Evaluation of Environmental Sustainability of Public-Private Partnerships Housing in Ogun State: Users' Satisfaction

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Abstract

The provision of sufficient housing remains a significant obstacle in numerous developing nations, particularly those where the population and urbanization levels are continually increasing. The pace at which the urban population is increasing indicates a higher demand for additional housing that surpasses the current supply of housing. This, in turn, results in the expansion of unplanned and unregulated settlements that are not officially recognized. The government of Ogun State has made efforts to address the shortage of housing in urban areas by utilizing a variety of housing strategies, such as public-private partnerships (PPPs), through several of its housing agencies. Thus, the PPP housing strategy was examined in this research work to evaluate environmental sustainability and the extent to which dwellers of such buildings are satisfied. The quantitative research method was used to approach the study using a survey. Data was gathered from residents of housing constructed through PPP by administering a structured questionnaire. Descriptive and inferential analyses were used to analyze the data. The research work concludes that PPP housing projects delivered in the study area are sustainable environmentally and dwellers express a high level of satisfaction. This implies that despite challenges that may be experienced in the course of housing delivered through PPP, the method can be viewed to be one of the best methods. Thus, governments are encouraged to use the PPP approach for housing delivery.

Keywords: Environmental sustainability, Housing, Post-occupancy evaluation, Public-private partnerships, Users' satisfaction

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Introduction

Housing is a basic human need and a fundamental right that is essential for social, economic, and environmental well-being. Adequate and affordable housing is crucial for maintaining a healthy and safe living environment, providing stability and security, and promoting social inclusion and cohesion. However, housing needs remain unmet for many individuals and communities around the world. According to the United Nations, an estimated 1.6 billion people globally live in inadequate housing conditions, while around 100 million people are homeless or living in inadequate shelter. In this context, understanding the factors that contribute to housing needs and identifying effective policy responses is critical (He *et al*., 2020; Liu *et al*., 2016; Olugbenga *et al*., 2017).

Research has highlighted a range of factors that contribute to housing needs, including poverty, inequality, urbanization, migration, and inadequate housing policies (UN-Habitat, 2020). Moreover, the COVID-19 pandemic has exacerbated existing

housing challenges, with millions of people facing eviction, homelessness, and housing insecurity due to economic disruption and job losses (The Lancet Public Health, 2021). Addressing these challenges requires a comprehensive approach that involves increasing access to affordable and secure housing, regulations (OECD, 2020). Housing is, on average, the single greatest cost in American household budgets, according to Adianto *et al.*, (2021). As a result, one of the factors that determine life satisfaction and happiness is satisfaction. Public housing is a type of housing that is provided by the government to its citizens.

The current and future state of the housing sector is influenced by how satisfied owners or occupiers are with the built environment (Dieleman, 2001). This emphasis derives from the fact that many problems in the built environment originate as a result of failing to consider the users' views. Customer satisfaction, according to Zarte *et al.*, (2019), is a life-cycle issue that must be considered from the beginning of the investment process. As a result, it is necessary to first comprehend and define what customers desire (both genuine and perceived needs), and only then can such expectations be delivered.

Public-private partnerships (PPPs) have been used in housing delivery as a way to leverage the resources and expertise of both the public and private sectors to achieve sustainable and inclusive housing outcomes. However, the environmental sustainability of PPP housing projects has been a subject of debate among policymakers, researchers, and practitioners. The need for sustainable housing is critical, given the environmental challenges facing the world, such as climate change, resource depletion, and pollution. Therefore, it is crucial to assess the environmental sustainability of PPP housing projects to ensure that they contribute to sustainable development goals.

Research has highlighted the potential benefits and challenges of using PPPs in sustainable housing delivery. On the one hand, PPPs can promote environmental sustainability by incorporating green design features, promoting energy efficiency, and reducing greenhouse gas emissions. On the other hand, PPPs may face challenges in promoting sustainability due to competing interests between public and private partners, inadequate regulatory frameworks, and limited resources for sustainability initiatives (Bakhtiari, 2020).

The environmental sustainability of PPP housing projects is a critical issue that requires further research and policy attention. By assessing the potential benefits and challenges of PPPs in promoting sustainable housing, post-occupancy evaluation of the PPP housing delivered in Ogun State taking into cognizance environmental sustainability for achieving sustainable development goals cannot be swept in the carpet.

