

Residents Post-Occupancy Evaluation of Social Housing in Liberia

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Abstract

This paper evaluates the livability and convenience of social housing in Liberia from the residents' perspectives. Using residents' appraisal from several social housing projects in the suburb of Monrovia, residents' satisfaction index with regards to the aesthetic, durability and comfort of their homes were measured. It also assessed their overall living environment which includes access to road and basic service facilities such as hospitals, schools, shopping and recreational centers. How secured and comfortable do they feel within their homes? What are the driving factors that led them to acquire their homes? Data were collected from 662 household heads from three housing estates in the suburb of Monrovia using the stratified systematic sampling method and analyzed using IBM SPSS descriptive statistic. Results show that while occupants of public housing are satisfied with certain aspects of their homes, they are generally unsatisfied with their living environment. This investigation is detailed to inform architects, designers and policymakers' decisions toward social housing in Liberia. It looks at the underlining challenges affecting the improvement of social housing from the end users' perspective and how these challenges can be mitigated to meet consumers' satisfaction and make them part of the design process and policymaking.

Keywords

Residents' Perception, Evaluation, Social Housing, Indoor Environmental Quality, Outdoor Environmental Quality, Liberia

1. Introduction

Shelter is an integral part of human existence and the development of any society. The history and importance of shelter are as old as the existence of humankind. According to [1] shelter is universally acknowledged as the second most

essential human need after food and is considered a significant economic asset in any nation. The importance of shelter and how it separates people into groups needs no further elaboration [2]. According to [3] the lack of adequate housing has made people forced to live in conditions that constitute an affront to human dignity. [4] enlightens the issue of considering housing condition as a social-economic indicator of urban poverty.

Like every other aspect of civilization, shelter has continued to evolve with time to meet up with changing demand. In today's complex and fast-changing world, shelters do not only serve as a place to keep us safe from unfavorable weather conditions but an area that provides us with the necessary comfort and convenience; a place that inspires us and makes our lives healthier and productive. That is why the need for a well-designed shelter to meet our growing needs is paramount to our time and age.

A well-designed building is one that is functional, aesthetic and structurally sound. It is a building that gives more than what has been requested while utilizing limited resources.

The need for Architects/designers to consider the end users of their products (the buildings or other facilities) has not been fully actualized as compare to other industries where consumer experience is the primary driving force.

As stated by [5] buildings are constructed and managed based on standards and specifications established by the government, professionals, and experts who are supposed to have adequate knowledge of user needs and expectations, however, these standards and specifications do not conform to the changing needs and expectations of users. Therefore, building performance can be enhanced by regular performance evaluation, exploring and understanding user needs, hopes, and aspirations.

Over the years, most Architects/Designers have spent a considerable amount of their time striving to showcase their creativity and ingenuity and paying very little attention to the user experience of their work. According to [6] post-occupancy evaluation is still an emerging discipline, and furthermore an obscure part of the design cycle. POE, in general, is the concern of a somewhat limited number of architects. Post-occupancy evaluation has been an even more elusive undertaking in the design cycle, not only because it is beyond the direct responsibility of the design architect but also because the post-occupancy evaluation task requires expertise other than design [6]. Traditionally, success in the construction sector has been measured by cost, quality, time and scope; many times a project is considered successful if the work is delivered within the deadline, budget and according to specification [7]; thereby, disregarding occupants' experience.

Rather than designing for the consumer, most architects and designers should begin to look at design from the users' perspective and start to plan with the consumers instead of for the consumers.

However, building evaluation work does not fit long-standing classifications; it spans the professions (architecture, services engineering and facilities man-

agement being the most prominent). It is multidisciplinary, often to a confusing extent (design, psychology, economics, planning, sociology, and engineering). It draws on laboratory research and physical measurement, but it is predominantly about empirical field work, visiting and studying real buildings in use and talking to real people [8].

Social housing in Liberia has not received much attention over the years leaving many citizens with the daunting task of undertaking their own construction projects to cater to their housing needs with little or no regulation from the government. This passive behavior toward social housing has led to the proliferation of sprawl and slums in most of the country leaving most citizens to live in unhealthy, unstructured, unsecured and inaccessible communities. The need to address this situation cannot be overemphasized and has laid the basis upon which this research is conducted. It investigates the performance of public housing to understand why most citizens are not attracted to public housing instead choose to undertake their own construction.

According to [9] POE is the collection and review of user satisfaction, space utilization, and resource consumption of a completed constructed facility after occupation to identify important occupant and building issues. This information can help architect, designers, and policymakers adequately mitigate these issues in future construction to provide a much better user experience.

Because our health and well-being depend on the serenity of our environment, this study aim at evaluating users' experience of public housing in Liberia and formulates realistic solutions to improve user experience and their health and well-being.

Many problems arising from the use of public housing are those of deficiency in the performance of buildings after its occupation. Such problems include performance and functional efficiency of the building, accessibility, distribution, and configuration of spaces. It also includes access to primary services (schools, hospital, shopping and recreational centers); spatial arrangement, indoor environment quality (ventilation, day-lighting, thermal comfort, and productivity) outdoor environmental quality; and the safety and security of life and properties. The need for a systematic and synergetic approach to alleviate these problems cannot be overemphasized. The primary and most significant step in this process is to understand the problem from the user perspective holistically; through a well-coordinated Post-Occupancy Evaluation POE. Architect, designer, developers and government regulator should have a better understanding of how buildings are performing when providing service to occupants. Comparing a building in use to their design intention can provide useful feedback to guide future design decision [10].

