Journal Homepage: www.ijrpr.com ISSN: 3049-0103 (Online)

International Journal of Advance Research Publication and Reviews

Vol 03, Issue 10, pp 517-523, October, 2026

Sustainability Indicators Assessment for Peri-Urban Housing Environment: A Review with Focus on Developing Nations and Ibadan, Nigeria

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ABSTRACT :

Sustainability of the housing environment is a major challenge in developing countries because of rapid urbanization, unplanned peri-urban growth, inadequate infrastructure, socioeconomic inequalities and weak development control. This paper reviews some of the indicators for assessing housing environment sustainability in developing countries within the background of peri-urban Ibadan, Nigeria. The sustainability of the housing environment is understood as the capacity of residential areas to provide safe, healthy, affordable, accessible, inclusive, economically sustainable and environmentally resilient living conditions.

The paper examines indicators in six dimensions: environmental quality, infrastructure, social well-being, economic viability, governance and climate resilience. These include sanitation, drainage, waste management, pollution, access to basic services, housing adequacy, residents' welfare, institutional effectiveness, stakeholders' participation and compliance with development control regulations.

The review emphasizes the unsuitable use of generic sustainability assessment frameworks without considering the local realities, in particular socioeconomic conditions, institutional capacity, infrastructure deficiencies and environmental risks. The peri-urban Ibadan context shows the need for measurable, locally relevant indicators that incorporate residents' perspectives along with physical, social, economic and governance factors. The paper therefore proposes a flexible and context-sensitive framework for assessing housing environment sustainability, supporting effective development control and promoting sustainable peri-urban development in Ibadan and similar cities.

Keywords: Sustainable Housing Environments, Sustainability Indicators, Peri-Urban Development, Developing Countries, Ibadan, Nigeria.

Introduction

The sustainability of housing ecosystems is a growing concern as cities expand their fringes and consume neighbouring rural areas. The peri-urban interface is a critical issue because it is where a large share of new residential development takes place, often outstripping the infrastructure, environmental services and institutional frameworks required. Thus, the availability of peri-urban housing cannot be measured only in terms of the physical adequacy of individual buildings or the presence of structures.

Other conditions to be considered are the quality of the environment in the neighbourhood, infrastructure, accessibility, social conditions, environmental safety, economic feasibility, governance and the capacity of the citizens to sustain a sufficient quality of life in the long term. The sustainability assessment is currently defined as an indicator-based process. Sustainability indicators are a useful tool to make the abstract and often ill-defined concept of sustainable development measurable and therefore comparable in different places and over time. However, recent literature emphasizes that transferability of metrics from one city or country to another is not straightforward without considering local environmental, cultural, economic and institutional contexts.

A study to assess the sustainability of neighbourhoods in metropolitan Lagos in 2023 found similarities between indigenous indicators and established global assessment frameworks, but also major differences due to contextual factors. Such a context-based approach is especially important in peri-urban areas. Their living environments are characterized by rapid growth, diverse land uses, infrastructural deficiencies, ecological problems, socio-economic diversity and changing governance arrangements. It is therefore necessary to develop a battery of comprehensive and context-specific indicators to assess the sustainability of living environments.

Concept of Housing Environment Sustainability

The sustainability of the housing environment is not only related to the physical characteristics of a dwelling, but also to the environmental, social, economic and institutional contexts where it is located, built and occupied. Sustainable housing is housing that provides adequate living conditions, conserves ecological resources, enhances social well-being, maintains affordability and ensures institutional capacity for long term development management.

As Adamec et al. (2021) state, sustainable housing is an integrative approach that aims to balance environmental, social, economic and institutional dimensions within the framework of buildings, communities and localities. Likewise, Michalina et al. (2021) showed that the modern sustainability frameworks increasingly value sustainability as a multidimensional construct rather than the environmental dimensions alone.

Gavaldà et al. (2023) stress the importance of a sustainability assessment as a key step to build a strong connection between indicators, measurable results and overarching goals of urban liveability. This is particularly the case in peri-urban areas where residential environments are immersed in fast-changing transitional landscapes with urban sprawl, conversion of agricultural land, infrastructural deficits, environmental problems and institutional weaknesses.