According to Bakhtiari (2020), the potential benefits and challenges of using public-private partnerships (PPPs) to deliver sustainable housing. It highlights the need for effective regulatory frameworks, collaborative approaches, and resource allocation to ensure that PPPs promote environmental sustainability.

Literature on BedZED eco-village in the UK was highlighted, which was developed through a PPP and incorporates renewable energy technologies, sustainable construction materials, and green spaces to achieve zero-carbon emissions and promote sustainable living (Carbon Trust. (n.d.)).

The report OECD (2019) guides how PPPs can be used to achieve sustainable development goals, including environmental sustainability. It highlights the importance of stakeholder engagement, risk assessment, and regulatory frameworks in ensuring that PPPs contribute to sustainable development.

The State of the world cities 2020: the value of sustainable urbanization report discusses the challenges and opportunities for sustainable urbanization, including the role of PPPs in delivering sustainable housing. It emphasizes the need for innovative financing mechanisms, social

inclusion, and environmental sustainability in housing delivery (UN-Habitat, 2020).

United Nations. (2015) The 2030 Agenda for Sustainable Development outlines the Sustainable Development Goals (SDGs), which include Goal 11: Sustainable Cities and Communities. The SDGs emphasize the need for sustainable housing, infrastructure, and urbanization to achieve sustainable development, including environmental sustainability.

Wong, Chen and Shen (2021) examine how public-private partnerships can be used to enhance the environmental sustainability of infrastructure and housing projects. The authors identify best practices and strategies for promoting sustainability, including stakeholder engagement, sustainability standards, and green procurement.

He, *et. al* (2020) researched the theoretical analysis and empirical study of the impact of public-private partnerships on sustainable development. This study examines the impact of public-private partnerships on sustainable development, including environmental sustainability. The authors argue that PPPs can contribute to sustainable development by

Materials and Methods

Research Design
A survey research design was adopted for this study. This was a result of the post-occupancy evaluation done on the PPP housing by the dwellers through a structured questionnaire, highlighting the environmental factors of sustainable PPP housing in the state.

Population, Sample and Research Instrument
This study focused on all the 6500 PPP housing units across all the twenty (20) local governments in Ogun State. About three housing schemes namely the Ministry of Housing, Ogun State Housing Corporation, and Gateway City Developmental City Limited were involved in a partnership with private investors in the construction of the housing units within the state. Out of the total number of 20 local government domiciled in the state, nine (9) of them

promoting resource efficiency, reducing emissions, and enhancing environmental management.

Kibert *et al*. (2016) examine the potential of public-private partnerships to promote sustainable development, including environmental sustainability. The authors highlight the importance of effective governance, stakeholder engagement, and risk management in ensuring that PPPs contribute to sustainable development.

An article written by Alfen (2019) presents a conceptual framework for sustainable public-private partnerships and provides empirical evidence of successful partnerships in various sectors, including housing. The author identifies key success factors, such as shared values, trust, and transparency, and emphasizes the importance of aligning PPP objectives with sustainable development goals.

The study of Lee and Kim (2019) evaluates the sustainability performance of public-private partnership projects in Korea, including housing projects. The authors use a multi-criteria decision analysis approach to assess environmental, social, and economic sustainability indicators and identify areas for improvement in PPP implementation were found to be PPP housing compliant at the time of this study when the 6500 housing units were constructed. Modified Cochran's sample size calculator was used to arrive at a sample size of 1186 from the focused population of the housing units.

The questionnaire mainly made use of a Five-point Likert scale with 1 meaning strongly dissatisfactory to 5 meaning strongly satisfactory to determine the environmental factors to the sustainability of PPP housing in the study area. The questionnaire was sectionalized into two (2). Section A consists of the socio-economic characteristics of the PPP housing dwellers with 6 close-ended questions while section B consists of the environmental factors to sustainable PPP housing on a Likert scale of 5 with 27 statements on environmental factors to PPP housing delivered.

Method of Data Analysis

For this study, a descriptive and inferential approach to data analysis was used. The distribution of PPP housing occupants was examined utilizing the descriptive section. The underlying structures in the set of environmental sustainability of the PPP housing as constructed in the study instrument were found using principal component analysis, a method of factor analysis. A principal component analysis is a multivariate statistical technique used to express variability among observable variables in terms of fewer unobserved variables known as factors, according to Yang (2005). An interesting construct may be validated using the principal component analysis. There are two basic uses for principal component analysis.

