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SCHOOL OF ENVIRONMENTAL TECHNOLOGY INTERNATIONAL CONFERENCE (SETIC) 2018

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Proceedings

CONTEMPORARY ISSUES AND SUSTAINABLE PRACTICES IN THE BUILT ENVIRONMENT

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Conference Proceedings of the School of Environmental Technology International Conference (SETIC) 2018

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FOREWORD

The organising committee of the 2nd School of Environmental Technology International Conference is pleased to welcome you to Federal University of Technology Minna, Niger State Nigeria.

The conference provides an international forum for researchers and professionals in the built and allied professions to address fundamental problems, challenges and prospects that affect the Built Environment as it relates to Contemporary Issues and Sustainable Practices in the Built Environment. The conference is a platform where recognised best practices, theories and concepts are shared and discussed amongst academics, practitioners and researchers. The scope and papers are quite broad but have been organised around the sub-themes listed below:

- Architectural Education and ICT
- Building Information Modeling
- Construction Ethics
- Energy efficiency and Conservation
- Environmental Conservation
- Facility Management
- Green Construction and Efficiency
- Health and Safety Issues
- Information Technology and Building Maintenance
- Information Technology and Construction
- Information Technology and Design
- Innovative Infrastructure Development
- Resilient Housing Development
- Smart Cities Development

- Social Integration in Cities
- Sustainable Building Materials Development
- Sustainable City Growth
- Sustainable Cost Management
- Sustainable Property Taxation
- Sustainable Architectural Design
- Sustainable Urban Transportation Systems
- Theory and Practices for Cost Effectiveness in Construction Industry
- Urban Ecology Management
- Urban Land Access
- Disasters, Resilient Cities and Business Continuity

We hope you enjoy your time at our conference, and that you have the opportunities to exchange ideas and share knowledge, as well as participate in productive discussions with the like-minded researchers and practitioners in the built environment and academia.

Local Organising Committee
School of Environmental Technology International Conference (SETIC) 2018
APRIL 2018

ACKNOWLEDGEMENTS

We have tried to build on the success of the maiden of SETIC held in 2016 which came with good feedbacks and memories. The success of the 2nd School of Environmental Technology International Conference holding at the Main Campus of the Federal University of Technology Minna, Nigeria is predicated on the support and goodwill from Vice-Chancellor of Federal University of Technology, Dean School of Environmental Technology and many other highly motivated people.

I sincerely wish to appreciate you for attending this Second edition of SETIC and to warmly welcome you to the city of Minna the capital of the *POWER STATE.* It is a great honour to have you in the beautiful campus of Federal University of Technology Minna, Nigeria. I am aware of the great sacrifices made by many of you to be present in this occasion and I will definitely not overlook the long distances some of you have had to cover to get to the conference venue. We genuinely appreciate all your efforts. It is our singular hope and desire that this 2nd edition of the conference (SETIC 2018) meets your expectations and gives you unquantifiable experience and tremendous developmental networking opportunities for a life fulfilling career.

We are grateful for the presence of the Vice Chancellor of the Federal University of Technology Minna Professor Abdullahi Bala whose leadership and distinguished academic career has served as inspiration and encouragement to many academics within and outside Nigeria. His desire to continue on the path of greatness for this Humble University of ours has seen the University become a destination for International conferences, Public lectures, Book Development, Presentations and Seminars that meet International standards. We are happy to have you as the Chief host to declare the conference open and deliver the welcome address.

We are grateful to the former Dean of School of Environmental Technology, Federal University of Technology Prof A.M. Junaid and the Ag. Dean of School of Environmental Technology Prof. S.N. Zubairu for providing the healthy platform, academic backing, management and guidance for the organisation of the conference. You increased the level of challenge from 2016 and provided the required resources, direction, energy and strategies for achieving its success, it is a great honour of having the opportunity to work closely with you and learning never to give up.

I wish to thank also all the special guests particularly leaders of the Industry, Built Environment and Academia.

A special thanks goes to the Bursar of Federal University of Technology, Mrs. Hajara Kuso for the timely responses to all our requests regarding the financial aspects of access to funds for the conference.

SETIC is beginning at the foundation this year and for this I wish to thank all those who have supported us through various forms of participation. Specifically I wish to thank the delegates and the partners for contributing significantly to the conferences. I wish to thank Prof. S.N. Zubairu Prof. A.M. Junaid, Prof. O. O. Morenikeji and Prof. Y.A Sanusi, who all genuinely and consistently monitored the progress of the conference preparations. My desire in 2016 was for SETIC to become a constant feature in the calendar of the University and global conference listings, am a happy person today seeing this desire fulfilled with the SETIC 2018 edition.