Some other benefits that come with POE are the recognition of functional design features that can be scrutinized recurrently. These include identification of problems to mitigate or reduce building or facilities defect, identification of building performance and environment, identification of redundant and unnecessary building features, and empowerment of user to negotiate building issues

and reduce maintenance work and cost [9].

In recent times, much research has been done on POE gear toward informing designers and architects decision and improving users' experience. However, this research investigates user experience of public housing in Liberia explicitly and seeks to understand and mitigate some of the challenges users of public housing faced.

2. Methodology

With user experience at the core of this research, the study was conducted using user survey questioners, physical building assessment, and personal interviews to gather firsthand information about user's experience of public housing in the suburb of Monrovia. The survey was conducted over a period of three months September 2017 to December 2017, with the assistance of haired survey assistants.

All of the sampling houses in this study were constructed by the government of Liberia through hire contractors for low to middle-income earners during the period 2006 to 2017. Using the stratified systematic sampling method, a total of 800 units (two and three bedrooms) from three housing estates located in Brewerville, Fendall and Schiefflin Town were selected for this study. Household heads were selected as our primary informants, and due to most household heads busy schedule, visits, assessments, and interviews were mostly scheduled for weekends morning when they were most likely home.

A total of 800 survey questionnaires were issued out to household heads, and a physical assessment of their homes was done along with personal interviews. The questionnaires cover several areas including general information about the occupants, their experiences with several aspects of their homes including spatial arrangement, indoor aesthetic and environmental qualities; outdoor aesthetic and environmental qualities; along with structural and safety issues. For detail about the questionnaire, please see [Appendix 1](#). The physical assessments assessed the buildings layout, materials used for construction including walls, doors, windows, ceiling, and roofing, along with their current conditions as well as structural integrity and safety features. For detail about building physical assessment, please see [Appendix 2](#). The personal interviews were to gather further information from the occupants about their experiences with their living environment.

Of the 800 questionnaires issued, 662 representing 82.75% were successfully returned and considered for sampling using IBM SPSS statistical analysis software.

During the sampling data collected were subjected to descriptive analysis to determine the frequencies, percentage of the respondents' personal information provided including gender, age, level of education, sectors of employment and range of income. The Sum of individual respondent's satisfaction score on all of the building attribute which is the Individual Satisfaction score (ISS) was extracted from the descriptive analysis. The average satisfaction score that was

given by all respondents on all of the building attributes which is the Mean Satisfaction Score (MSS) was also extracted. Also, the sum of actual satisfaction score on the five-point Likert scale given by all the respondents on each building attribute which is Relative Performance Index (RPI) was also extracted from the descriptive analysis.

While ISS is an expression of the respondent's satisfaction with all of the building attributes put together, MSS is the average satisfaction score given by all respondents on each of the attributes. RPI is computed as the sum of the actual satisfaction score on the five-point Likert scale given by all the respondents on each building attribute as a proportion of the sum of maximum possible satisfaction score on the five-point Likert scale that all the respondents could give on each of the building attributes. The RPI is taken as a measure of the relative contribution or importance of each building attribute towards enhancing the activities and well-being of the residents.

3. Results

3.1. Occupants' General Information

After running a descriptive analysis of the information collected from our respondents, the result shows that 74.9% are males while 25.1% are females. This result was anticipated as evident by [11] Gender Economic participation and opportunity ranking, Liberia rank 114 among 144 countries in the world. The report indicates that there is a gender gap in income earnings and opportunity in most African countries where males tend to dominate the income earnings while most female partners are left with domestic work thereby disenfranchising them from owning properties. This gap could also be because principal respondents are household heads and males tend to be the head of the home. Therefore, this result does not indicate if the husband and his wife contributed to purchased their home.

While it was not prudent to ascertain the exact ages of our principal respondents, the result shows that 35% are between the ages of 46 - 60 years. While 29% are between the ages of 36 - 45%, 17.2% are between the ages of 26 - 35 years, 16.8% are above 60, and 2% are between the ages 18 - 25 years. This result is because most of the homes that were investigated, were constructed during 2006-2017 and most of those who could afford to acquire during this time were those who were actively employed and still in the employment age range as compared to those who were just starting their lives or those who were retired.

It is also observed that 49.7% of the principal respondents have been living in their homes for 4 - 6 years while 33.7% have been living in their homes for 7 - 10 years and 16.6% have been living in their homes for 1 - 3 years. This pattern shows these houses were constructed in phases over a period of 10 years, therefore leading to gradual acquisition and occupation.

Majority of the respondents 55.6% are married, 11% are divorced, 22.1% are unmarried, and 11.3% are widowed. Result also shows 74.2% have obtained their

Bachelor's degrees, 18.45% have obtained their Master's degrees, 6.2% have obtained their Ph.D. degrees and 1.2% are holders of high school diplomas. Of this amount, 71.6% are employed in the public sector while those employed in the private sector are 28.4%. This result shows the government constructed these houses for low and middle-income earners and the government is the highest employer in the country. Therefore, it is expected that a majority of those who can afford to acquire a home are within the employed of the government.