It is utilized for two purposes: first, data reduction, and second, finding structure (underlying dimensions) inside a group of variables. According to Howard, (2023) the choice of which factor to keep is based on the proportion of variation explained by the variable, the absolute variance explained by each factor, and if the factor has a meaningful interpretation. In general, factors with Eigenvalues larger than one are kept. The Kaiser-Meyer-Olkin (KMO) test and Bartlett's sphericity test can both be used to evaluate the sample's adequacy. The KMO statistic is a measure of proportional variance between variables that may share similar variation; it ranges from zero to one, with zero being insufficient and close to one being sufficient. The identity matrix (off-diagonal is 0) and the observed correlation matrix are compared using Bartlett's test. If they are comparable, there will need to be an equal number of factors and variables, rendering the analysis worthless. In general, Bartlett's sphericity test results with p 0.05 and KMO values more than 0.50 are regarded as acceptable.

Results and Discussion

Demographic Data Analysis of PPP housing dwellers

Table 1 depicts the frequency and percentage analysis of residents of delivered PPP housing in the study area. Item 1 of the table indicated the age range of the participants. Results indicated that the majority of the participants representing 294(33.2%) were between the age range of 40-54 years, 174(19.7%) were more than 70 years, 187(21.1%) were found to be between the age range of 55-69 years, 168(19%) were between the age range of 25-39 years while the minors representing 62(7%) were below 25 years. This implies that the age distribution of the participants was evenly distributed and was mature enough to have given substantive information about their respective PPP-delivered housing units.

From item 2 of the table, the result indicated from the educational background of the participants showed that the majority of them representing 323(36.5%) possess post-secondary education, 268(30.3%) have secondary education, 260(29.4%) have postgraduate education while the minor constituting 34(3.8%) of the entire participants have primary education. This implies that the majority of the respondents were found to have the minimum basic secondary education, indicating that the responses provided based on the set objectives of this research are unbiased as the basic concept of the survey is adjudged and understood by the selected participants.

On the analysis of item 3 as depicted by the participant's (dwellers) marital status, the result showed that the majority of them representing 513(58%) were married, 159(18%) were separated, 71(8%) were divorced, while, 89(10.!%) were widowed while 53(6%) of them representing the minority were single. The result implies that the fact the majority of the respondents are married and have at least one dependant, information on the satisfaction and sustainability of their apartment will be provided in an unbiased manner as information supplied on the building characteristics portrayed the true picture of each PPP delivered housing projects in terms of the minimum number of household (size) it can accommodate in each apartment.

Taking the participants' nature of employment into consideration, the result of item 4 showed that the

majority of them representing 427(48.2%) were civil/public servants, 188(21.2%) were self-employed, 81(9.2%) were wage earners while 189(21.4%) were retiree. This implies that civil/public servants (government workers) have major access to the housing units provided by the public/private partners as against self-employed participants and those working in the private sector of the economy.

It cannot be overemphasized from their socio-economic status in item 5 that majority of them which represents 425(48%) were in the category of upper medium income earners, 273(30.8%) were high-income earners, 168(19%) were lower income earners while 19(2.1%) of the entire participants were low-income earners. This implies that the majority of the dwellers can afford the housing units

provided by agencies irrespective of whether their payment methods are outright or in instalments.

From the analysis of item 6 depicting the range of average monthly income of the residents, the result showed that the majority of the respondents representing 292(33%) earn above ₦110,000.0, 249(28.1%) earn between ₦91,000-₦110,000, 160(18.1%) earn between ₦71,000-₦90,000, 119(13.4%) earn between ₦51,000-₦70,000 while 65(7.3%) of them earn between ₦30,000-₦50,000.

Hence, socio-economic characteristics of the participants as evidenced from the field survey, indicated that the PPP housing units were mostly benefitted by government workers who may later mortgage it to private individuals as evidenced from their nature of employment.

