Investigating the Application of CFA in the Liveability Assessment of Public Low-income Housing in Nigeria

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Abstract

Studies on the liveability of Nations/Cities or neighbourhoods have been on the increase due to their perceived aftermath significant contributions to the quality of life. In this study, the liveability dimensions and attributes were developed based on the previous studies and experts opinions to assess the level of living conditions in the public low-income housing estates in Minna, Niger State, Nigeria. The focus of this paper is to explore the liveability dimensions and attributes reliability and to validates its usefulness in determining the liveability of the selected housing estates. It is presumed that not all identified liveability dimensions and attributes variables in the extant literature will be effective in measuring liveability in a cultural context like Nigeria. The data used for this study came from survey questionnaire administered to the residents of the selected three housing estates. Prior to the confirmatory factor analysis (CFA), the Cronbach's Alpha result obtained supported four-factor constructs. The variance explained as obtained from exploratory factor analysis (EFA) was good (67%). The CFA conducted led to the construction of an 18 items measurement. This paper contributed to the empirical study of liveability of housing/residential estates in terms of establishing the reliability and validity of the measurement constructs. Hence, it suggests that CFA analysis even with four-factor constructs can be used in future researches.

Keywords: Factor analysis, Liveability, dimensions and attributes, Low-income, housing estate.

Introduction

Liveability of cities or neighbourhoods has continued to attract more attention all over the world. Liveability as a planning concept is of interest to urban residents, researchers, policy makers, town planners, service providers and real estate developers. Liveability as a concept remains an umbrella to different themes of study such as neighbourhood quality (Omuta, 1988; Howley et al., 1999, Ekop, 2012), residential satisfaction (Ukoha and Beamish, 1997; Salleh, 2008; Mohit et al., 2010; Ibem and Aduwo), quality of life (Ghioca, 2011; Marans and Stimson, 2011; Azah et al., 2009; Mohit, 2013). However, liveability concept has also been linked with sustainability concept. It has been described as a subset of sustainability and that no aspect of liveability is contrary to sustainability plans or policies (Lowe et al., 2013). The extant literature shows that studies on the aforementioned areas have been conducted in different countries; such as Nigeria (Omuta, 1988; Ekop, 2012; Ibem and Aduwo, 2013), Malaysia (Salleh, 2008; Azah et al., 2009; Leby and Hashim, 2010; Mohit, 2013), Melbourne (Lowe et al., 2013), India (Pandey et al., 2014), Turkey (Sam et al., 2012) and Australia (Samaratunga, 2013). These studies revealed many dimensions and indicators/attributes of measuring or achieving a particular focus. For instance, neighbourhood liveability study by Omuta (1988) revealed five dimensions (Employment, Education, Housing, Amenities, Nuisance and Socio-economic). Another study of social housing by Heylen (2006) operationalized liveability to include; housing/dwelling quality, physical environment quality, quality of social environment and safety of the neighbourhood. Residential satisfaction by Djebarni and Al-Abed (2000) examined the level of privacy, distance to work, location of schools and shops. Evidence from these studies showed that there is no general pattern in the literature in studying neighbourhood quality, residential satisfaction and liveability. The usual practice is to identify the dimensions/indicators from previous studies and further imposed

item(s) for the current study. However, the identified indicators may not be measuring the constructs designed to measure. There is also a paucity of empirical studies on the factorial validity of liveability dimensions and attributes/indicators in the context of public low-income housing estates in Nigeria. It is against this background; this study focused on the psychometric properties of the liveability dimensions and attributes for assessing the level of satisfaction of the residents of public low-income housing estates in Nigeria. Therefore, this study is guided by the following research questions;

A. How reliable and valid are the identified measurement structure of liveability?
B. To what extent are these dimensions and attributes explained the liveability of public low-income housing estates selected?
C. Does the hypothesized model of liveability assessment have a good fit?

