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Appraising Habitability of Affordable Housing Projects in Nairobi, Kenya

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ABSTRACT

The objective of this study is to empirically evaluate the habitability of three exemplary affordable housing projects in Nairobi, Kenya, based on criteria related to physical house qualities and architectural excellence. A 24-item questionnaire derived from a synthetic habitability measure was delivered to 92 participants, with data analysis conducted utilising the Severity measure (SI). The findings indicated that respondents primarily derived functional meaning from specific habitability variables such as circulation and access efficiency, locational factors, acoustic quality, and the suitability of height and density, whereas social meaning was predominantly derived from the capacity to foster interaction and the adequacy of privacy. Residents found diminished significance in housing resilience and the implementation of sustainable and renewable systems. Anova tests indicated substantial correlations between inhabitants' essential socio-demographic attributes and specific variables. The analysis of national and global housing standards was conducted using three checklists, while interviews with professionals in architecture, planning, and health were employed to evaluate the impact of the planning system on habitability. Findings can aid policymakers in identifying and prioritising the most significant aspects when formulating future housing plans in Kenya.

Keywords: Affordable housing, Habitability, Public housing, Minimum dwelling standards.

INTRODUCTION

Extensive research indicates that approximately one billion individuals resided in inadequate, overcrowded, and substandard housing conditions at the turn of the millennium, a figure expected to increase steadily, particularly in the Global South regions of Africa, Latin America, and Asia (Bredenoord, van Lindert, & Smets, 2014; UN-Habitat, 2003). Various initiatives have been implemented to address the two primary issues of housing affordability and availability in Kenya. Policy initiatives such as rent control and interest rate subsidies seek to address affordability (UN-Habitat, 2011), while availability is managed through the functions of 'enabler' (private sector participation in housing production) and 'provider' (government construction of new housing and enhancement of informal settlements) (Huchzermeyer, 2008; Schramm, 2017). The direct participation paradigm has faced criticism for insufficient involvement of intended beneficiaries in the planning process. Researchers have examined whether the objectives of the professionals involved are to meet the needs of the National Housing Corporation (NHC) by minimising time and expenses, or to ensure the construction of suitable buildings that address users' spatial needs (Fernandez & Calas, 2011; Ochieng, 2007). These problems significantly shape the research questions utilised in this study. Habitability is crucial as it constitutes one of the principal criteria established by the United Nations in defining 'adequacy' in affordable housing efforts, alongside affordability, accessibility, security of tenure, cultural responsiveness, and infrastructure provision. United Nations Human Settlements Programme, 2003.

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The housing constraints in Nairobi, stemming from colonial policies enacted in 1905 and 1927, fostered racial and spatial isolation, relegating Africans to informal settlements on the outskirts of the city (Amis, 1984; Ochieng, 2007; Makachia, 2011). The housing shortages intensified post-independence due to the misappropriation of land resources returned by the British, coupled with economic factors and rapid urbanisation. The result is an urban population of around 1.5 million inhabitants (60% of the total population) living in 134 informal communities scattered throughout the city (Syagga, Mitullah, & Gitau, 2001; UN-Habitat, 2006). This is accompanied by rapid urbanisation, with the urban population rising from 9.9% in 1969 to 22% in 2010, propelled by improvements in social services and employment opportunities (UN-Habitat, 2010). Despite acknowledging universal access to adequate housing as a fundamental human right for all citizens (ROK, 2004) and ratifying international human rights treaties, Table 1 demonstrates that the government has offered a limited quantity of housing units during the past three decades.

Table 1: Housing units delivered over a 30-year period.