Table 1: Frequency and percentage analysis of residents' socio-economic characteristics

s/n	Socio-economic variables		Frequency	Percentage (%)
1	Age range of PPP Housing dwellers	Below 25	62	7
		25-39	168	19
		40-54	294	33.2
		55-69	187	21.1
		70 years >	174	19.7
		Total	**885**	**100**
2	Educational background	Primary	34	3.8
		Secondary	268	30.3
		Post-secondary	323	36.5
		Postgraduate	260	29.4
		Total	**885**	**100**
3	Marital status	Married	513	58
		Separated	159	18
		Divorced	71	8
		Widowed	89	10.1
		Single	53	6
		Total	**885**	**100**
4	Nature of employment	Government	427	48.2
		Self-employed	188	21.2
		Wage earner	81	9.2
		Retiree	189	21.4
		Total	**885**	**100**
5	Socio-economic status	Low income	19	2.1
		Lower medium income	168	19

		Upper medium income	425	48
		High income	273	30.8
		Total	**885**	**100**
		₦30,000-₦50,000	65	7.3
		₦51,000-₦70,000	119	13.4
6	Range of average monthly income	₦71,000-₦90,000	160	18.1
		₦91,000-₦110,000	249	28.1
		Above ₦110,000	292	33
		Total	**885**	**100**

Source: Field Survey, 2023

Environmental Factors that Influence PPP Housing Projects Delivered

Table 2 depicts the descriptive statistics of variables of environmental factors influencing PPP housing projects, the mean score and associated standard deviations can be evidenced. The result from items 1-29 showed mean response scores of 3.45 between 4.21 with a standard deviation ranging from 0.730 to 1.254. this implies that the majority of the residents were satisfied with the level of privacy in their house (mean score 3.72); satisfied with the open spaces, parks and reserves, individual space for each member of their household, building setback for outdoor living space, the distance of the building from the side boundary, the distance of the building from the rear boundary fence, the width of footpaths, off-street parking, colour(s) of paints used in the house and emergency/escape route provided in the buildings. In addition, they were also satisfied based on the building's aesthetic appearance, adequacy of on-street parking, and nearness of the house to medical facilities, and to firefighting station. However, residents were neutral based on the level of deterioration of their building on the premise of an increase in repairs and maintenance costs including space for landscaping. Other environmental factors as satisfied by the residents of PPP housing projects can be seen in items 20-27.

Overall, the grand mean score of 3.80 implies that the satisfactory level of the participants in terms of the environmental factors influencing PPP housing projects in Ogun State is high, implying that to some greater extent, environmental-wise, the PPP housing projects domiciled in the study area is satisfactory in terms of the provision made available. However, confirmatory analysis of the analysed table can be evidenced in the principal component analysis approach. This approach factors out the most prominent environmental factors influencing the PPP-delivered housing projects.

Table 2: Descriptive Statistics of Variables of Environmental Factors

s/n	Environmental factors	MS	SD	Remarks
Envf1	The level of privacy in your house	3.72	1.089	S
Envf2	Open spaces, parks and reserves	3.80	1.082	S
Envf3	Individual space for each member of your household	4.19	.730	S
Envf4	Building setback (distance from house to your property boundary) for outdoor living space.	3.99	.886	S
Envf5	Distance of your building from the side boundary	3.51	1.113	S
Envf6	Distance of your building from the rear boundary fence	3.84	1.059	S
Envf7	The width of footpaths	3.76	1.254	S
Envf8	Off-street parking	3.53	1.137	S
Envf9	Colour (s) of paints used in the house	3.69	1.118	S

Envf10	Emergency/Escape route	4.08	.921	S
Envf11	Aesthetic appearance	3.95	.974	S
Envf12	Adequacy of on-street parking	3.56	1.143	S
Envf13	The nearness of your house to medical facilities (hospitals/clinics)	3.97	1.022	S
Envf14	The nearness of your house to the firefighting station	3.70	1.056	S
Envf15	Level of deterioration of your building based on the annual increase in repairs and maintenance cost	3.45	1.129	S
Envf16	The brightness of light in your house during the daytime	3.72	1.127	S
Envf17	Indoor Air Quality	3.96	1.077	S
Envf18	Space for landscaping	3.49	1.184	S
Envf19	Noise level	3.56	1.111	S
Envf20	Water pollution	3.93	.965	S
Envf21	Landscaping of streets (i.e., trees, hedges, grass etc.)	3.75	1.070	S
Envf22	Air pollution	3.76	.992	S
Envf23	Source(s) of Water	3.71	1.031	S
Envf24	Drainage System	4.21	1.562	S
Envf25	Refuse disposal system	3.78	.890	S
Envf26	Street lighting	3.83	1.058	S
Envf27	Ventilation of House	4.11	.966	S

