalized the initial version of the questionnaire after obtaining face to face interview during the content validity process, prior to pilot testing. The questionnaire was designed based on four sections (Section A to D). Section A solicits the information on demographic details of respondents. Section B of the questionnaire intends to ensure the respondents' perception of the factors and attributes of green commercial office building under the environment feature. Section C of the survey explores the respondents' opinion of the factors and attributes of green commercial office building based on social feature. While the last section of the questionnaire discovers the respondent's view towards the factors and attributes of green commercial office building based on the economic features.

Likert scales with rank order response categories classified within the ordinal level of measurement. However, the intervals between values cannot be assumed equal. Thus, in this study, a total of 56 close-ended questions have been developed based on 10-point interval Likert scale, moving from ranking score to rating score [26]. It has become an ordinary tradition to accept that Likert-type categories constitute interval-level measurement [27]. A 10-point agree-disagree scale typically would assign the number of 10 to the highest endpoint "strongly agree" and number 1 to the lowest endpoint "strongly disagree" [28]. When applying statistical methods, there are three most important assumptions concerning data should be applied which are identically, independently and normally distributed [26]. Thus, the 10-point scale with no labelling has been chosen for the reason that one of the statistical assumptions regarding data is independence. Therefore, the respondents should be able to translate into the score available in the questionnaire rather than referring to the label. If the questionnaire possesses a label on each score of item, then the respondents are more likely to look at labels when giving the score. Without labels, the score will be based on their perceived rating and the data will be continuous [26].

The method of analysis (exploratory factor analysis) utilized the sample size as the main function used for the study. There are different thoughts and numerous guiding rules of thumb regarding the sample size for factor analysis that have been quoted in the literature. The general Tabachnick's rule of thumb suggests that having as minimum as 300 cases are necessary for factor analysis [29]. While, Hair, Black, Babin and Anderson in their 7th edition of Multivariate Data Analysis book recommended that sample sizes should be 100 or larger [30].

A study conducted by MacCallum and Widaman revealed that if the items' communalities were high (e.g., 0.60 or greater), the result of an exploratory factor analysis was very consistent with the population loadings even with sample sized less than 60 cases [31]. This is to reproduce the population factor loadings for different sample sizes and variation in the communalities of the variables. Others researcher like Guadagnoli, Velicer, Sapnas and Zeller were found that for factor analysis, the solutions with correlation coefficients greater than 0.80 require smaller sample sizes as minimum as 50 cases [32][33]. Thus, for the purpose of the pilot study, a total of 100 green commercial office building occupiers in the area of Putrajaya, Kuala Lumpur and Selangor have been adequately sampled through random sampling technique. This is because the majority of green commercial office buildings are located in those areas [34].

4.0 STEP THREE: FINALISING THE SURVEY

4.1 Exploratory Factor Analysis (EFA)

The validation of the instrument has been piloted using Exploratory Factor Analysis (EFA). The establishment of EFA, one of the methods for data reduction has been employed in this study. This is due to the questionnaires that contain of lots of questions (variables) [35][26] and at the same time become rather complicated. Prior to further analysis can be carried out; the variables must be reduced into a manageable number.

In factor analysis, the interconnected variables will be brought together under more general fundamental variables [36]. More accurately, the factor analysis aims to moderate "the dimensionality of the original space and to give an explanation of the new space, spanned by a decreased number of new dimensions which are supposed to underlie the old ones" [36], or to support the variance in the observed variables in terms of underlying latent factors" [37]. Therefore, besides obtaining a clear view of the data, factor analysis also proposes the probability of using the output in following analyses [38][36]. In other words, the factor analysis procedure will group together the variables which possess similar characteristics under one component. Hence, in this study, instead of having to deal with 56 attributes, the author only deals with a few components resulted from the EFA procedure.