The concept of liveability; definitions, dimensions and attributes

The term "Liveability" has emerged as a philosophy for proactive planning/management of the built environment. It has been described to function as a container in which almost everything fits: sustainability, quality of life and well-being. As a result, a number of definitions of liveability exist (Van de Heuvel, 2013). Similar to other concepts such as the quality of life, well-being, sustainability, housing quality, residential satisfaction, and the boundary of liveability concept is dependent on the researcher's focus. For instance, liveability is referred to as a city with good planning that provides a vibrant, attractive and secure environment for the people to live their life, work and play. It is a city with good governance, competitive economy, high quality of life and environmentally sustainable (Center for liveable cities Singapore, 2011). The Economic Intelligent Unit (EIU, 2012) perceived liveability as an assessment of which location(s) around the world provide the best or worst living conditions. Furthermore, Mercer Quality of Life Survey (2011) like its counterpart EIU operationalized the dimensions of liveability to includes; political and social environment, economic environment, socio-cultural environment, health and sanitation, schools and education, public services and transportation, recreational facilities, consumer goods, housing and natural environment. However, on a micro level liveability assessments of residential or living environment have been on the increase in different part of the world. From the literature, it is evident that there are divergent of dimensions and several indicators depending on the focus of the study. A summary of the identified few studies are shown in the table 1 below;

Table 1: Liveability Dimensions as found in empirical studies

Authors	Liveability dimensions	Methods of evaluation	Focus
Omuta (1988)	Employment, Housing, Amenity, Education, Nuisance and Socio-economic	Descriptive statistics	Study on quality of urban life and liveability

Balsas (2004)	Safe, Clean, Beautiful, Economically vital, Affordable to diverse population, Efficiently administered, Functional infrastructure, Ample parks, Effect public transportation, Interesting cultural activities and Sense of community	Exploratory	The study explored urban center liveability
Chaudhury (2005)	Consumer goods, Utility services, Housing affordability, Social security and Environmental conditions	Exploratory	Comparative study on City liveability in Bangladesh
Heylen (2006)	Dwelling unit, Physical environment, Social environment and Safety	Exploratory; interview	Social housing liveability
Betanzo (2009)	Connectivity, Accessibility, Mixed use and Density	Descriptive statistics	Exploring city density liveability relationships
Leby and Hashim (2010)	Social, Physical, Functional and Safety dimensions	Descriptive statistics /Cronbach Alpha	Neighbourhood liveability study in Malaysia
Song (2011)	Ecological environment, Public resources, Economic development	Structural equation modelling (SEM)	City liveability
Asiyanbola *et al.* (2012)	Neighbourhood facilities; Road quality, Garbage collection, Public transport, State of cleanliness, Street light, State of security, Crime level, Pollution, Water supply, Interpersonal relationship, School quality, Shops, Drainage system, Power supply and General condition	Descriptive statistics/ inferential statistics	Comparative study of two neighbourhoods liveability in Ogun state, Nigeria
Namazi-Rad *et al.* (2012)	Home, Neighbourhood, Services, Entertainment, Work & Education, and Transport	Descriptive statistics and ANOVA	Experimental determination of perceived liveability
Li (2012)	Dwelling unit, Dwelling building, Housing estate, Urban neighbourhood	Descriptives & Linear regression	High Rise Housing Estates

Yanmei (2012)	Infrastructure and physical attributes, Demographics, Business accessibility, Public services, Neighbourhood housing	Descrptives & Regression analysis	Neighbourhood liveability
Buys et al. (2013)	Individual dwelling unit, Building complex domain, Community domain	Qualitative approach	Inner core city liveability
Saitluanga (2013)	Objective dimensions Economic, Social, Household, Accessibility. Subjective dimensions Socio-economic environment, Physical & infrastructural environment	Principal component analysis	Spatial pattern of urban environment
Lawanson *et al.* (2013)	City governance, Safety & Security, Cultural identity & Global relevance, Environmental indices and infrastructure	Simple descriptives and Chisquare	African City liveability conceptualization
Pandey *et al.* (2014)	Social interaction, infrastructure, public services, cultural environment, shops, housing options, good connectivity, natural environment, safety, education, healthcare, recreation, cleanliness	Descriptive statistics	City liveability

However, the extant empirical studies as articulated in the table above revealed various approaches used in those studies including evaluation methods employed. A diagnostic of their evaluation methods showed a paucity of psychometric properties of the measurement items or indicators. Following the establishment of the liveability dimensions and attributes, this study, therefore examines the measurement model of liveability assessment of public low-income housing estates focusing on five underlying dimensions and measurement scale. The five measurement constructs to be confirmed include; housing unit characteristics, neighbourhood facilities, economic vitality, safety environment and social interaction.