Envf = Environmental Factors; Weighted Averages: Strongly Satisfactory (SS) = 4.5-5.0;
Satisfactory (S) = 3.50-4.4; Neutral (N) = 2.5-3.4; Not Satisfactory (NS) = 1.5-2.4; strongly not satisfactory
(SNS) = <1.5; MS = Mean score; SD = Standard Deviation
Source: Researcher's Computation, 2023

Sampling Adequacy and Measure of Sphericity

The suitability of the sub-variables of the identified factors for principal component analysis was fine-tuned using the Kaiser-Meyer-Olkin (KMO) sampling adequacy and Bartlett's test of sphericity in Table 3. Coefficient 0.722 of the environmental sustainability variables indicated that the inter-relationships of the sub-variables were averagely adequate and of good precision. However, the Chi-square values of Bartlett's test of sphericity with degrees of freedom 378 indicated from the p-values < 0.05 that it is reasonable to consider applying a dimension-reduction technique to the aforementioned variables as the variables are from a multivariate normal distribution (MVN~(µ,∑), and that the correlation matrix is significantly different from an identity matrix. Since the value of KMO exceeds 0.5, using factor separation based on fundamental concepts is allowable.

Table 3: Kaiser-Meyer-Olkin (KMO) and Bartlett's Test

Factors	KMO Measure of Sampling Adequacy	Bartlett's Test	
		Chi-square	p-value
Environmental factors	0.772	12581.280[378]	0.000

Figures in parentheses [ ] represent the degree of freedom (*df*)

The component analysis results are shown in Table 4, where eight (8) main components with Eigen values greater than 1 explained 69.9% of the total variance. The first component explains approximately 23.1% of the total variance, and the second component explains approximately 12.32% of the overall variance among other components.

Table 4: Total Variance Explained Based on Environmental Factors

Component	Extraction Sums of Squared Loadings		
	Total	% of Variance	Cumulative %
1	6.470	23.107	23.107
2	3.439	12.283	35.390
3	2.282	8.151	43.541
4	1.910	6.821	50.362
5	1.708	6.102	56.463
6	1.531	5.468	61.931
7	1.153	4.119	66.050
8	1.069	3.817	69.866

Extraction Method: Principal Component Analysis.

Source: *Researcher's Computation*

Graphical representation of the ordered eigenvalues shown in Figure 1 also showed that eight (8) components with ordered eigenvalues greater than 1 are considered in identifying the prominent environmental factors influencing the PPP housing project delivered in Ogun State.
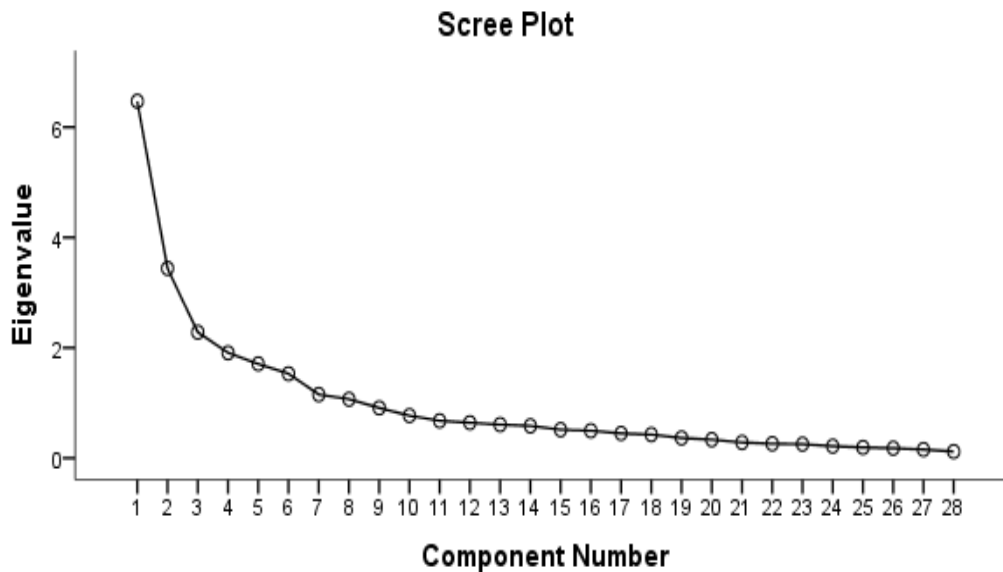

Figure 4.3: Scree plot of the ordered eigenvalue of environmental factors influencing PPP housing delivered