Also, 67.7% of the houses are 2-bedroom, and 32.3% are 3-bedroom with 54.1% of them having more than four occupants, 21.8% having four occupants, 14.55% having three occupants, 6.6% having two occupants and 3% having one occupant. This result coincides with the fact that most African families are large and accommodating distance relatives is a norm in most African societies.

As obtaining the exact earning of the respondents was not feasible. The result shows that 34.7% of the principal respondents are earning between USD 201 to 500, 24.8% are earning 501 - 1000, 18.6% are earning 1001 - 2000, 11.8% are earning 101 - 200, and 10.1% are earning above 2000. This result coincides with the fact that these houses were constructed for low and middle-income earners. This result shows why 57.6% are paying mortgages on their homes, only 19.65% own their homes, 10.6% are renting, 8.6% have a short-term lease, and 4.1% have a long-term lease. Price was the primary reason that influenced 58.6% of the respondent's purchase. Those influenced by the location of the property were 20.4%; while those influenced by the spatial arrangement of the property were 12.5%. Additionally, those influenced by the quality of the property were 3.5%; and those influenced by the aesthetic appearance of the property were 5%.

3.2. Buildings Physical Characteristics

From the physical assessment done on these buildings, it is evident that they were constructed using conventional building materials (Blocks, Bricks, Mortar, timber, steel, sand, glass, aluminum and corrugated roofing sheets) found on the local market. The physical assessment shows they are structurally sound which speaks to the fact that they were recently constructed and adequately supervised by the requisite government agency responsible for public housing construction. **Table 1** show details obtained from the physical assessment of the houses under investigation.

Table 1 shows that most of the buildings 47.1% are 2-bedroom single family bungalow constructed with hollow masonry block as the predominant wall material plaster with mortar and covered with enamel paint covering. 72.1% of the windows are sliding glass aluminum windows, 73.4% of the homes have exterior steel doors and interior plywood doors. 94.7% of the homes have burglar bars on their windows. Most of the buildings are relatively in good structural and physical condition and are well kept by the occupants. While the layout of the buildings is well planned, there are not sufficient green spaces for occupant despite the lack of public parks. These housing estates also lack proper storm water

Table 1. Buildings physical characteristics.

Buildings physical characteristics			
No.	Characteristics	Frequency (N = 662)	Percentage
1.0	Building Topology		
1.1	Single-family bungalow	312	47.1
1.2	Semidetached bungalow	205	31
1.3	Duplex	123	18.6
1.4	Triplex	22	3.3
2.0	Number of bedrooms in the building		
2.1	Two bedrooms	448	67.7
2.2	Three bedrooms	214	32.3
3.0	Building wall material		
3.1	Refractory bricks	25	3.8
3.2	Compressed laterite bricks	285	43
3.3	Hollow sandcrete blocks	352	53.2
4.0	Wall covering material		
4.1	Refractory bricks finish	25	3.8
4.2	Compressed laterite bricks finish	285	43
4.3	Mortar screening Enamel paint covering	352	53.2
5.0	Window type		
5.1	Sliding glass	477	72.1
5.2	Jalousie	185	27.9
6.0	Door type		
6.1	Steel door exterior, timber door interior	112	16.9
6.2	Steel door exterior, plywood door interior	486	73.4
6.2	Timber door exterior, plywood door interior	64	9.7
7.0	Availability of insect screen		
7.1	Yes	634	95.8
7.2	No	28	4.2
8.0	Availability of burglar bars on the window		
8.1	Yes	627	94.7
8.2	No	35	5.3
9.0	Floor finish material		
9.1	Porcelain tiles	101	15.3
9.2	Ceramic tiles	516	77.9
9.3	Vinyl tiles	45	6.8
10.0	Ceiling material		
10.1	Plaster of Paris (POP) screened	18	2.7
10.2	Painted hard board	451	68.2
10.3	Painted plywood	169	25.5
10.4	Acoustic	24	3.6

Continued

11.0	Roof covering material		
11.1	Galvanize roofing sheets	335	50.6
11.2	Aluminum roofing sheets	267	40.3
11.3	Long span aluminum roofing sheets	25	3.8
11.4	Roofing tiles	35	5.3
12.0	House condition		
12.1	Excellent	66	10
12.2	Good	344	52
12.3	Needs manor repair	156	23.6
12.4	Needs repair	80	12
12.5	Needs major repair	16	2.4
13.0	Building layout condition		
13.1	Well planned	441	66.6
13.3	Properly layout	221	33.4
14.0	Sanitary condition		
14.1	Excellent	36	5.4
14.2	Good	382	57.7
14.3	Satisfactory	192	29
14.4	Fair	52	7.9

drainages for the collection and discharge of runoff water thereby causing fear of flood for residents during the torrential raining season. Because these physical assessments were conducted during the dry season, a substantial residue of dust was observed on the exterior walls, windows, and furniture of most of these homes due to unpaved roads.

Figure 1 shows a floor plan of the 2-bedroom single family bungalow and **Figure 2** shows the floor plan of the 3-bedroom single family bungalow, two of the housing types under investigation. It can be observed from the plan that the total floor areas of the buildings are 104.37 m² and 158.17 m² respectively. The minimum bedroom size is 13.18 m² and a living and dining room area of more than 26 m². This configuration of space explains why 31.7% and 49.8% of the respondents are very satisfied and satisfied respectively with their bedroom size while 29.8% and 50.2% are very satisfied and satisfied respectively with their living area size as shown in **Table 2**. It is also evident from **Figure 1** that all of the bedrooms have two windows each that enable proper cross ventilation which explains while 23.60% and 40.80% of the respondents are very satisfied and satisfied respectively with the Natural ventilation in their building. However, respondents are not satisfied with the overall aesthetic of their homes.