4.2 Kaiser-Meyer-Olkin (KMO) Measure of Sampling Adequacy/Bartlett's Test of Sphericity

Factor analysis should undergo several tests in order to measure the appropriateness dataset of the respondent prior to the factors extraction. These tests

involve Kaiser-Meyer-Olkin (KMO) Measure of Sampling Adequacy, Bartlett's Test of Sphericity and the determinant of correlation matrix procedure. A high value of KMO (between 0.5 and 1.0) is considered appropriate while a value of KMO with less than 0.5 is not suitable for factor analysis [26][38][39][40]. Correspondingly, a low value of Bartlett's test of Sphericity with below than 0.05 and a value for the determinant of correlation matrix close to 0 indicates that data at hand is adequate to proceed into factor analysis [26][39][40].

In EFA, the procedure has been conducted on the main construct in order to determine the number of sub-construct in the model [26][38]. Accordingly, the assessment of Kaiser-Meyer-Olkin (KMO) Measure of Sampling Adequacy and Bartlett's Test of Sphericity in this research are based on the three main constructs, namely environment, social and economic separately. The results for both measures are depicted in the respective Table 2, Table 3 and Table 4.

Table 2 KMO and Bartlett's Test for Environment items.

Kaiser-Meyer-Olkin (KMO) Measure of Sampling Adequacy		0.878
Bartlett's Test of Sphericity	Approx. Chi-Square	1913.173
	Df	435
	Significance	.000

The KMO value of 0.878 as depicted in Table 2 for environment items is within the range as it exceeds the suggested value of 0.6 [26]. Both KMO (value close to 1.0) and the Bartlett's Test significance (value close to 0.0) measures recommend that the data is applicable to continue with the items reduction procedure.

Table 3 KMO and Bartlett's Test for social items.

Kaiser-Meyer-Olkin (KMO) Measure of Sampling Adequacy		0.878
Bartlett's Test of Sphericity	Approx. Chi-Square	1037.487
	Df	105
	Significance	.000

The KMO and Bartlett's Test significance result for social items is both shown the acceptable value which is 0.878 and significance value close to 0.0 (Table 3) respectively. This exhibit that the data is also applicable to proceed with its reduction procedure.

Table 4 KMO and Bartlett's Test for economic items.

Kaiser-Meyer-Olkin (KMO) Measure of Sampling Adequacy		0.818
Bartlett's Test of Sphericity	Approx. Chi-Square	861.211
	Df	55
	Significance	.000

The result of KMO value (0.818) and Bartlett's Test significance value (close to 0.0) for economic items, as shown in Table 4 indicate the data applicable to proceed with its reduction procedure. Since all items for all three construct are considered suitable for factor analysis, the next step to be adopted is running Factor Analysis procedure using IBM SPSS (Statistical package for Social Science) Statistic 20 software.

4.3 Factor Rotation

The aim of factor rotation is to simplify the factor structure of a group of items. In other words, the item with high factor loadings will be gathered on one factor and item with small factor loadings grouped on the remaining factor solutions [41][42]. The techniques of principal component analysis (PCA) and varimax rotation afterward have been applied in this research in order to the respondents' ratings for the green factors and attributes of commercial office building based on the three main constructs.

Habing mentioned (as quoted in Darlington) that in many statistical programs, PCA server as the default method, and thus, is most commonly used in EFA [41][43] while Field also proposed for using PCA in EFA procedure [44].

Another issue comprises the number of measures that are engaged in an EFA involving to the number of factors that are extracted from EFA procedure. Since this study employed the PCA as the extraction procedure with communalities fixed at 1.0 to extract the principal components or factors, the calculation of eigenvalue is crucial to emphasize on.