Table 5 revealed that component 1 is highly correlated with seven (7) original variables of the level of privacy in the apartment, building setback, the width of footpaths, aesthetic appearance, space for landscaping, water pollution and house ventilation. More so, component 2 is also correlated with two original environmental variables such as colour(s) of paints used in the house and light brightness, component 4 also correlated with three original variables of off-street parking and the level of deterioration the resident's buildings based on the annual increase in repairs and maintenance with components 4-8 correlating with one each of the original variables of the adequacy of on-street parking, nearness of the buildings to fire-fighting service, emergency/escape route, source(s) of water

and indoor air quality. Therefore, all eight constructed PCs are statistically significant as they contain 69.9% of the total variation of all the identified 27 environmental confirmed factors.

Hence, the nineteen identified original variables were found to be the major environmental factors influencing the PPP housing projects in Ogun State, Nigeria.

Table 5: Communalities and Component Matrix of Environmental Factors for the Sustainability of PPP housing projects

Dimensions	h^2	PC1	PC2	PC3	PC4	PC5	PC6	PC7	PC8
The level of privacy in your house	.845	.593	-.496	.349	-.312	-.076	-.134	-.027	.062
Open spaces, parks and reserves	.621	.363	.537	.184	.096	.031	.074	-.388	-.001
Individual space for each member of your household	.796	.480	.256	-.253	.019	-.177	-.603	-.204	.011
Building setback (distance from house to your property boundary) for outdoor living space.	.791	.600	-.323	-.391	-.137	.366	-.046	-.122	-.072
Distance of your building from the side boundary	.767	.544	-.268	.122	.600	-.036	-.023	.149	-.012
Distance of your building from the rear boundary fence	.687	.094	.517	.288	-.103	.073	.077	.510	-.216
The width of footpaths	.716	.589	-.027	-.417	-.139	-.369	.127	.082	.127
Off-street parking	.677	.428	-.417	.497	-.231	.023	.029	.037	.132
Colour (s) of paints used in the house	.652	.391	.566	.263	.123	.084	.111	-.244	.123
Emergency/Escape route	.652	.518	.287	-.281	-.041	-.122	-.447	.071	-.014
Aesthetic appearance	.785	.650	-.270	-.361	-.156	.355	-.010	.014	-.097
Adequacy of on-street parking	.667	.556	-.243	.151	.481	-.057	.076	.177	-.070
The nearness of your house to medical facilities (hospitals/clinics)	.600	.451	.409	.065	-.246	-.079	-.092	.348	-.168
The nearness of your house to the firefighting station	.771	.404	.100	-.332	-.036	-.440	.537	-.063	.032
Level of deterioration of your building based on the annual increase in repairs and maintenance cost	.609	.486	-.256	.424	-.268	.130	.076	-.028	.183

The brightness of light in your house during the daytime	.597	.484	.530	.063	.187	.170	-.067	-.095	.012
Indoor Air Quality	.663	.065	.392	.061	.092	.201	-.085	.399	.535
Space for landscaping	.728	.570	.055	-.309	.087	.519	.116	.099	.072
Noise level	.627	.254	-.284	.232	.602	-.103	.025	.230	.042
Water pollution	.684	.569	.402	.236	-.224	-.080	.115	.056	-.265
Landscaping of streets	.796	.511	.030	-.330	-.032	-.415	.476	.059	.146
Air pollution	.785	.480	-.514	.417	-.287	-.056	.057	-.155	.061
Source(s) of Water	.719	.274	.550	.328	.225	.093	.199	-.360	.074
Drainage System	.578	.262	.102	-.047	-.133	-.202	-.289	.026	.595
Refuse disposal system	.663	.483	-.095	-.249	.026	.551	.232	.004	.031
Street lighting	.821	.547	-.370	-.021	.468	-.217	-.259	-.142	-.177
Ventilation of House	.703	.662	.201	.128	-.246	-.146	-.138	.082	-.315

h^2 *(Communalities) represents the proportion of the variance of each variable that can be explained by the principal components*
Note: Bolded Communalities represents the 19 highly correlated original environmental factor variables
Source: *Researcher's Computation, 2023*