Delegates to SETIC 2018 are from different academic and research institutions that are spread across different countries. This offers participants a wonderful opportunity for exchange of cultural, social and academic ideas during the conference periods. It is also an opportunity to create awareness about programmes and events at the participants' individual institutions. I encourage you all to make good use of the networking opportunities that are available.

In this 2nd edition we received 258 abstract submissions because we had a wide distribution outlet as compared to the 1st edition which is an indication of growth. Using a rapid review system we accepted a total of 209 abstracts and the authors were communicated on what issues they were to examine while developing the full papers based on their titles and aim of the paper. Two hundred (200) full papers were received and reviewed. We sent back the reviewed papers and reviewers comments forms to each of the prospective authors to assist

in the preparation of the revised papers. It was after this rigorous and time consuming process that we were able to accept 172 papers for presentation at the conference. It gives me great joy therefore to congratulate all the authors whose papers made it to the conference. It is my sincere believe that the presentation of the different ideas in your paper would go a long way in improving the knowledge of the participants and also generate meaningful discussions over the tea beaks, lunch and beyond.

I wish to express my utmost gratitude to each of the Seventy-three (73) reviewers for a wonderful job done well and for tolerating our deadlines and Oliver Twist syndrome. It is your dedication and expertise that has ensured that the conference is a success.

Special thanks to all our keynote speakers, Arc. Umaru Aliyu, (ficiArb, fnia, ppnia) (*President, Architects Registration Council of Nigeria (ARCON)*, Prof. Stella N. Zubairu (*Former Dean Postgraduate School, Federal University of Technology Minna*), Dr. Julius A. Fapohunda, (*Editor-in-Chief: International Journal of Sustainable Energy Development & Leader: Sustainable Building and Urban Growth Research Unit, Cape Peninsula University of Technology*).
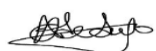
It is important to appreciate the roles and efforts of the following people for their selfless and very significant contributions made towards the successful organization of the conference: Oyetola Stephen, Alonge Olubunmi, Lynda Odine, Adedokun John, Idowu Oqua, Bamidele Eunice and Muhina Lami (for being available to run around at very short notice),

The organisation of this conference would not have been this easy without dedicated individuals offering to serve. My heartfelt gratitude goes to Dr. Taibat Lawanson, Dr. R.A. Jimoh, Dr. L.O. Oyewobi, Dr. N.I. Popoola, Dr. Lekan Sanni, Dr. I.B. Muhammad, Dr. A.A. Shittu and Dr. A. Saka for their unflinching support all through the process.

It is our sincere hope that this conference will serve as a forum for the advancement of research in the urban sphere towards achieving a sustainable environment. It is our sincere believe that academics and professionals in practices will continually participate in this forum.

Worthy thanks goes to the members of the Local Organising Committee for the tireless effort. The success of the conference goes to these wonderful people. You have made SETIC 2018 to ROCK.

Once again I wish to thank you all for creating time out of your busy schedule to attend this conference. Please do enjoy your stay at Federal University of Technology Minna, and the city as a whole. Ensure that you make use of the different fora created throughout the conference to build new relationships for the future and strengthen existing relationships. I look forward to seeing you all in future.

Olatunde Folaranmi ADEDAYO
SETIC 2018 LOC Chairperson
APRIL 2018

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DECLARATION

PEER REVIEW AND SCIENTIFIC PUBLISHING POLICY STATEMENT

10th APRIL 2018

TO WHOM IT APRIL CONCERN

I wish to state that all the papers published in SETIC 2018 Conference Proceedings have passed through the peer review process which involved an initial review of abstracts, blind review of full papers by minimum of two referees, forwarding of reviewers' comments to authors, submission of revised papers by authors and subsequent evaluation of submitted papers by the Scientific Committee to determine content quality.

It is the policy of the School of Environmental Technology International Conference (SETIC) that for papers to be accepted for inclusion in the conference proceedings it must have undergone the blind review process and passed the academic integrity test. All papers are only published based on the recommendation of the reviewers and the Scientific Committee of SETIC

Names and individual affiliation of members of Review and Scientific Committee for SETIC Conference 2018 are published in the SETIC 2018 Conference Proceedings and made available on www.futminna.edu.ng

Olatunde Folaranmi ADEDAYO
Chairman SETIC 2018
Federal University of Technology, Minna, Nigeria

Papers in the SETIC 2018 Conference Proceedings are published on www.futminna.edu.ng.