Research Method

Research Process

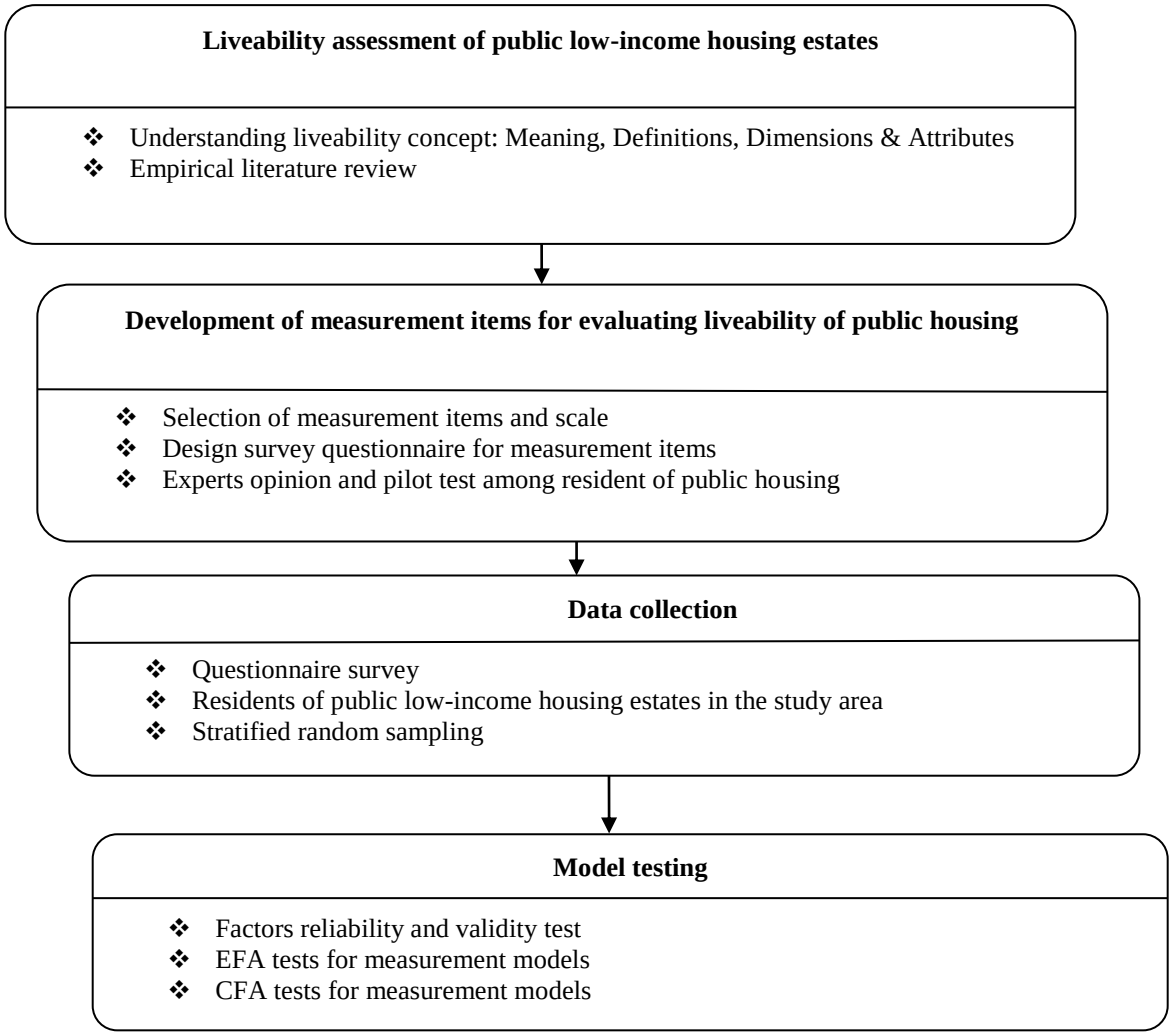

Figure 1: Research flow-chart

Sequel to the literature reviewed and the conceptualization of the liveability dimensions and attributes as mentioned earlier to include; housing unit characteristics, neighbourhood facilities, economic vitality, safety environment and social interaction. We operationalized the construct by developing a multi-item 5 point Likert scale (Mohit and Hannan, 2012; Marques *et al.*, 2015) to evaluate the different dimensions of liveability of public low-income housing. The survey questionnaire developed was based on various literature searches as summarized in Table 1, and this was subjected to pilot test of a smaller group of respondents in a housing estate outside the three selected housing estates for this study. Also, few selected expert opinions were sought, and all the feedbacks from the pilot test helped to improve the final version of the questionnaire.

Development of measurement items

As earlier stated, the liveability items were extracted from previous studies such as enunciated in Table 1 and coupled with the experts' opinions. We generated forty items measurement (see Table 2). The expert opinions ensured content and face validity of the measurement items (Zhu et al., 2008). The questionnaire items measurement was based on 5-piont Likert scale (Marques *et al.,* 2015; Mohit and Hannan, 2012). The questionnaire instrument had six sections; the first section was on socio-economic characteristics of the respondents. The other five sections focused on the dimensions of liveability that includes economic vitality, housing unit characteristics, social environment, neighbourhood facilities and safety environment.

Table 2: Dimensions and attributes generated from review

Housing Unit Characteristics	**Neighbourhood Facilities**	**Safety Environment**	**Economic Vitality**	**Social Interaction**
House size **(HE1)**	Children education **(NF1)**	Crime safety **(SE1)**	Total monthly income **(EV1)**	Communication with neighbours **(SI1)**
Living area size **(HE2)**	Heath care centers **(NF2)**	Accident safety **(SE2)**	Daily cost of transportation **(EV2)**	Voluntary association **(SI2)**
Dining size **(HE3)**	Shopping centers **(NF3)**	Property safety **(SE3)**	Effect of loan on income **(EV3)**	Comm. Activity participation **(SI3)**
Bedroom size **(HE4)**	Garbage collection **(NF4)**	Police protection **(SE4)**	Effect of rent on income **(EV4)**	