Conclusion

PPP housing can potentially contribute to environmental sustainability in various ways. For instance, PPP housing projects in the state have incorporated green building designs, such as energy-efficient systems, sustainable materials, and green spaces, to reduce the carbon footprint and promote eco-friendliness. PPP housing can also leverage public and private resources to invest in infrastructure and services that support sustainable living, such as public transport, waste management, and renewable energy. However, the environmental sustainability of PPP housing delivered depends on several factors, such as the design, location, materials, and management of the projects. Therefore, a thorough assessment of each PPP housing project is necessary to evaluate its environmental sustainability. Moreover, sustainability is a multifaceted concept that goes beyond environmental considerations to include social and economic dimensions. Therefore, the sustainability of PPP housing projects should also consider their impact on communities, affordability, accessibility, and long-term viability. The research work concludes that PPP housing projects delivered in the study area are sustainable environmentally and dwellers express a high level of satisfaction. This implies that despite challenges that may be experienced in the course of housing delivered through PPP, the method can be viewed to be one of the best methods. Thus, governments are encouraged to use the PPP approach for housing delivery. The environmental sustainability of PPP housing delivered can be more positively inclined in outcome if the projects are designed, implemented, and managed with sustainable principles and practices. However, the specific environmental sustainability of a particular project will depend on several factors that require careful analysis and evaluation.

References

Adianto, J., Gabe, R. T., Kurniawati, R., & Armenda, S. (2023). From shelters for numbers to shelters for welfare: rectifying the social housing provision programme in Jakarta. *Housing Policy Debate*, *33*(3), 662-680.

Alfen, H. W. (2019). Sustainable public-private partnerships: Conceptual framework and empirical evidence. *Sustainability*, 11(22), 6388.

Bakhtiari, E. (2020). The role of public-private partnerships in promoting sustainable housing. *Journal of Housing and the Built Environment*, 35(2), 545-562.

Carbon Trust. (n.d.). BedZED. Retrieved from https://www.carbontrust.com/resources/case-studies/bedzed

Dieleman, F. M. (2001). Modelling residential mobility; a review of recent trends in research. *Journal of housing and the built environment*, *16*, 249-265.

He, W., Hu, Z., Liu, J., & Lu, Q. (2020). Theoretical analysis and empirical study of the impact of public-private partnership on sustainable development. *Journal of Cleaner Production*, 244, 118823.

Howard, M. C. (2023). A systematic literature review of exploratory factor analyses in management. *Journal of Business Research*, *164*, 113969.

Kibert, C. J., Thiele, L. P., & Kibert, B. D. (2016). A review of public-private partnerships as a model for sustainable development. *Journal of Environmental Planning and Management*, 59(11), 1905-1926.

Lee, K. H., & Kim, J. H. (2019). Evaluating the sustainability performance of public-private partnership projects in Korea. *Sustainability*, 11(16), 4357.

Liu, J., Love, P.E.D., Smith, J., Matthews, J. and Sing, C.P. (2016), "Praxis of performance measurement in public-private partnerships:

moving beyond the iron triangle*", Journal of Management in Engineering*, 32 (4),1-10.

OECD. (2019). Public-Private Partnerships for Sustainable Development. Retrieved from https://www.oecd.org/dac/financing-sustainable-development/PPPs-for-sustainable-development.pdf

Olugbenga, T. D., Yusoff, N., Abd Aziz, N., & Baba, A. N. (2017). Unleashing the potential of housing sector in Nigeria as perceived by users. International Journal of Built Environment and Sustainability, 4(3).

The Lancet Public Health. (2021). Protecting the right to housing during COVID-19 and beyond. The Lancet Public Health, 6(4), e196. https://www.thelancet.com/journals/lanpub/article/PIIS2468-2667(21)00062-1/fulltext

UN-Habitat. (2020). The State of the World's Cities 2020: The Value of Sustainable Urbanization. Retrieved from https://www.unhabitat.org/sites/default/files/2020/07/swc-2020-full-report.pdf

United Nations. (2015). Transforming our World: The 2030 Agenda for Sustainable Development. Retrieved from https://www.un.org/sustainabledevelopment/sustainable-development-goals

Wong, L. P., Chen, Y., & Shen, L. (2021). Enhancing the environmental sustainability of public-private partnership projects: A review. *Journal of Cleaner Production*, 291, 125891.

Yang, B. (2005). Factor analysis methods. *Research in organizations: Foundations and methods of inquiry*, (181-199).

Zarte, M., Pechmann, A., & Nunes, I. L. (2019). Decision support systems for sustainable manufacturing surrounding the product and production life cycle–A literature review. *Journal of Cleaner Production*, 219, 336-349.