3.3. Occupants' Satisfaction and Building Performance

As shown in **Table 3**, nineteen building attributes with MSS between 4.00 and 3.00 are contributing significantly to the overall needs of occupants. Seven

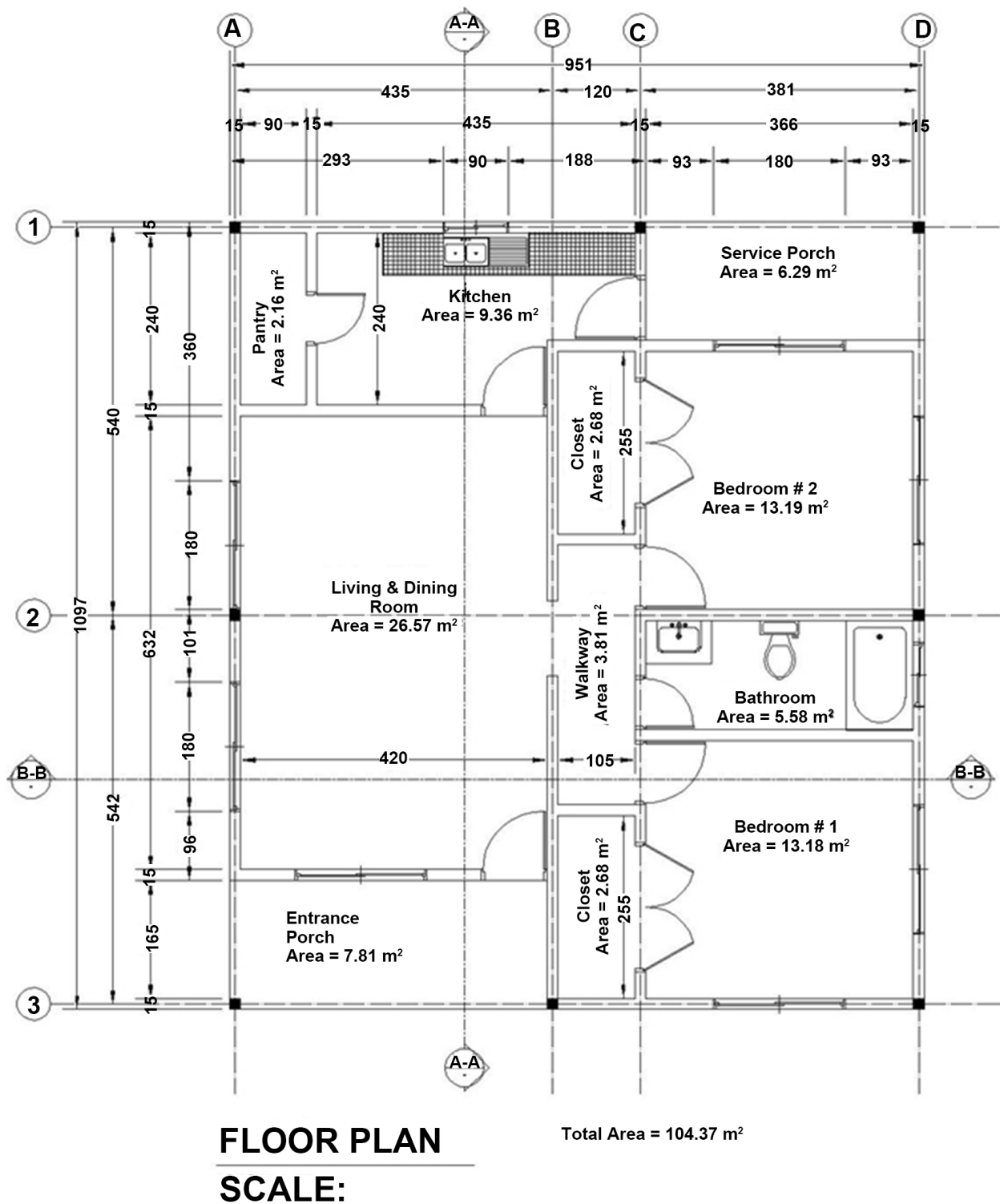


Figure 1. Typical floor plan of the 2-Bedroom single family Bungalow.

building attributes with MSS between 2.88 and 2.50 are contributing averagely to the overall needs of occupants and eleven attributes with MSS between 2.41 and 1.65 are contributing negligibly to the overall needs of the occupants. The average MSS is 2.89 which show residents are not satisfied with their living



Table 2. Residents' satisfaction with their home.