Kitchen size **(HE5)**	Water supply **(NF5)**	Fire-fighter service **(SE5)**	Access to public transport **(EV5)**	
No of bathroom **(HE6)**	Open/Green space **(NF6)**	Vigilante services **(SE6)**	Standard of living **(EV6)**	
No of toilets **(HE7)**	Electricity supply **(NF7)**	Street lights **(SE7)**		
House Ventilation **(HE8)**	Nature of roads **(NF8)**			
Affordability **(HE9)**	Public transport **(NF9)**			
Parking lot **(HE10)**	Drainage system **(NF10)**			
Road network **(HE11)**	Community hall **(NF11)**			
Estate cleanliness **(HE12)**				
House condition **(HE13)**				

Data collection

A reconnaissance survey of the study area was carried out using a questionnaire developed to elicit information from the residents of three selected public low-income housing estates in Minna, Niger State, namely; M.I. Wushishi estate, Bosso estate and Tunga low-cost. The conduct of household surveys was based on stratified random sampling purposely to select various homes in the three public low-income housing estates selected. A total of 400 housing units were surveyed out of 1000 housing units in three different locations (Krejcie & Morgan, 1970). However, 366 respondents (household heads) returned their questionnaires which represents 91.5% response and used for the analysis.

Data Analysis

The analysis of data collected from the survey was done with SPSS software version 22. The descriptive statistics gave the socio-economic characteristics of the respondents. Secondly, the reliability of the measurement items was obtained from Cronbach's Alpha (Pallant, 2007; Creswell, 2011). After that, exploratory factor analysis was conducted to establish the constructs and to deal with multicollinearity issues that would have arisen due to inter-correlation of the indicators used in measuring the liveability of the survey areas. Also, the confirmatory factor analysis of four-factor constructs of liveability was analyzed with the statistical package for the social science (SPSS version 22) and Analysis of Moment Structure (AMOS version 22) software. To appraise the goodness-of -fit of the hypothesized model, the conventional criteria as found in the literature were considered. For instance, Root *Mean Square of Approximation* (RMSEA) value > 0.05 indicates good fit (Marques *et al*, 2015) and other consensuses put it as < 0.1 (Yuet *et al*., 2014). The *Comparative Fit Index* (CFI) cut off > 0.9 (Navabakhsh and Motlaq, 2009) and that above 0.95 is preferable (Richard, 2007).