EXPLORING FACTORS THAT CONTRIBUTES TO RESIDENTIAL ENVIRONMENT LIVEABILITY IN MINNA, NIGER STATE

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Creating a liveable residential environment has been given prominence globally, and of particular concern is the residents' and neighbourhood satisfaction relationship. The increasing reports of slum situation in many urban areas spur the greater concern about liveability of mass housing projects around the globe. This paper explored the factors that contribute to the residential environment liveability through grounded theory approach. Extant literature provides factors such as dwelling unit features, neighbourhood facilities, economic vitality and safety. Based on this, a questionnaire survey was developed to obtain views from the residents' of housing estates in Minna, Niger State of Nigeria. Residents' views collected consisted of seventeen indicators of liveability of their residential environment. Analyses of data for this study include regression analysis, ANOVA and relative importance index (RII). The analysis of variance (ANOVA) result showed that all the four factors with $F_{(4, 361)} = 92.442$, $p<0.05$ significantly predict the dependent variable liveability. The regression analysis result revealed neighbourhood facilities (34.8%) as the most significant predictor of the liveability of residential environment. The results appear to be relevant globally; however this study recommends an upgrading of neighbourhood facilities and other key factors of liveability in the study area by the relevant authorities.

Keywords: residential environment, liveability, grounded theory and regression analysis.

INTRODUCTION

One of the earliest studies to identify the key factors that contributed to residential environment liveability was by Sanoff and Sawhney (1972) in their study of the town of Asheboro, North Carolina which concerned with identifying and understanding the dwelling and neighbourhood dimension satisfaction of the low-income families housing. In particular, seventeen (17) and twenty (20) attributes of dwelling and neighbourhood were identified respectively. Subsequent to Sanoff and Sawhney's work, there has been a series of other studies (Omuta, 1988; Azahan et al., 2009; Betanzo, 2009; Abdulazeez et al., 2010; Ismail et al., 2015) concerning the liveability of residential environment both nationally and internationally. Evidently, these studies have been inhibited by a range of problems including wide range and type of data collected. Also is the large numbers of variables of possible relevance. Similarly, there is difficulty in defining the concept of liveability and this has created significant conceptual differences between researchers (Balsas, 2004; Heylen, 2006; Omuta, 1988). Noticeably is the lack of theoretical development in the literature (Van den Heuvel, 2013), however a handful of empirical studies exist that broadly involve a direct comparison of a composite measure of liveability over different geographic areas (Giap *et al.,* 2013). Some other studies have operationalized liveability dimensions and various indicators (Omuta, 1988: Balsas, 2004: Heylen, 2006). However, liveability as described by some authors such as Cutter (1985), Castellati (1997), Balsas (2004), Southworth (2007) sees to the geographical quality of a place as it is being experience and appraise by the inhabitants, and relative importance of each of these to the individual.

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This is best described as a place-based study which evaluates inhabitant's quality of life against the backdrop of living environment, this is generally enough based that all sections of the community can accept as a basis for subsequent decision-making (Myers, 1988). The place-based liveability study connects both objective and subjective data to present precise picture of the local quality of life problems. Therefore, liveability is related to the features of the place, which constitutes community's quality of life and the shared characteristics that are experienced by the residents in the place, which the residents subjectively evaluate. It is against this background, this study explores the key factors to the residential environment liveability through subjective evaluation by the residents' of housing estates in Minna, Niger State of Nigeria.

Objectives

(1) To find out the level of predictions of the identified liveability dimensions of the study area

(2) To identify and highlight empirically the relative importance of the indicators as perceived by the inhabitants of the study area