The eigenvalues refer to the total of variance explained by a factor and are computed by squaring the loadings on a factor and summing them simultaneously [42][45]. Rietveld and Van Hout as cited in Gaskin state, "the number of dimensions is determined by the number of positive eigenvalues required to represent a set of scores without any loss of information" [36][42]. Therefore, the eigenvalues with positive numbers defines the number of factors/components that have been extracted [42][45]. A number of rules have been recommended for defining how many factors should be retained (see [36] [38]) as follows:

- Only those factors with an eigenvalue greater than 1 should be retained(Guttman-Kaiser rule);
- Keep the factors which describe for about 70-80% of the variance in total;
- Make a scree-plot5; retain all factors before the breaking point or elbow

The output in Table 5 demonstrates that Factor Analysis procedure has extracted seven different dimensions with eigenvalues beyond 1.0 (component 1 to 7) for environment items. Table 6 indicates the result of Factor Analysis procedure in establishing the three distinct dimensions with eigenvalues more than 1.0 (component 1 to 3) for social items while in Table 7, a total of three distinct dimensions has been extracted from economic items according to eigenvalues more than 1.0.

Table 5 Total variance explained for environment items

Component	Initial Eigenvalues			Rotation Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	11.474	38.247	38.247	6.557	21.857	21.857
2	2.405	8.016	46.263	3.298	10.993	32.850
3	1.866	6.220	52.483	3.053	10.176	43.026
4	1.659	5.531	58.015	3.034	10.113	53.139
5	1.437	4.791	62.806	2.159	7.198	60.337
6	1.212	4.041	66.846	1.591	5.302	65.639
7	1.123	3.742	70.588	1.485	4.950	70.588
8	.906	3.019	73.608			
9	.844	2.813	76.420			
10	.774	2.581	79.001			
11	.691	2.303	81.304			
12	.599	1.995	83.300			
13	.565	1.883	85.183			
14	.532	1.772	86.954			
15	.447	1.489	88.444			
16	.409	1.364	89.807			
17	.370	1.234	91.042			
18	.329	1.096	92.138			
19	.320	1.067	93.205			
20	.281	.937	94.142			
21	.273	.911	95.053			
22	.256	.853	95.906			
23	.201	.671	96.577			
24	.192	.642	97.218			
25	.181	.605	97.823			
26	.172	.573	98.396			
27	.167	.555	98.951			
28	.132	.441	99.392			
29	.101	.336	99.727			
30	.082	.273	100.000			

Table 6 Total variance explained for social items

Component	Initial Eigenvalues			Rotation Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	7.314	48.762	48.762	3.853	25.690	25.690
2	1.872	12.481	61.243	3.739	24.927	50.616
3	1.401	9.338	70.581	2.995	19.965	70.581
4	.997	6.644	77.225			
5	.600	3.998	81.223			
6	.490	3.269	84.491			
7	.448	2.988	87.479			
8	.368	2.453	89.932			
9	.311	2.072	92.004			
10	.305	2.031	94.035			
11	.232	1.550	95.585			
12	.205	1.367	96.951			
13	.171	1.140	98.091			
14	.153	1.022	99.113			
15	.133	.887	100.000			

Table 7 Total variance explained for economic items

Component	Initial Eigenvalues			Rotation Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	5.407	49.150	49.150	3.325	30.225	30.225
2	2.358	21.439	70.589	3.031	27.556	57.781
3	1.062	9.655	80.244	2.471	22.463	80.244
4	.502	4.561	84.805			
5	.408	3.706	88.511			
6	.361	3.283	91.794			
7	.336	3.054	94.848			
8	.223	2.026	96.874			
9	.135	1.224	98.099			
10	.108	.981	99.079			
11	.101	.921	100.000			

4.4 Interpretation

One of the crucial parts of the interpretation process is the decision on how many factors to keep as being meaningful or significant once the factors have been obtained from a correlation matrix. Normally, the numbers of variables that must load on a factor are at least two or three variables to be given a significant interpretation [41]. According to Russell, in order to identify a factor model, the minimum of three items per factor are required [45]. This was because more items within one factor consequences in over identification of the model. Numerous authors have suggested that to ensure a sufficient identification of the factors, at least four or more items on one factor should be integrated in the factor analysis [46][47][48].