	Building components	Scores									
		Very Unsatisfied		Unsatisfied		Nature		Satisfied		Very satisfied	
		Frequency	Percent	Frequency	Percent	Frequency	Percent	Frequency	Percent	Frequency	Percent
1	Bedrooms size	21	3.20	93	14.09	8	1.21	330	49.80	210	31.70
2	Bedrooms location	32	4.80	115	17.39	12	1.81	291	44.00	212	32.00
3	Living area size	21	3.20	101	15.14	11	1.66	332	50.20	197	29.80
4	Living area location	35	5.30	107	16.19	14	2.11	326	49.20	180	27.20
5	Service area size	30	4.50	121	18.29	6	0.91	402	60.70	103	15.60
6	Service area location	12	1.80	86	13.04	13	1.96	413	62.40	138	20.80
7	Building overall layout	8	1.20	82	12.43	21	3.17	445	67.20	106	16.00
8	Building floor to ceiling height	334	50.50	242	36.44	9	1.36	72	10.90	5	0.80
9	Building capacity to meet occupants needs	36	5.40	82	12.47	26	3.93	314	47.40	204	30.80
10	Building Privacy level	20	3.00	74	11.28	22	3.32	318	48.00	228	34.40
11	Building interior aesthetic	117	17.70	334	50.48	18	2.72	151	22.80	42	6.30
12	Building overall comfort level	30	4.50	147	22.17	24	3.63	407	61.50	54	8.20
13	Flow of natural light in building	18	2.70	152	23.03	19	2.87	418	63.10	55	8.30
14	Artificial lighting in building	48	7.30	258	38.92	27	4.08	301	45.50	28	4.20
15	Natural ventilation in building	18	2.70	202	30.48	16	2.42	270	40.80	156	23.60
16	Texture of walls, ceilings and floors	65	9.80	424	64.06	36	5.44	113	17.10	24	3.60
17	Bathroom and kitchen fixtures	28	4.20	267	40.36	38	5.74	329	49.70	0	0.00
18	Option to control indoor temperature	150	22.70	455	68.73	23	3.47	34	5.10	0	0.00
19	Regular smell in building	287	43.40	0	0.00	31	4.68	317	47.82	27	4.10
20	Option to control noise transmission into the building	215	32.50	336	50.71	37	5.59	74	11.20	0	0.00
21	Plumbing work			257	38.80	48	7.30	321	48.50	36	5.40
22	Outdoor air quality	18	2.70	387	58.46	42	6.34	194	29.30	21	3.20
23	Waste disposal	15	2.30	260	39.32	33	4.98	330	49.80	24	3.60
24	Exterior aesthetic	73	11.00	319	48.25	52	7.85	161	24.30	57	8.60
25	Runoff water collection and disposal	195	29.50	354	53.37	24	3.63	60	9.10	29	4.40
26	Space between buildings	9	1.40	427	64.41	37	5.59	168	25.40	21	3.20

Continued

27	Green space	76	11.50	421	63.57	32	4.83	133	20.10	0	0.00
28	Access to basic services	316	47.70	232	35.10	51	7.70	63	9.50	0	0.00
29	Access to electricity	297	44.90	328	49.54	9	1.36	28	4.20	0	0.00
30	Access to water supply	184	27.80	453	68.44	7	1.06	18	2.70	0	0.00
31	Road access	61	9.20	473	71.49	12	1.81	116	17.50	0	0.00
32	Security in building	74	11.20	339	51.19	14	2.11	198	29.90	37	5.60
33	Option to escape fire emergency	150	22.70	334	50.42	25	3.78	153	23.10	0	0.00
34	Building capacity to prevent break-in	60	9.10	169	25.58	16	2.42	375	56.60	42	6.30
35	Building capacity to keep insects out	36	5.40	174	26.39	6	0.91	410	61.90	36	5.40
36	Building capacity to withstand flood	92	13.90	301	45.45	46	6.95	163	24.60	60	9.10
37	Electrical works	66	10.00	287	43.32	29	4.38	218	32.90	62	9.40
Average score		88	13.26	248	37.53	24	3.65	237	35.78	64	9.63

environment. **Table 2** shows 13.26% of the respondents are very unsatisfied with their dwelling place while 37.53% are unsatisfied, 35.78% are satisfied, 9.63% are very satisfied with their dwelling place and 3.65% of the respondents have nurture feeling about their home. Mainly, respondents are more satisfied with the level of privacy and the general building layout which includes bedrooms' sizes and locations, living area size and location, service area size and location. They are also satisfied with the overall indoor environment quality and comfort of their homes. Basically among their satisfaction are the flow of natural light across their homes, natural ventilation across their homes, regular smell in their homes and disposal of solid and liquid waste from their homes. Even though they had dissatisfaction about the insufficient floor to ceiling height, option to control noise transmission in their homes and option to control indoor temperature.

Respondents are mostly unsatisfied with the interior and exterior aesthetic of their homes including the texture and appearance of their walls, floor, and ceiling which explains why the aesthetic of their home influenced only 5% of the respondent's purchase. Like [12] notice in Malaysia, this could be the result of shoddy artistry in the finishing work. Most building technicians are not formally trained and lack the skills to perform these tasks flawlessly.

Even though most of the homes surveyed have exterior steel doors and burglar bars, most respondents do not feel safe in their homes due to the lack of electricity. Access to electricity, water supply, and basic services score the least MSS as shown in **Table 3**.

Table 3. Building attributes mean satisfaction scores and relative performance indices.