Therefore, the sustainability of the residential milieu should be defined as the ability of peri-urban communities to provide safe, affordable, accessible, healthy and environmentally sustainable housing, and at the same time to maintain the capacity to adapt to future social, economic and climatic challenges.

Sustainability Indicators as a Tool for Assessing Housing Environments

Sustainability indicators are quantitative measures that enable the practical implementation of the wide-ranging and complex concept of sustainability. They allow scholars and decision makers to translate non-tangible objectives such as environmental integrity, societal welfare, cost effectiveness and good governance into quantifiable and comparable measures.

Adamec et al. (2021) developed a Sustainable Housing Assessment Tool with 55 phenomena and the respective method of assessment. The importance of the indicator-based methods for the assessment of housing is emphasized. Similarly, Hiremath et al. (2013) argued that the indicator-based assessment provides a pragmatic basis to incorporate environmental conservation and developmental objectives in urban planning.

Michalina et al. (2021) in their recent analysis of 50 urban sustainability indicator frameworks showed that indicators are increasingly used for sustainability assessment in the environmental, social, economic and institutional dimensions. Adeyemi et al. (2023) in their study of neighbourhood sustainability assessment in Lagos Metropolis state that sustainability indicators are important in monitoring progress toward sustainability goals but must be contextualized to the context of use.

Momoh et al. (2024) review the SUCCEED assessment tool for developing countries and emphasize the significance of selection, prioritization and integration of sustainability indicators. This study is particularly relevant for developing countries because it challenges the assumption that sustainability assessment frameworks developed in Western countries can be directly applied without adaptation. This is an important methodological justification for the present study. The metrics to be used for assessing housing conditions in the peri-urban areas of Ibadan should be grounded on the realities of housing, infrastructure, environmental, socio-economic and planning institutions in Nigeria and should be conceptually in line with global sustainability principles. A carefully chosen set of indicators allows for an analysis of the interaction between housing conditions, quality of the environment, availability of services, social well-being, economic stability and governance.

Dimensions of Housing Environment Sustainability

Traditionally, the literature considers ecological, social and economic aspects as the foundations of sustainability, however modern models also include institutional or governance aspects. For example, Adamec et al. (2021) have included environmental, social, economic and institutional aspects in their framework for the assessment of housing sustainability.

According to Michalina et al. (2021), indicators in urban sustainability frameworks are usually grouped into four dimensions; environmental, economic, social and institutional. Gavaldà et al., (2023) showed that at present urban sustainability assessments require a multi-dimensional integration, but not a single perspective of sustainability.

Environmental aspects of residential environments include waste, pollution, energy, water, green spaces and ecological health. The social dimension includes health, security, accessibility, equity, educational facilities, and community services and social cohesion. The economic dimension covers affordability, employment, household economic status and housing costs. The institutional dimension involves governance, citizen participation, urban planning, development control and institutional performance.

For peri-urban housing, a multidimensional framework would be more appropriate as it could be the case that the environmental quality degrades even if the housing is economically viable and that infrastructure is not in place even if the physical quality of housing improves – as pointed out.

Environmental Indicators

Environmental Indicators measure the performance of residential environments regarding natural resource conservation and good ecological conditions. The main indicators are: quality of air and water, waste disposal, energy consumption, land use efficiency, green spaces, pollution levels, drainage and environmental risks.

Key environmental dimensions of urban sustainability frameworks are water, waste, air quality, energy, land use and climate change (Michalina et al., 2021). However, Goodwin et al. (2021) found that many urban sustainability frameworks are often more effective at addressing carbon, water and land use demands compared to more hidden ecological impacts such as biodiversity and nutrient pollution. In addition, Thomas et al. (2021) argued that equity should be incorporated into environmental indicators, as the quality of the environment is not the same for all urban residents.

Environmental indicators are particularly important in peri-urban areas where rapid land change can lead to erosion, flooding, accumulation of waste, loss of vegetation and pollution. Hence, a measure of environmental sustainability should be based on the condition of the surrounding residential area and the larger ecological forces acting upon the community.

Infrastructure as a Sustainability Indicator of Housing Environments

Infrastructure as a key component of the sustainability of housing ecosystem. Access to basic services is a central dimension of housing quality. Some of the relevant indicators are: potable water, energy, sewage, toilets, roads, rubbish, telecommunications, public transport and social infrastructure.