The factors should be examined to designate which items are attributable to a factor. The factor will be named, or will be given a theme thereafter. The labelling of factors is a theoretical, subjective and inductive procedure. Henson and Roberts note "the meaningfulness of latent factors is eventually dependent on the researcher's definition" [49]. The purpose of systematic and comprehensive factor analyses is to segregate highest factor loadings items in the subsequent pattern matrices [41].

Factor loadings that are represented in the rotated component matrix are important for the clarification of the factors, particularly the higher ones. In order to determine on how high a factor loading for interpretation of the factor in an important technique may be referred to some guidelines. According to Igbaria, Livari and Maragahh, there are some guidelines regarding the factor loading of the item should be complied with [50].

- The item which loads more than 0.6 under one component (say component 1) and loads less than 0.35 on the other components should be gathered into component 1.
- The item which has a factor loading less than 0.6 under all components should be dropped from the analysis.
- The item with a factor loading of more than 0.6 under one component and also loading more than 0.35 in the other component, it should be released from further analysis due to a positive cross-loading.

The results of the factor extraction of the main construct of environment, social and economic are depicted in Table 8, Table 9 and Table 10.

Table 8 shows the factor loading for a total of 30 items (denote by EN1 to EN30) for environment construct. There are seven components that have been extracted namely component 1 to component 7.

In this study, the guidelines regarding the factor loading as highlighted by Igbaria, Livari and Maragahh has been applied. The item with higher factor loading (0.6) was grouped under the respective component [50]. For environment items, item EN16 to EN24 obtained factor loading higher than 0.6 and falls under component 1. Component 2 consists of four items including EN1, EN5, EN29 and EN30. Component 3 also obtained four items which are EN8, EN9, EN10 and EN11. EN2, EN7, EN8 and EN15 fall under component 4. Items EN12 and EN13 belongs under component 5. Items EN27 and EN28 fall under component 6 while EN25 and EN26 belongs to component7. Meanwhile, items EN3, EN4 and EN14 were excluded from the analysis since their factor loading is lower than 0.6 [50].

Table 8 The rotated component matrix for environment item

Environment items	Environment components						
	Component 1	Component 2	Component 3	Component 4	Component 5	Component 6	Component 7
EN1		0.765					
EN2				0.622			
EN3							
EN4							
EN5		0.686					
EN6				0.709			
EN7				0.662			
EN8			0.650				
EN9			0.793				
EN10			0.685				
EN11			0.639				
EN12					0.760		
EN13					0.825		
EN14							
EN15				0.611			
EN16	0.730						
EN17	0.814						
EN18	0.850						
EN19	0.782						
EN20	0.756						
EN21	0.687						
EN22	0.696						
EN23	0.696						
EN24	0.661						
EN25							0.610
EN26							0.686
EN27						0.741	
EN28						0.751	
EN29		0.668					
EN30		0.690					

Table 9 indicates the rotated component matrix for all 15 social items (represent by SC1 to SC2). Item SC5, SC7, SC8, SC9 and SC11 attained factor loading higher than 0.6 and falls under component 1. Component 2 consists of four items containing SC1 to SC4 while SC12 to SC15 belongs to component 3. Nevertheless, since the factor loading for items SC6 and SC10 is lower than 0.6, both items are excluded from the analysis.

Table 9 The rotated component matrix for social items

Social Items	Social Components		
	Component 1	Component 2	Component 3
SC1		0.799	
SC2		0.868	
SC3		0.819	
SC4		0.694	
SC5	0.732		
SC6			
SC7	0.616		
SC8	0.904		
SC9	0.722		
SC10			
SC11	0.834		
SC12			0.733
SC13			0.691
SC14			0.838
SC15			0.870

The rotated component matrix for economic items is shown in Table 10. A total of three components was extracted from a total of 11 economic items (denoted with EC1 to EC11). Items EC1 to EC4 belong to Component 1. Component 2 consists of EC5 to EC9 while components 3 generate two items which are EC10 and EC11. None of the economic items need to be dropped from the analysis since all items indicate the factor loading higher than 0.6.