Mean Satisfaction scores and relative performance indices of RPIs (in descending order of importance).				
No.	Building attributes	MSS	ASSac	RPIa
1	Building privacy level	4.00	2646	0.799
2	Bedrooms size	3.93	2601	0.786
3	Living area size	3.88	2569	0.776
4	Service area location	3.87	2565	0.775
5	Building capacity to meet occupants needs	3.86	2554	0.772
6	Building overall layout	3.84	2545	0.769
7	Bedrooms location	3.81	2552	0.762
8	Living area location	3.77	2495	0.754
9	Service area size	3.65	2413	0.729
10	Natural ventilation in building	3.52	2330	0.704
11	The flow of natural light in the building	3.52	2327	0.703
12	Building overall comfort level	3.47	2294	0.693
13	Building capacity to prevent insects entry	3.36	2222	0.671
14	Building capacity to withstand break-in	3.26	2156	0.651
15	Plumbing works	3.21	2122	0.641
16	Regular smell in building	3.13	2070	0.625
17	Waste disposal	3.13	2074	0.627
18	Bathrooms and kitchens fixtures	3.01	1992	0.602
19	Artificial lighting in building	3.00	1989	0.601
20	Electrical works in building	2.88	1909	0.577
21	Outdoor air quality	2.72	1799	0.544
22	Exterior aesthetic	2.71	1796	0.543
23	Building capacity to withstand flood	2.69	1784	0.539
24	Security in building	2.68	1771	0.535
25	Space between buildings	2.65	1751	0.529
26	Building interior aesthetic	2.50	1653	0.499
27	The texture of walls, floors, and ceilings	2.41	1593	0.481
28	Provision of green space	2.34	1546	0.467
29	Road access to the building	2.28	1507	0.455
30	Option provided to escape fire emergency	2.27	1505	0.455
31	Runoff water collection	2.05	1360	0.411
32	Option to control noise transmission in building	1.95	1294	0.391
33	Option to control indoor temperature	1.91	1265	0.382
34	Access to water supply	1.79	1183	0.357
35	Access to basic services	1.79	1185	0.358
36	Building floor to ceiling height	1.75	1158	0.350
37	Access to electricity	1.65	1092	0.330

While most respondents are satisfied with the privacy level, spatial arrangement, indoor environmental quality and the overall comfort of their homes; the majority of the respondents are frustrated with their access to basic services. Because these housing estates are in the suburb of the city, occupants have to drive for several miles to access basic services such as shopping centers, medical centers, schools and recreational centers.

Respondents are not also satisfied with the road access to their communities something that was evident by several visits made on these roads. With regards to the outdoor environmental quality, most of the respondents interviewed were unsatisfied due to the unpaved road leading to their communities and in their communities. They said due to the tropical climate of the country; they are faced with nearly impossible reads during the raining season and insufficient collection and discharge of runoff water due to the lack of adequate drainage facilities which often leave them with fear of their homes flooding. Moreover, during the dry season, they have to deal with the residue of dust left in their homes settling on walls, windows, and furniture due to unpaved roads in their communities. While these housing estates do not have public parks, results show most of the respondents are not satisfied with the space between their homes and the adjacent homes and that the green spaces provided them are insufficient. As shown in **Figure 3**, majority of the respondents are not satisfied with their dwellings and will like more to be done to make some improvement.

4. Conclusions

Evident by the results gather while residents are satisfied with some aspect of their homes like the privacy level, spatial arrangements and indoor environment quality they are unsatisfied with their living environment. Their dissatisfaction is due to several factors ranging from the look of their homes, low floor to ceiling height; inaccessibility of water, electricity and basic services; poor road access and inadequate drainage system. This result is contrary to that of [10] and [13] where residents of public housing estates in Lagos and Ogun State of Nigeria were satisfied with their living environment. It is also contrary to [14] findings in Kuala Lumpur where building performance criteria highly correlated with the occupants' satisfaction. It also does not correlate with [15] where initial outcomes showed a positive relationship between perceptions and building performance criteria.

As [4] noted the empirical evidence of the relationship between housing conditions and quality of life, it is essential for governmental regulators to put policies into place to ensure communities are adequately planned with adequate road access and access to basic services. The need to ensure the provision of electricity and potable water also needs to be addressed adequately by the government. Despite the presence of steel doors and burglar bars on their homes, occupants do not feel safe in their homes due to the lack of electricity. The problem with roads in these estates also needs to be adequately addressed by the

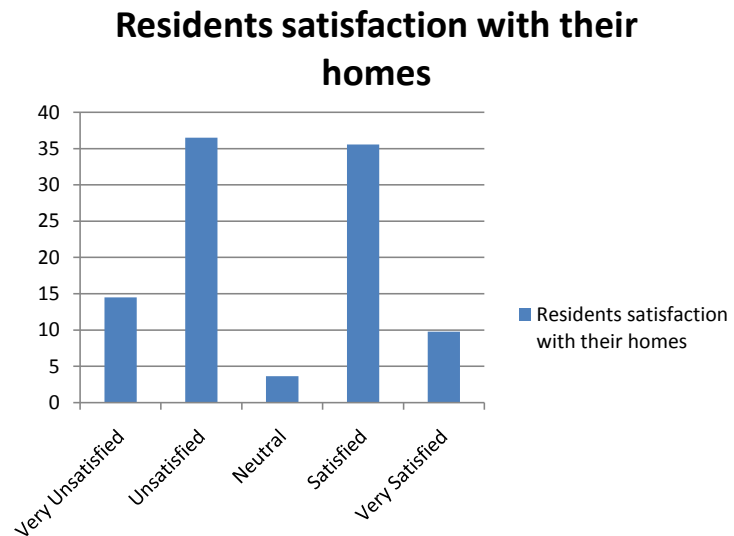


Figure 3. Residents satisfaction with their homes.

government because most residents complain that they are facing severe health problem due to the residue of dust left in their homes during the dry season which also increases the maintenance frequency and cost of their homes.