LITERATURE REVIEW

The extant literature on the liveability of residential environment revealed a complex issue and open for debate is the method of measurement and value system (Pacione, 2003). Conceptualizing liveability in the early 70's sought the work of Sanoff and Sawhney (1972) identifying and understanding the dwelling and neighbourhoods dimension attributes focusing on low-income family housing in North Carolina. Other empirical studies shows wide-ranging liveability dimensions (Omuta, 1988; Balsas, 2004; Heylen, 2006; Salleh, 2008; Ismail *et al.,* 2015; Ukoha and Beamish, 1997; Leby and Hashim, 2010; Asiyanbola *et al.,* 2012 and Lawanson *et al.,* 2013). However, liveability connotes an urban system that contributes to the physical and social well-being as well as personal development of all inhabitants (Song, 2011). Liveability concept has also been linked to the quality of life given the microeconomic activities a city offers its inhabitants (Bouffard *et al*., 2013; Chaudhury, 2005; Song, 2011). According to VanZerr and Seskin, (2011) *"liveability refers to a community service and amenities, whereas quality of life refers to how those amenities shape and benefit the human experience"*. Thus, researchers such as Litman (2011) and *Lowe et al.,* 2013) observed that liveability is within the scope of sustainability. For instance, urban amenity, mixed uses, safety and sense of place and workable streets are goals of liveability and sustainability (Howley, *et al.,* 2009). However, several authors have measured liveability in different climes and revealed is the numerous attributes measuring liveability which depends on the goals and value system of the assessor. Previous studies suggest common agreement on the aspects that contribute to liveability such as housing/dwelling unit features (Omuta, 1988; Heylen, 2006; Li, 2012 *et al*; Namazi-Rad *et al.,* 2012; Buys *et al*; 2013), physical/neighbourhood conditions (Balsas, 2004; Chaudhury, 2005; Heylen, 2006; Leby and Hashim, 2010; Asiyanbola *et al*., 2012), economic vitality or development (Balsas, 2004; Song, 2011; Saitluanga, 2013), safety (Leby and Hashim, 2010; Asiyanbola *et al*., 2012; Lawanson *et al*., 2013) and social interaction (Pandey *et al*., 2014; Leby and Hashim, 2010; Saitluanga, 2013). However, Buys *et al* (2013) opine that residential satisfaction studies connects liveability to specific features of home and building, this includes; dwelling age, size, structure and aesthetic feelings (Lu, 1999) as well as features of the broader neighbourhood, including access to facilities, noise, pollution, safety risks and social features (Howley, *et al.,* 2009). Liveability as an umbrella to many other concepts like quality of life (QoL), QoL is recognised and being conceptualize but difficult to define for everyone to comprehend (Balsas, 2004). However, QoL is widely well-defined as having three broad dimensions: social, economic and environmental well-being and may be measured using objective and subjective indicators (Marans and Stimson, 2011; McCrea *et al.,* 2012). Arguably, the three concepts of liveability, quality of life and sustainability geared towards achieving the same goal or goals. These terms are driving vision of the 21st century. For example, at different times City mayors adopted these terms as their policy focus to address various urban issues (such as in the case of Bogota). Addressing various urban issues, liveability focused more on particular location at a particular point in time, this subjectively translate to quality of life whereas the objective of sustainability is future generations (Buys *et al*.,2013). Undeniably, liveability, quality of life and sustainability concepts overlap as shown in Figure 1; this is the gap in the literature and filled in this study.
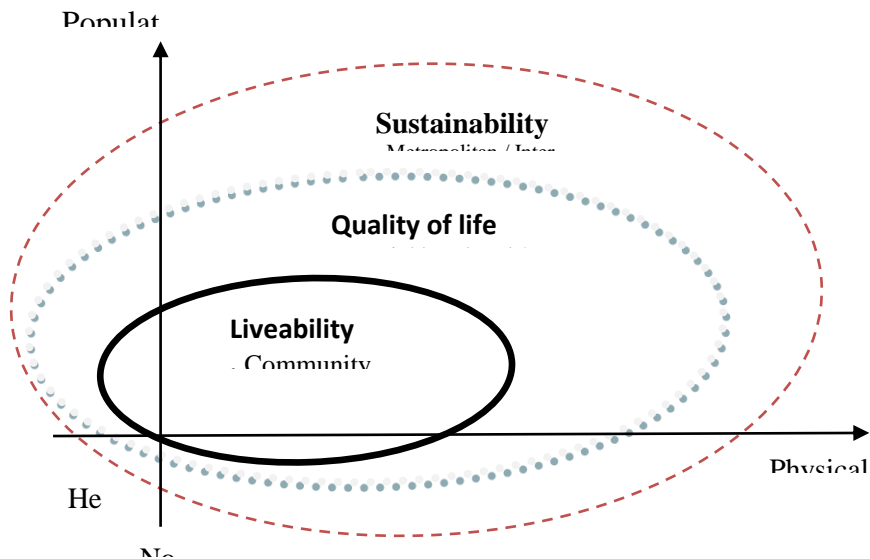
Figure 8: Liveability, Quality of life and Sustainability (Modified after Lowe *et al.,* 2013)