Table 10 The rotated component matrix for economic items

Economic Items	Economic Components		
	Component 1	Component 2	Component 3
EC1	0.852		
EC2	0.873		
EC3	0.819		
EC4	0.759		
EC5		0.622	
EC6		0.750	
EC7		0.816	
EC8		0.861	
EC9		0.607	
EC10			0.937
EC11			0.947

4.5 Reliability Analysis Of The Measuring Items

The following step to be taken is to specify the reliability measure for the measuring items under every component [26][38]. The diagnostic measure for consistency of the entire scale was utilized using Cronbach's alpha. The generally lower limit accepted Cronbach's alpha value for a component to yield, reliability is 0.6 [26] [38]. This is to portray the measuring items under that certain components provide a reliable measure of internal consistency. In other words, Cronbach's alpha shows how consistent all the items combine each other under every component in EFA using the following formula:

Cronbach's α is: $$\alpha = \frac{N^2\overline{\text{Cov}}}{\sum s^2_{\text{item}} + \sum \text{Cov}_{\text{item}}}$$

Table 11 shows the values of Cronbanch's alpha for every item under each component for main construct of environment, social and economic.

Table 11 Reliability Statistics for main construct of environment, social and economic

Construct	Component	Number of items in a component	Cronbach's Alpha
Environment	Component 1	9	0.941
	Component 2	4	0.824
	Component 3	4	0.844
	Component 4	4	0.797
	Component 5	2	0.717
	Component 6	2	0.701
	Component 7	2	0.685
Social	Component 1	5	0.881
	Component 2	4	0.891
	Component 3	4	0.883
Economic	Component 1	4	0.898
	Component 2	5	0.870
	Component 3	2	0.939

As shown Table 11, the value of Cronbach's alpha for all items under each component are all reliable with the value exceeding the minimum value of 0.6 as recommended by Nunnally [51].

5.0 CONCLUSION

Exploratory factor analysis is an intricate multivariate statistical technique involving many linear and sequential stages. Moreover, many choices and rules of thumb employ themselves to EFA emphasizing that a clear decision sequencing and protocols are vital in each EFA stage.

Following the process of survey development and validation, the objective of the paper is to provide an instrument, which would better capture the green factors and their attributes for commercial office building under the sustainability features namely environment, social and economic. Furthermore, it is expected that the step-by-step Exploratory Factor Analysis procedure will be valuable for researchers undertaking research requiring this statistical approach. Additional analysis of the stability of the survey's factor structure can be examined by Confirmatory Factor Analysis (CFA). The process of survey development and validation is extensive and requires thoroughness in data collection and data analysis thereafter. Nevertheless, it improves the quality and richness of the data collected.

Acknowledgement

We are thankful for the UTM scholarship to Author 1.