The need for a social/behavioral design approach as proposed by [6] needs to be considered by Architects, designers and policymakers in Liberia to ensure a healthier and sustainable living environment for the end users.

It is also important to consider the need to train more professionals and technicians in the building industry as it is very vital and critical to the development of the building industry.

Findings show that occupants are not satisfied with their buildings and these buildings are not meeting their overall needs. Basically among residents' dissatisfactions as shown in **Table 2** are:

- Option to control noise pollution
- Option to control indoor temperature
- Access to water supply
- Access to basic services
- Building floor to ceiling height and
- Access to electricity

As stated by [16] Government has to stimulate housing development by providing more infrastructures including roads, hospitals, schools, improved water and electricity supply, especially in strategic locations to reduce housing demands in the cities. A study of risk accumulation and reduction in African cities by [17] found that risk in most African cities is not only limited to the proliferation of hazards and vulnerability but also the way in which hazards are created. Notably through urban expansion into exposed locations and through failures in infrastructure provision.

The slow process of urban planning and zoning, in the face of rapid urbanization in most urban centers, has resulted in the poor layout of buildings with in-

adequate roads between them and inadequate drainage and provision for refuse evacuation. Thus there is a high incidence of pollution (water, solid waste, air, and noise) and inadequacy of open spaces for other land uses [18]. Like [19] emphasized the need for The Malaysian building industry to develop and work towards a more sustainable and green architecture, the Liberian building industry needs to do the same with the government laying a sustainable framework. It is therefore recommended that the government of Liberia develop adequate housing policies with the health and well-being, convenience and productivity, safety and security of occupants as the top priorities. It is also essential for developers to consider accessibility, access to basic services and the provision of potable water and electricity during the initial planning stage of these developments. With these policies and measures in place, it is also prudent to consider training professionals and technicians in the building industry as it was observed occupants' dissatisfaction with the look of their homes was mostly due to shoddy finishing work that was done by building technicians and supervised by building professionals. It is also critical for Architects, designers and policymakers to begin to engage in what [6] calls social/behavioral design approach with occupants experience at the center of the design process, as [6] proposed:

- Design practice should incorporate social design as a complement to the holistic task of architectural practice.
- Social design should be the fundamental task of an architect. The eventual design product should be humane and habitable, serving the goals and objectives of the occupants of a specific built environment.
- Accordingly, the architectural education system should break new ground in producing architects with an added value regarding environment-behavior expertise to undertake the tasks of both programming and post-occupancy evaluation.
- An even more necessary transformation could be achieved by reducing the enormous gap between the attitudes and values of designers and those of the general public concerning the designs of various facilities.

The sampling in this study is from three housing estates in the suburb of Monrovia that were constructed between 2006 and 2017 and should not represent the entire public housing sector in Liberia; it is essential that further extensive research be conducted to ascertain a broader user perception of public housing in Liberia. Further research also needs to look at the energy efficiency, sustainability, and maintenance frequency and cost to occupants.

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Appendix 1

Post Occupancy Evaluation Questionnaire

Dear respondent,

We are conducting a Post-Occupancy Evaluation research on houses within your housing estate and would appreciate your time answering our questions below. We guarantee you that all information provided us will straightly be kept confidential and use only for academic purpose.

Thanks for taking time from your busy schedule to respond to our questions.

If you have any inquiry regarding this questionnaire, please do not hesitate to contact us at +231776077064 or email: jakezee92@gmail.com

Please mark (✓) or answer accordingly where necessary.

A) General

Please mark the answer appropriate to you.

A1) What is your Gender? 1) Male ☐ 2) Female ☐

A2) How old are you? 1) 18 - 25 years ☐ 2) 26 - 35 years ☐

3) 36 - 45 years ☐ 4) 46 - 60 years ☐ 5) above 60 years ☐

A3) How long have you been living in this house? 1) 1 - 3 years ☐

2) 4 - 6 years ☐ 3) 7 - 10 years ☐

A4) What is your marital status? 1) Marry ☐ 2) Divorce ☐ 3) Unmarried

☐ 4) Widowed ☐

A5) What is the highest level of education you have attained?

1) High school diploma ☐ 2) Bachelor degree ☐ 3) Master's degree ☐

4) PhD Degree ☐ 5) Others, please specify_____

A6) What is your occupation? Please specify_____

A7) Which sector are you employed in? 1) Public ☐ 2) Private ☐

A8) How many persons live in this house? 1) 1-Person ☐ 2) 2-Persons ☐

3) 3-Persons ☐ 4) 4 Persons ☐ 5) More than 4 persons ☐

A9) What is the range of your monthly income in United States Dollars?