Adamec et al. (2021) framed infrastructure-related factors in a building-community-locality framework. Assessment of urban sustainability is reliant on social infrastructure and provision of essential services (Michalina et al., 2021). Access to transport, sanitation and vital infrastructure are key components of the built environment and overall wellbeing, according to OECD (2023). Infrastructure indicators are particularly important in peri-urban areas where housing growth is often faster than public infrastructure development. This may result in rapid housing development in a settlement without improvements to roads, drainage, water supply, electricity and waste management systems.

Social Sustainability Indicators

Social sustainability metrics look at whether residential environments are enabling health, safety, inclusiveness, equity, accessibility, social cohesion and quality of life. Typical indicators include: education and health services; safety in the neighbourhood; recreational facilities; social cohesion; equal opportunity; participation in the community; and access to public utilities.

For example, Michalina et al. (2021) define social sustainability in key categories such as education, health, housing, safety, equity, social infrastructure, green space and culture. Dixon and Woodcraft (2018) emphasized social sustainability as the capacity of places to sustain social and cultural well-being over time. A recent systematic review by Barron et al. (2021) found that sustainable urban development is strongly related to social inclusion and access to basic services and resources.

The usefulness of social indicators is particularly evident in demonstrating the distinctions that exist between communities and social classes in peri-urban housing situations. The house may be structurally sound but the living environment may not be sustainable in the absence of educational institutions, health care facilities, recreational amenities, safety, or opportunities for engagement. For example, social sustainability ranges from the condition of the dwelling to the quality of life and the inclusiveness of the community.

Economic Sustainability Indicators

Economic sustainability is also reflected in the existence of affordable housing that does not impose a heavy economic burden on families and communities, and supports livelihoods and economic opportunities. Common signals are home affordability, household income, rate of employment, housing costs, construction and operational costs, access to financing and economic stability.

In terms of economic factors, the most important in urban sustainability models are economic performance and job creation (Michalina et al., 2021). Housing cost burden and overcrowding are important indicators of the welfare impacts of the built environment (OECD, 2023. Emerging evidence on housing affordability suggests strong links between housing costs, housing quality and wider sustainability outcomes.

The economic sustainability of peri-urban areas is based on the accessibility of land and housing for households and the adequacy of their income to meet basic services, maintenance and other household needs. So, if the structure is adequate but the costs are too high, the housing may not be sustainable in the long run.

Governance and institutional indicators

Governance and institutional indicators measure the effectiveness, transparency, accessibility and responsiveness of the institutions responsible for planning, land management, infrastructure and development control. The metrics are: planning effectiveness, transparency, civic engagement, institutional collaboration, availability of land data, regulatory enforcement, recognition of land entitlements and control of corruption. This is particularly important in peri-urban areas where rapid development can outstrip institutional capacity.

Babalola (2023a) found that the residents of peri-urban Ibadan viewed efficiency, transparency, corruption control and recognition of land rights as important but poorly implemented. Likewise, Babalola (2023b) identified variations in sustainability performance (environmental, social and economic indicators) in peri-urban areas of Ibadan. Development control can be useful for urban sustainability but lack of resources, poor funding, political interference and institutional weaknesses may impede its effectiveness (Adeyemi et al., 2023).

Climate Resilience: A New Dimension of Sustainability

Climate-related threats compromising otherwise sufficient housing conditions are giving rise to the importance of climate resilience in the sustainability of residential environments. The key indicators are vulnerability to flooding, exposure to heat, efficiency of drainage systems, preparedness for disasters, availability of emergency services, good construction, ecological infrastructure and response of communities to climatic stresses.

Increasingly, studies on urban resilience have connected sustainability and resilience. Sustainable communities must be resilient to disturbances and capable of maintaining critical functions. Urban resilience is defined as the capacity of urban systems to absorb shocks and recover quickly to optimal functioning after disturbances (Meerow et al., 2016). According to the authors Sharifi and Yamagata (2018), it is important to measure resilience to understand how well cities can respond to hazards related to climate change.