References

[1] Lorenz, D., Trück, S., & Lützkendorf, T. 2006. Addressing risk and uncertainty in property valuations: a viewpoint from Germany. *Journal of Property Investment & Finance*. 24(5): 400–433.
[2] Warren-Myers, G. 2013. Is the valuer the barrier to identifying the value of sustainability?. *Journal of Property Investment & Finance*. 31(4): 345–359.
[3] RICS. 2014. *RICS Valuation – Professional Standards January 2014*.
[4] Myers, G., Reed, R., & Robinson, J. 2007. The Relationship between Sustainability and the Value of Office Buildings, (January). 1–22
[5] Moran, K. 2010. *The Effect of Sustainability on Property Value*. Rinker School of Building Construction.
[6] Lützkendorf, T., & Lorenz, D. 2011. Capturing sustainability-related information for property valuation. *Building Research & Information*. 39(3): 256–273.
[7] Warren Myers, G. 2012. The value of sustainability in real estate: a review from a valuation perspective. *Journal of Property Investment & Finance*. 30(2): 115–144.
[8] Runde, T. P., & Thoyre, S. 2010. Integrating Sustainability and Green Building into the Appraisal Process, (1)
[9] Boyd, T. 2006. Evaluating The Impact Of Sustainability On Investment Property Performance Central Queensland University and Queensland University of. *Journal of Property Research*. 12(3): 254–271.
[10] MD Darus, Z., & Hashim, N. A. 2012. Sustainable Building in Malaysia : The Development of Sustainable Building Rating System. In Sustainable Development - Education, Business and Management - Architecture and Building Construction - Agriculture and Food Security.
[11] Babawale, G. K., & Oyalowo, B. A. 2011. Incorporating Sustainability into Real Estate Valuation: the Perception of Nigerian Valuers. *Journal of Sustainable Development*. 4(4): 236–249
[12] Lützkendorf, T., & Lorenz, D. 2011. Capturing sustainability-related information for property valuation. *Building Research & Information*. 39(3): 256–273
[13] Warren, C., & Myers, G. W. 2009. Valuation and Sustainability are Rating Tools Enough? European Real Estate Society Conference Stockholm, Sweden 24-27. *In European Real Estate Society Conference Stockholm*, Sweden 24-27th June 2009 Dr . 1–16. Stockholm, Sweden.
[14] Samari, M., Ghodrati, N., Esmaeilifar, R., Olfat, P., & Mohd Shafiei, M. W. 2013. The Investigation of the Barriers in Developing Green Building in Malaysia. *Modern Applied Science*. 7(2): 1–10.