1) \$1 - \$100 ☐ 2) \$101 - \$200 ☐ 3) \$201 - \$500 ☐ 4) \$501 - \$1000 ☐

5) \$1001 - \$2000 ☐ 6) Above \$2000 ☐

A10) What is the status of your tenure of this house? 1) owned

2) Long term leasing 3) Short term leasing 4) Renting 5) Mortgaging

A11) What was the primary reason that led to your decision to purchase/rent/lease this house? 1) Location ☐ 2) Price ☐ 3) Aesthetic ☐

4) Space 5) Quality ☐ 6) Accessibility ☐ (7) Others,

pleases pecify_____

A12) Which housing estate is your house located? 1) Brewerville, NASSCORP Village ☐ 2) Fendall Sinlib ☐ 3) Schiefflin Town (EcoHomes) ☐

A13) There are how many bedrooms in your house? 1) One bed room ☐ 2) Two bedrooms ☐ 3) Three bedrooms ☐ 4) Four bedrooms ☐ 5) Five bedrooms ☐ 6) More than five bedrooms ☐

B) Occupants satisfaction with the building attributes

How satisfied are you with the building attribute of your home? Please mark (√) the answer appropriate to you.

No.	Building attributes	Very unsatisfied	Unsatisfied	Neutral	Satisfied	Very satisfied
1	Sizes of bedrooms					
2	Location of bedrooms					
3	Sizes of your livening areas (Front porch, Living and Dining Rooms?)					
4	Location of your livening areas (Front porch, Living and Dining Rooms?)					
5	Sizes of your service areas (Kitchen, Service porch, Store room and Bathrooms)					
6	Location of your service areas (Kitchen, Service porch, Store room and Bathrooms)					
7	Overall how satisfied are you with the general building layout?					
8	floor to ceiling height of your home					
9	The capacity of your home to meet your overall needs					
10	Level of privacy provided by your home					
11	The overall aesthetic of the interior of your home					
12	The overall comfort of your home					
13	The flow of natural light in your home					
14	Artificial lightings in your home					
15	Natural ventilation across your home					
16	The texture of your walls, floor, and ceiling					
17	Fixtures in your bathroom(s) and kitchen?					
18	Options to control the indoor temperature of your home					
19	The regular smell in your home?					
20	Transmission of noise into your home					
21	Overall plumbing work within your home					
22	Outdoor air quality					
23	Disposal of solid and liquid waste from your home					
24	The exterior aesthetic of your home					
25	Collection and disposal of runoff water around your home					
26	Space between your home and the adjacent homes					

Continued

-
- 27 Green space provided around your home
 - 28 Access to basic services such as shopping centers, hospitals, schools, worship and recreational centers
 - 29 Access to electricity
 - 30 Access to water supply
 - 31 Road access to your home
 - 32 Security provided by your home
 - 33 The option provided you to escape fire emergency
 - 34 Home ability to prevent intrusion from thieves
 - 35 Home ability to prevent intrusion from animals and insects
 - 36 Home ability to withstand flood?
 - 37 Overall electrical work within your home?
-

Please state below any other information you may like to share with us:

End of the survey.

We highly appreciate you taking time off your busy schedule to participate in our survey.

Appendix 2

Physical assessment form

House No: _____

Location: _____

Inspector: _____

- 1) What is the typology of this housing unit? 1) Single-family bungalow ☐
- 2) Semi detached bungalow ☐ 3) Duplex ☐ 4) Triplex ☐ 5) quadruplex ☐
- 2) What is the wall material of this unit made of? 1) Refractory bricks ☐
- 2) Compressed laterite bricks ☐ 3) Hollow sandcrete blocks ☐
- 4) Concrete blocks ☐ 5) Others please specify _____
- 3) What is the wall covering of this house? 1) Refractory bricks finish ☐
- 2) Compressed laterite bricks finish ☐ 3) Mortar screening Emission paint covering ☐
- 4) Mortar screening Enamel paint covering ☐ 5) ☐ Ceramic tiles covering
- 4) What is the type of window install on this unit? 1) Sliding glass ☐ 2) Glaze casement ☐
- 3) Timber casement ☐ 4) Jalousie ☐ 5) Timber louvers ☐
- 5) What types of doors are installed on the exterior of this unit? 1) Steel door exterior, timber door interior ☐
- 2) Steel door exterior, plywood door interior ☐ 3) Timber door exterior, plywood door interior ☐
- 4) All plywood ☐ 5) All timber
- 6) Are the inset screens installed on the windows of this unit?
1) Yes ☐ 2) No ☐
- 7) Are there steel grills installed on the windows of this unit?
1) Yes ☐ 2) No ☐
- 8) What type of floor finish does this unit have? 1) Granite tiles ☐
- 2) Porcelain tiles ☐ 3) Ceramic tiles ☐ 4) Vinyl tiles ☐
- 5) Cement screened ☐
- 9) What type of ceiling is installed in this unit? 1) Plaster of Paris (POP) screened ☐
- 2) Painted hardboard ☐ 3) Painted plywood ☐ 4) Acoustic ☐
- 5) Polished timber ☐
- 10) What is the roofing covering of this unit? 1) Galvanize roofing sheets ☐
- 2) Aluminum roofing sheets ☐ 3) Long span aluminum roofing sheets ☐
- 4) Roofing tiles ☐ 5) Others please specify _____
- 11) What is the current condition of this unit? 1) Excellent ☐ 2) Good ☐
- 3) Needs manor repair ☐ 4) Needs repair ☐ 5) Needs major repair ☐
- 12) What are the buildings layouts like? 1) Well planned ☐
- 2) Properly layout ☐ 3) Condensed ☐ 4) Spacious ☐ 5) Disorganized ☐
- 13) What is the sanitary situation like? 1) Excellent ☐ 2) Good ☐
- 3) Satisfactory ☐ 4) Fair ☐ 5) Poor ☐