METHODOLOGY

This research is based on survey through which data was collected with the aid of questionnaire administration to the residents of the selected housing estates in Minna. The administration of the questionnaire was based on stratified random sampling; the elements of the strata were housing types- two bedrooms and three bedrooms. The selected housing estates include – Bosso Estate, M.I. Wushishi Estate and Tunga Low-Cost. The total housing units of the estates form the basis for sample size. Researchers use various ways to determine require sample size for their studies, for instance, Ifesanya (2012) sampled 215 houses out of 4,236 houses in the five selected communities of Ajegunle neighbourhood. However, Krejcie and Morgan (1970) sample size table shows that a total of 278 samples are require from a total population of 1000. Based on the aforementioned, a total sample of 400 housing units was selected out of the total housing units of 1000 (see Table 1). The distribution of the questionnaire was done by the researchers with the help of field assistants (see Table 1 for questionnaire distribution / sample size).

Table 1: Questionnaire distribution / Sample size

Housing Estates	Housing units	Number sampled	Received questionnaire	Non-received	Percentage (%)
Bosso Estate	250	125	115	10	92%
M.I.Wushishi	500	150	133	17	88.7%
Tunga Low-cost	250	125	118	7	94.4%
Total	1000	400	366	34	91.5%

Source: Field Survey, 2014(Information from Planning & Survey Unit, Niger State Housing Corporation)

Furthermore, the questionnaire distributed was based on the 5-point scale standard response format of Likert scale (Bertram, 2009). Data collected for this study were analysed with the use of regression analysis, ANOVA and relative importance index (RII). The five-point Likert scale was converted to a relative importance index for each indicator (Aibinu and Jagboro, 2002). The relative importance index serves as a useful supplement to regression analysis; it is useful in ranking the items in the factors so as to determine how the respondents perceived them in order of importance. The weighted average for each item in the four factors was determined, and ranks (R) were assigned to each item representing the overall perception of the respondents. The calculation of the relative importance index (RII) for each item was through the formulated statistical expression as found in the study of Aibinu and Jagboro (2002).

$$RII = \frac{5n1 + 4n2 + 3n3 + 2n2 + 1n5}{5N}$$

Where n1 = number of respondents for 'very unsatisfied'
  n2 = number of respondents for 'unsatisfied'
  n3 = number of respondents for 'fair'
  n4 = number of respondents for 'satisfied'
  n5 = number of respondents for 'very satisfied'
  N is the total number of respondents.

RESULTS AND DISCUSSION

Table 1 shows the R^2 value obtained was 0.506 suggesting that 51% of the variance in the perception of the liveability of residential housing environment can be explained by housing unit characteristics, economic vitality, neighbourhood facilities and safety of the environment. The difference between R^2 (0.506) and the adjusted R^2 (0.501) is 0.005. In other words, if the model were derived from the total population rather than a sample of it, the outcome would have revealed a less variance of 0.5%.

Table 1: Regression analysis of the prediction of liveability indicators of residential environment

Model Summaryb

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	R Square Change	F Change	df1	df2	Sig. F Change
					Change Statistics				
1	.711[a]	.506	.501	.42559	.506	92.442	4	361	.000

a. Predictors: (Constant), SAFE_ENV, H_UNIT, N_FAC, ECO_VIT
b. Dependent Variable: Liveability

Table 2 reveals that the four factors are very significant in the prediction of the liveability degree of residential housing environment with $F_{(4, 361)} = 92.442$, P= 0.000. Based on the significant level (p<0.05), this implies that there were significant differences among the variables of the four factors.

Table 2: Analysis of variance of liveability indicators of residential environment

ANOVAa

Model		Sum of Squares	Df	Mean Square	F	Sig.
1	Regression	66.974	4	16.744	92.442	.000[b]
	Residual	65.386	361	.181		
	Total	132.360	365			

a. Dependent Variable: Liveability
b. Predictors: (Constant), SAFE_ENV, H_UNIT, N_FAC, ECO_VIT

Table 3 shows the regression analysis conducted based on survey data which revealed that neighbourhood facilities is the most predictor of the liveability of the housing estates selected with β = 0.348, p < 0.000, followed by housing unit characteristics with β = 0.185, p < 0.000, similar results were found by other authors such as (Salleh, 2008; Ukoha and Beamish, 1997). Other results such as safety of the environment with β = 0.166, p < 0.003 (Leby and Hashim, 2010; Asiyanbola *et al*., 2012; Lawanson *et al.,* 2013) and economic vitality with β = 0.152, p < 0.009 are key indicators of liveability of the living environment.