[15] Creswell, J. W. 2013. *Research Design - Qualitative, Quantitative and Mixed Methods Approaches* (Third Edit.). United States of America: Sage Publication Ltd
[16] Burns N, Grove SK. 1993. *The Practice Of Nursing Research Conduct,Critique, And Utilization*. 2nd ed. Philadelphia: WB Saunders Company.
[17] Carmines, E. G.,&Zeller,R. A. 1979. *Reliability And Validity Assessment*. Beverly Hills, CA: Sage.
[18] Waltz, C.F., Strickland, O.,&Lenz, E. 1991. *Measurement In Nursing Research* (2nd ed.). Phil- adelphia: F. A. Davis.
[19] Slaper, T. F., & Hall, T. J. 2011. The Triple Bottom Line : What Is It and How Does It Work? *The Indiana Business Review*. *86*(1): 4–8.
[20] Yaghmaie, F. 2003. Content Validity and its Estimation. *Journal of Medical Education.* 3(1): 25–27.
[21] Lynn, M. R. 1986. Determination and quantification of content validity. *Nursing Research*. 35: 382-385.
[22] Waltz, C. F., & Bausell, R. B. 1981. Nursing research: Design, statistics, and computer analysis. Philadel- phia: F. A. Davis.
[23] Polit, D. F., & Beck, C. T. 2006. The content validity index: are you sure you know what's being reported? Critique and recommendations. *Research in Nursing & Health*. *29*(5): 489–97.
[24] Waltz, C.,&Bausell, R. B. 1983. *Nursing Research: Design, Statistics, And Computer Analysis*. Philadelphia: F. A. Davis.
[25] Waltz, C.F., Strickland, O.,&Lenz, E. 1991. *Measurement In Nursing Research* (2nd ed.). Phil- adelphia: F. A. Davis.
[26] Zainudin, A. 2012. *Research Methodology and Data Analysis* (2nd ed). UiTM Press, Selangor.
[27] Blaikie, N. 2003. *Analyzing Quantitative Data, From Description to Explaination*. *SAGE Publications Ltd*. London.
[28] Hair, J. F., Hult, G. T. M., Ringle, C. M., & Sarstedt, M. 2014. *PARTIAL LEAST SQUARES STRUCTURAL EQUATION MODELING (PLS-SEM)*. United States of America: SAGE Publications, Inc.
[29] Tabachnick, B. G., Fidell, L. S., & Osterlind, S. J. 2001. Using multivariate statistics.
[30] Hair, J. F., Black, W. C., Babin, B. J., & Anderson, R. E. 2010. *Multivariate Data Analysis* (7th Edition) (7th Editio.). Englewood Cliffs, NJ: Pearson Prentice Hall.
[31] MacCallum, R. C., & Widaman, K. F. 1999. Sample Size in Factor Analysis. *Psychological Methods*.
[32] Guadagnoli, E., & Velicer, W. F. 1988. Relation of sample size to the stability of component patterns. *Psychological Bulletin*. 103(2): 265–275.
[33] Sapnas KG, Zeller RA. 2002. Minimizing sample size when using exploratory factor analysis for measurement. *Journal of Nursing Measurement*. 10(2): 135-53.
[34] GBI, 2013. Website: http://www.greenbuildingindex.org/organisation-certified-buildings-NRNC-01.html retrieved on 16 April 2015.
[35] Darlington, R. B. 2004. Factor Analysis. Website: http://comp9.psych.cornell.edu/Darlington/factor.htm access on 18 April 2015.
[36] Rietveld, T. & Van Hout, R. 1993. Statistical Techniques for the Study of Language and Language Behaviour. Berlin – New York: Mouton de Gruyter.
[37] Habing, B. 2003. Exploratory Factor Analysis. Website: http://www.stat.sc.edu/~habing/courses/530EFA.pdf access on 18 April 2015.
[38] Field, A. 2005. *Discovering Statistics Using SPSS*. *Ism Introducing Statistical Methods* (Vol. 2nd).
[39] Malhotra, N. K. 1996. Marketing Research: An Applied Orientation. Second edition. USA: Prentice-Hall
[40] Kline. P. 1994. An Easy Guide to Factor Analysis. London: Routledge
[41] Williams, B., Brown, T., & Onsman, A. 2012. Exploratory factor analysis : A five-step guide for novices. *Journal of Emergency Primary Health Care (JEPHC)*. *8*(3): 1–13.
[42] Gaskin, J. 2012. Exploratory Factor Analysis. *Gaskination's StatWiki*. 1904(Darlington): 1–15.
[43] Thompson B. 2004. Exploratory and confirmatory factor analysis: understanding concepts and applications. Washington, DC: American Psychological Association.
[44] Pett MA, Lackey NR, Sullivan JJ. 2000. *Making Sense Of Factor Analysis: The Use Of Factor Analysis For Instrument Development In Health Care Research*. California: Sage Publications Inc.
[45] Russell, D. W. 2002. In Search of Underlying Dimensions: The Use (and Abuse) of Factor Analysis in Personality and Social Psychology Bulletin. *Personality and Social Psychology Bulletin*. 28: 1629–1646.
[46] Comrey, A. L., & Lee, H. B. 1992. *A First Course In Factor Analysis* (2nd ed.). Hillsdale, NJ: Lawrence Erlbaum.
[47] Fabrigar, L. R., Fabrigar, L. R., Wegener, D. T., Wegener, D. T., MacCallum, R. C., MacCallum, R. C., Strahan, E. J. 1999. Evaluating the use of exploratory factor analysis in psychological research. *Psychological Methods*. 4(3): 272–299.
[48] Gorsuch, R. L. 1988. Exploratory factor analysis. In J. R.
[49] Henson, R. K., & Roberts, J. K. 2006. Use of Exploratory Factor Analysis in Published Research: Common Errors and Some Comment on Improved Practice. *Educational and Psychological Measurement*. 66(3): 393–416.
[50] Igbaria, M., Iivari, J. and Maragahh, H. 1995. Why do individuals use computer technology? A Finnish case study. *Information and Management*. 5: 227-238.
[51] Nunnally, J. C. 1978. *Psychometric Theory*. 2nd edition. New York: McGraw-Hill.