Adewoyin et al. (2024) showed that the peri-urban green infrastructure in Ibadan, Nigeria, could enhance climate resilience by addressing the challenges of flooding, heat and biodiversity depletion. The importance of climate resilience should be a key component in the assessment of housing sustainability. Sustainability of a community in today's context may not translate to sustainability if it is highly vulnerable to future climate risks.

Customized Indicators for Developing Countries: Evidence from Peri-urban Ibadan

Sustainability indicators cannot be transferred from rich to poor countries or peri-urban areas. The choice of indicators should take into account local socio-economic conditions, deficiencies in infrastructure and governance frameworks, environmental risks and development trajectories.

Shen et al. (2011) highlighted the need for urban sustainability indicators that are specific to the context, while Michalina et al. (2021) identified substantial differences among urban sustainability frameworks, which partially mirror the diversity of cities' risk priorities and contexts.

Momoh et al. (2022) developed the SUCCEED methodology for the assessment of neighbourhood sustainability in the Nigerian context, incorporating social, environmental, economic and planning considerations. A crucial lesson from current research on sustainability is that indicators are difficult to share. For example, Adeyemi et al. (2023) examined neighbourhood sustainability indicators in metropolitan Lagos and found that while some indicators were aligned with international standards, there were large variations in indicators based on contextual factors. The study concluded that sustainability indicators are context specific and that the adaptation of western evaluation frameworks for developing countries can be a challenge.

Momoh et al. (2024) also contribute to the mix, with a study of the SUCCEED neighbourhood sustainability evaluation instrument for emerging countries. They demonstrated that the sustainability assessment is affected by the way weighting and aggregation are performed. This means that metrics must not be borrowed from LEED, BREEAM, CASBEE or other recognised frameworks without considering the socio-economic, environmental and institutional contexts of Ibadan for the present study. Ibadan evidence supports need for contextual adaptation. (2023b) examined 29 sustainability indicators across peri-urban communities and found a significant gap between the aspirations of people and the actual sustainability outcomes. Air quality, schools, recreational facilities, equal opportunities and electrical supply were important, as the locals supposed.

A framework for a key indicator for peri-urban Ibadan should be based on deficiencies in local infrastructure, environmental conditions, socioeconomic status, development regulation, governance and spatial inequalities between communities and not on external assessment models.

Main Synthesis of Studies

The literature reveals a clear shift from the assessment of housing in one dimension to a comprehensive study of housing and environmental sustainability. Existing frameworks are increasingly taking into account environmental, social, economic and institutional dimensions. Community attitudes and climate resilience are becoming more important. The indicator-based evaluation offers a systematic approach to translate these features into measurable metrics. But the selection of indicators must be done carefully to accurately reflect local conditions.

This contextual factor is especially pertinent in peri-urban localities where rapid urbanization creates particular combinations of infrastructure deficiencies, environmental degradation, socio-economic inequalities, land-use change and institutional barriers. The Ibadan data show that the physical characteristics of housing do not explain sustainability outcomes. The viability of residential environment depends on anticipation of inhabitants, availability of infrastructure, environmental standards, socio-economic conditions and efficiency of regulation of land management and development.

Babalola's research on per-urban Ibadan is important because it provides empirical evidence that residents are able to distinguish between the importance of sustainability attributes and their actual implementation in practice, and thus provides a basis for prioritising policy actions. It is therefore possible to systematically structure a contextually relevant evaluation framework for peri-urban Ibadan along six interdependent dimensions: (i) Physical/housing conditions; (ii) Environmental quality; (iii) Infrastructure and services; (iv) Social wellbeing; (v) Economic sustainability; and (vi) Governance and institutional effectiveness, with climate resilience and residents' perception serving as cross-cutting assessment considerations.

This methodology provides a better basis for identifying geographic disparities in housing sustainability and for relating empirical results to policies of development regulation and sustainable urban planning.

Cognitive Deficiencies

Great advances have been achieved in the area of sustainability assessment studies, but many deficiencies are still present.