Results and Discussions

Participants profile

The descriptive statistical output revealed that 79% of the participants are males, and 21% are females. Their average age stood at 43years, and about 94% attended tertiary institution. 85% were married, and average household size is seven. Over two-third were gainfully employed and the majority 63% monthly income shows N100, 000.00. On the length of stay, 73% indicates less than ten years. The above profile has shown the participants in the survey could be said to have enough knowledge of their neighbourhood environment, and therefore, the data emanated from them could be regarded as reliable.

Test of reliability of measurement items

The liveability dimensions and attributes used in this study as depicts in Table 2 were found to have reliable Cronbach's alpha reading above 0.7, although the initial results showed that the 7items of safety environment recorded 0.5 values as against 0.7 benchmark (Pallant, 2007) . However, Pallant (ibid) suggested removal of item(s) perceived not measuring the factor, or to recode items seems to be negatively worded. Thus, following the scrutiny of the items of safety environment only three items was retained based on Cronbach's Alpha 0.916. On the other hand, the dimension "social interaction" violates the model reliability assumption having recorded negative values, and this dimension was removed from the initially hypothesized model. The exact alpha values for each of the variables are as shown in Table 3 below;

Table 3: Cronbach's Alpha

	Housing Unit Characteristics	**Neighbourhood Facilities**	**Safety Environment**	**Economic Vitality**	**Social Interaction**
No of items	13	11	7	6	3
No of items deleted	None	None	4	None	All
Cronbach's Alpha	0.932	0.715	0.916	0.866	-0.947

Uni-dimensionality test (EFA)

The existence of one construct underlying a set of items is known as uni-dimensionality (Hoe, 2008). The use of principal components analysis with varimax rotation to determine the eigenvalue was found useful as many other studies suggested (Hoe, 2008; Song, 2011; Eugienie *et al*., 2014). The rule of thumbs suggests that eigenvalues > 1 provide support for the uni-dimensionality of the scales. Analysis of the data in this study shows absence of singularity of item(s), highly correlated items were excluded and the data was free of multicollinearity problem such that all correlations were < 0.9 (Eugienie *et al*., 2014). The Kaiser-Meyer-Okin (KMO) and Bartlett's Test for adequacy of sample size for factor analysis was achieved as the value of 0.917 was obtained for KMO as against 0.05 minimum criterion. Also, a Bartlett's significant value of 0.000 was obtained which satisfied the criterion of value < 0.05. For the communaities, items with < 0.5 were suppressed. Thus, four-factor were set to be extracted, and the result indicates based on eigenvalues of 1, total cumulative variance explained revealed 66.868% (see Table 4).

Table 4: Four-factor total variance explained

Total Variance Explained									
	Initial Eigenvalues			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings		
Component	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	10.229	42.622	42.622	10.229	42.622	42.622	5.716	23.816	23.816
2	2.711	11.296	53.918	2.711	11.296	53.918	4.364	18.183	41.999
3	1.756	7.315	61.233	1.756	7.315	61.233	4.253	17.721	59.720
4	1.352	5.634	66.868	1.352	5.634	66.868	1.715	7.147	66.868
Extraction Method: Principal Component Analysis.									

Confirmation of measurement items (CFA)

Confirmatory factor analysis (CFA) serves as a mechanism to assess or observe how well the measurement items reflect their respective latent variable in the hypothesized model (Zhu *et al.*, 2008). From the extant literature various goodness of model fit exists, for instance; p-value should be > 0.05 (Field, 2009) and where p-value criteria not met, another criterion must be satisfied. This includes- RMSEA value should not exceed 0.1 (Yuet et al., 2014; Marques et al., 2015), while CFI value should be greater than 0.9

(Richard, 2007; Navabakhsh and Motlaq, 2009). Given the above background, the result of the 24 measurement items (model 1) extracted from the EFA shows a poor model fit (see Table 5). In this case, opinions from the literature suggest a modification to the model until a 'fit' is achieved (Adul Malek *et al*., 2009; Marques *et al.*, 2015). Moreover, Yuet *et al.* (2014) opined that factor weight of 0.5 is tolerable but above is more preferable. Based on this suggestion, initially hypothesized model was modified by excluding items with factor weights < 0.6 from the model. Consequently, the modified model (model 2) was found to have the goodness of fit (see Table 5).