Duration/ Region	**1986-1990**	**1991-1995**	**1996-2000**	**2001-2005**	**2006-2010**	**2011-2015**	**2016-2017**
Nairobi	454	970	173	333	926	1367	1,600
Coast	0	157	22	161	0	0	0
Eastern	0	128	0	0	0	0	0
Central	523	66	77	54	38	0	0
Rift-Valley	237	40	0	39	0	0	0
Nyanza	105	0	0	0	138	40	500
Western	596	252	0	0	80	0	126
North-Eastern	0	0	0	0	0	0	0
Total	**2,187**	**1,613**	**272**	**587**	**1,182**	**1,407**	**2,226**

Adapted from (ROK, 1996, 2011, 2018)

Table 1 illustrates the substantial deficit of housing supply in comparison to demand. Kenya's urbanisation data indicate that the housing gap escalated from 60,000 units per year in the 1980s to 150,000 units by 2004 (ROK, 2004). Delivery figures for the 30-year period commencing in 1986 have predominantly stayed below 2,000 units for each five-year interval. This equates to 270 units annually, which is exceedingly insufficient (under 2%) in comparison to the yearly deficit. Government engagement in housing production in Latin America, namely in Colombia and Mexico, constitutes almost 60% of the official housing sector (Landázuri & Mercado, 2013; Pérez Pérez, 2011).

Housing studies in Nairobi are adequate but predominantly concentrate on squatter housing (Huchzermeyer, 2008; Meredith & MacDonald, 2017; Mitullah, 2003; Weru, 2004), affordability concerns (Fernandez & Calas, 2011; Ochieng, 2007), and privately developed urban housing, including multi-storey tenement structures (Gulyani, Talukdar, & Bassett, 2018; Huchzermeyer, 2007; Mwangi, 1997). In the Kenyan context, there exists a paucity of post-occupancy evaluative studies that examine residential evaluation through the theoretical lens of the 'meaning of housing/built environment.' This approach emphasises the relationships and perceptions of inhabitants regarding their housing, the manner in which users attain satisfaction by ascribing significance to their residential environments, and the evaluation of the objective performance of livable spaces in relation to minimum dwelling

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standards. This study addresses the subject of whether residents of public inexpensive housing see their flats as habitable and suitable for their housing needs. What is the habitability of residential areas according to minimum dwelling standards criteria, and how have planning systems and policies impacted housing habitability?

Although there is a substantial amount of study on inexpensive housing, the current literature has not adequately examined the habitability of affordable housing projects in Nairobi, Kenya. These shortcomings are substantial as they restrict the capacity to formulate comprehensive, evidence-based solutions that can enhance housing circumstances for low- and middle-income residents. The subsequent are several significant deficiencies recognised:

- Insufficient emphasis on habitability in studies of inexpensive housing: The affordability of housing is well-documented; nevertheless, the notion of habitability encompassing spatial quality, health and safety standards, access to necessary services, and environmental conditions has not been extensively examined in Nairobi's cheap housing initiatives. Research by Kieti & Mutua (2019) and Amollo (2018) predominantly emphasises the cost and quantity of cheap housing, overlooking the extent to which these units satisfy the living standards necessary for human well-being. Consequently, there is an absence of thorough frameworks or benchmarks expressly intended to evaluate the habitability of inexpensive housing in urban locales such as Nairobi.

- Limited empirical research on resident satisfaction and experiences: There are few empirical studies that have documented the lived experiences and satisfaction levels of residents in Nairobi's affordable housing initiatives. Comprehending occupants' perceptions of their dwellings' habitability, encompassing factors such as spatial adequacy, safety, community engagement, and accessibility to social infrastructure (educational institutions, healthcare facilities, marketplaces), is essential for assessing housing quality. Although studies like Were et al. (2021) examine the physical state of affordable housing, there exists a deficiency in research that incorporates qualitative data from the inhabitants' viewpoints. In the absence of this, policy proposals may become top-down and insufficiently attuned to the needs of the target population.