Table 3: regression analysis on the contribution of the independent variables

Coefficientsa

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	3.317	.022		149.104	.000
	H_UNIT	.159	.039	.185	4.028	.000
	N_FAC	.368	.055	.348	6.696	.000
	ECO_VIT	.109	.041	.152	2.644	.009
	SAFE_ENV	.123	.041	.166	3.003	.003

a. Dependent Variable: Liveability

Based on the ranking of the weighted average of the relative importance indices (RII) for the eighteen items (see Table 4). It shows that two items of safety ranked most, that is, safety from accident (RII = 0.772) and safety of property (RII = 0.748). This implies that, building regulations and standard is considered top most for achieving safety from accidents that could result from building failure. Also, property safety has to do with security of tenure. Further, in the ranking order, house ventilation (RII = 0.745) emerged third factor influencing the perception of the respondents of the liveability of the housing estates. Other liveability indicators as perceived by the respondents indicate child's education (RII = 0.737) as fourth important. While, affordability (RII = 0.728) became the fifth consideration and safety from crime (RII = 0.725) in the housing estates is key to the liveability of the housing. Furthermore, housing unit, living area size and bedrooms were significant given their (RII = 0.723), (RII = 0.720) and (RII = 0.717) respectively. Moreover, health care services (RII = 0.712) and garbage collection (RII = 0.706) ranked 10th and 11th position indicating strong contribution to the residential environment liveability. On the other hand, the last three ranked elements indicate low level of satisfaction by the respondents. These elements are toilet and bath size (RII = 0.669), standard of living (RII = 0.634) and recreation facilities (RII = 0.630), it implies low level of contribution to the liveability of the study areas.

Table 4: Relative importance of the liveability attributes as perceived by the respondents

S/No	Liveability items	Rate of Responses					Sum	RII	Ranking
		5	4	3	2	1			(R)
1	Housing unit size	56	149	129	28	4	366	0.723	7th
2	Living size area	50	159	125	24	8	366	0.720	8th
3	Dining area size	41	124	143	44	13	365	0.675	15th
4	Bedrooms size	52	156	118	34	6	366	0.717	9th
5	Kitchen size	46	122	138	44	11	361	0.682	14th
6	Toilet and bath size	45	122	130	53	16	366	0.669	16th
7	Housing unit ventilation	66	164	107	27	2	366	0.745	3rd
8	Affordability	63	133	149	17	4	366	0.728	5th
9	Total monthly income	59	128	113	51	12	363	0.694	12th
10	Public transport accessibility	61	106	132	55	9	363	0.685	13th
11	Standard of living	23	58	245	39	1	366	0.634	17th
12	Children educational services	49	174	119	21	1	364	0.737	4th
13	Health care services	37	176	110	39	3	365	0.712	10th
14	Garbage collection	40	161	127	26	11	365	0.706	11th
15	Recreational facilities	40	110	122	38	49	359	0.630	18th
16	Safety from crime	63	143	129	20	10	365	0.725	6th
17	Safety from accident	73	178	107	4	3	365	0.772	1st
18	Safety of properties	75	155	106	23	6	365	0.748	2nd

CONCLUSION AND RECOMMENDATIONS

It is evident from this study that, neighbourhood facilities (34.8%) and housing unit characteristics (18.5%) have statistically significant contribution to the liveability of the living environment. Hence, these findings support the previous studies indicating that most significant predictors of liveability of the living environment are neighbourhood facilities and dwelling unit quality (Salleh, 2008; Ismail *et al.*, 2015; Ilesanmi, 2012; Ibem and Aduwo, 2013; Ukoha and Beamish, 1997). However, safety from accident (RII = 0.772) and safety of property (RII = 0.748) ranked very high, indicating building regulations and standard is considered top most for achieving safety from accidents that could result from building failure. And, property safety has to do with security of tenure. The findings corroborate some other studies such as Leby and Hashim (2010), Asiyanbola *et al.* (2012) and Lawanson *et al.* (2013) where they confirmed that the safety of the environment is one of the key indicators of the liveability of living environment. This study provides evidence for the housing policy-makers, on the needs and aspirations of those being planned for and this will help the architects who design and the planners who planned such a housing estate environment on the significance of the four-factors and elements used in measuring liveability of the living environment. Based on the findings, this study recommends an upgrading of neighbourhood facilities and other key factors of liveability in the study area by the relevant authorities.

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