- Lack of a universal indicator system: There is no widely accepted system of sustainability indicators for housing-environment that can be applied to all peri-urban areas. Recent studies show that indicators need to be adapted to the local environment.
- Poor integration of housing and community indicators: Some studies are focused on construction performance, others on local services. Very few studies attempt to incorporate housing quality, infrastructure, environmental standards, social conditions, economic capacity and governance into a single framework.
- Lack of attention to peri-urban Nigeria. Despite huge progress in sustainability assessment frameworks globally, there is a lack of empirical studies on integrated housing-environment sustainability indicators in the fast-urbanizing peri-urban areas of Nigeria.
- Limited spatial analysis in Ibadan: Babalola (2023) provides strong evidence at the level of some peri-urban settlements, but there is a need for a thorough spatial assessment across the different peri-urban LGAs of Ibadan.
- Integration of development control: Impact of urban planning and administration on physical development outcomes However, sometimes, sustainability assessment systems distinguish administration and effectiveness of housing-environment. The current study can address this deficiency by examining the execution of development control in conjunction with physical, environmental, and socioeconomic metrics.
- Insufficient correlation between socio-economic attributes and sustainability results: It is essential to determine how residents' socio-economic traits, including income, education, occupation, and tenure, affect the sustainability ratings of their housing settings.
- Insufficient attention to climate resilience: Flooding, erosion, elevated temperatures, and altered precipitation patterns are becoming increasingly significant in Ibadan, although these threats are not consistently integrated into traditional neighbourhood sustainability models.

Conclusion

Sustainable urban development plays a crucial role in the sustainability of housing environments, particularly in the peri-urban regions of developing nations, where swift urbanization, unregulated spatial growth, insufficient infrastructure, socio-economic disparities, and institutional deficiencies present significant planning challenges. The research established that sustainable housing environments are not only based on the quantity of residential buildings but also quality of the surrounding ecosystem, access to critical infrastructure, social welfare, economic viability, effective governance and resilience to environmental threats. Hence, a sustainability assessment of residential environments requires a comprehensive strategy considering the interdependence of physical, environmental, socio-economic and institutional characteristics of residential areas.

Environmental indicators, such as drainage condition, sanitation, waste management, land use, and pollution control determine the ecological condition

and safety of residential areas. Availability of clean water, electricity, transportation networks and adequate sanitation facilities are concrete indicators of adequacy of housing conditions in meeting the basic needs of inhabitants. These assessments are based on social and economic indicators that measure adequacy of housing, health, safety, affordability, equity, employment prospects and ability of residents to maintain acceptable standards of living; Governance and institutional factors are also important, as the quality and sustainability of peri-urban housing environments are strongly influenced by the effectiveness of planning regulations, development control, stakeholder participation, institutional cooperation and enforcement mechanisms.

One of the main findings that can be extracted from this review is the increasing need to embed climate resilience into the sustainability assessment of housing environments. Peri-urban areas are becoming increasingly vulnerable to environmental hazards such as flooding, erosion, changing rainfall patterns, poor drainage and inappropriate land use.

Therefore, integrating climate-related measures into sustainability assessment frameworks would improve the capacity of planning agencies and communities to identify vulnerabilities, predict environmental hazards, and foster safer and more resilient housing development. This illustrates the inadequacy of the traditional sustainability assessment frameworks when applied without due consideration of the local conditions especially in the peri-urban area of Ibadan.

The variation in socio-economic status of inhabitants, availability of infrastructure, geographical features, ecological issues, understanding of developmental regulations, institutional efficiency implies the need for context relevant indicators to the study area. The indicators must be measurable, flexible and detailed enough to reflect both the objective environmental conditions and the occupants view on the quality of their home environment. Such a decision also has to take into account the pragmatic limits of developing countries such as limited financial resources, weak institutional capacity, inadequate environmental data and competing demands on urban infrastructure. Development of a multi-dimensional framework of sustainability indicators of residential environment, which are contextually relevant to assess peri-urban residential environments and to guide sustainable urban development strategies, is needed.

In conclusion, the environment, infrastructure, social, economy, governance and climate-resilience indicators can help in improving development regulation, support prioritization of infrastructure investment, protect the environment, and promote inclusive urban planning for Ibadan and other similar cities in developing countries. Future research should focus on validating and prioritizing these indicators with residents, built environment professionals, planning officials and other relevant stakeholders. This will help operationalize sustainability assessment, re-evaluation of development control regulations and in developing healthier, safer, more equitable and environmentally sound peri-urban housing.

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