Table 5: Goodness of fit indices for the hypothesized models-liveability assessment of public low-income housing (n=366)

	Chi-square	P-value	Normed chi-square	CFI	RMSEA
Model 1	1726.531	0.000	7.018	0.764	0.128
Model 2	570.892	0.000	4.426	0.907	0.097

Note: *CFI= Comparative Fit Index; RMSEA= Root Mean Square of Approximation*.

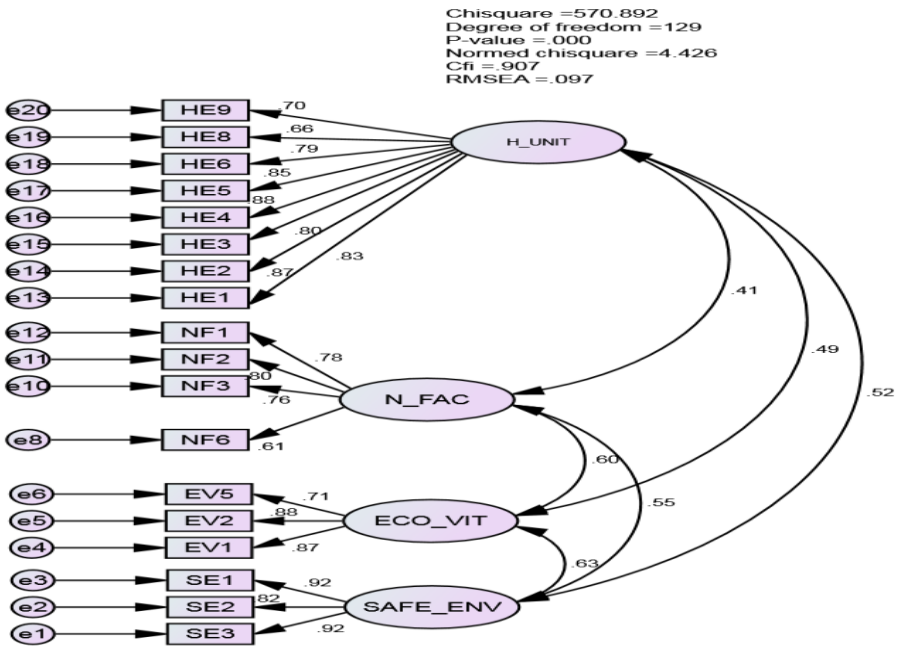

Figure 1: Model 2 for the liveability assessment of public low-income housing estates

Conclusion and Recommendation

The study examined the liveability assessment of public low-income housing estates of Niger State, Nigeria. From the data analysis, four-factor of liveability dimensions and attributes satisfied both internal reliabilities and constructs validity (Table 3). Also, finding showed that the four-factors extracted with an Eigenvalues of 1 explained 67% variance of liveability dimensions of public low-income housing estates investigated, this could be said to be substantial (Table 4). On the other hand, the CFA results of the hypothesized models revealed that a four-factor model with eighteen indicators (model 2) provides an adequate fit to the data. Hence, the empirical results show that all the eighteen

items/indicators are critical in evaluating liveability of public low-income housing and, therefore, validate the theoretical model (Fig. 1). The measurement items used in this study have raised our understanding of liveability assessment of public low-income housing and the measurement items validated in this study should serve as a starting point for future research. Admittedly, this study is limited somewhat for instance; 67% variance explained shows that there are other important variables not identified. Despite this limitation, the study was able to improve our understanding of public low-income housing liveability in Nigeria thus provide opportunities for further investigation in this direction. The continuous use and refinement of the measurement items/constructs developed in this study will lead to valid and reliable measurement items. Therefore, CFA applications have potentials in the liveability assessment of public low-income housing.

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