The influence of urban planning and infrastructure on housing habitability: There is a lack of study regarding the effects of urban planning policies and adjacent infrastructure on the habitability of affordable housing initiatives in Nairobi. Although research frequently emphasises the housing units, there is insufficient focus on how the proximity of these developments to urban amenities, transit systems, career prospects, and green areas influences occupants' quality of life. Housing that is geographically isolated from economic and social centres may restrict prospects for social mobility and general well-being, irrespective of the internal liveability of the units. The absence of cohesive infrastructure development (e.g., roads, drainage systems, power, and water supply) in certain cheap housing complexes aggravates substandard living conditions. Investigation is required to examine how urban planning and infrastructure availability, or their absence, influence the efficacy of affordable housing projects.

Theoretical Perspectives and Background to Habitability

This study's concepts are informed by the theoretical framework established in Amos Rapoport's 1982 publication, the Meaning of the Built Environment, which examined individuals' interactions with their constructed surroundings (Shema, et.al., 2025). The foundational study examines the influence of housing on daily life activities

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and how significance informs the design and utilisation of residences (Rapoport, 1982; Wohlwill & VanVliet, 2013). Meaning is intrinsically linked to environmental evaluation, in which constructed forms and physical elements imprint cognitive taxonomies and schemata in individuals' minds, subsequently decoded to interpret and assign significance to the world (Rapoport, 1968, 1982; Shema, 2019). This process is depicted in Figure 1 and aligns with the findings of McIntyre et al. (2006), which assert that meaning is fundamental to comprehending environmental dynamics, and the interactions between occupants and housing constitute a reciprocal process involving ongoing assessments of previous meanings and the creation of new ones. Rapoport's beliefs are additionally corroborated by Lawton (1982) and Mercado & Gonzalez (1991), who propose that architecture serves as a medium for conveying intricate meanings. Lawton observes that meanings are varied, with users' interpretations deviating from those of designers, as the former are influenced by emotional, personal, and symbolic connections through spatial arrangements, shapes, and colours (Lawton, 1982; Rapoport, 1968).

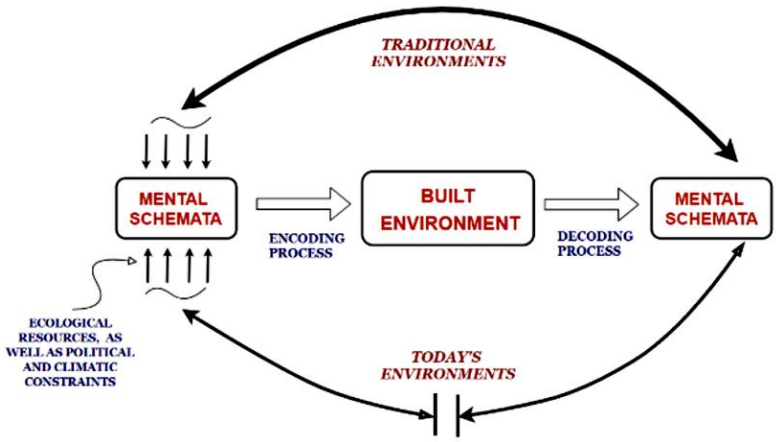

Figure 1: Processes of encoding and decoding mental schemata. (Rapoport, 1982).

This study examines Rapoport's concept of 'meaning' in housing by classifying it into three aspects. The functional significance of housing is based on the notion of habitability proposed by Mercado and Gonzalez (1991). Functionality, as defined by McGuire & Schiffer (1983), refers to the intentionality of housing in fulfilling the daily requirements of its occupants, or the fundamental utilitarian roles anticipated from architectural environments. Secondly, housing possesses social significance, examining the abstraction of housing as a social process in which meaningful human interactions with the environment are facilitated and integrated. The third aspect pertains to the symbolic significance of housing and addresses semantic and semiotic ideas of how housing enables communication and representation. Habitability refers to the qualitative characteristics of environments and their capacity to fulfil both objective and subjective requirements of occupants, facilitating healthy biological, psychological, and social development of inhabitants (Castro, 1999; Mercado & González, 1991). Meng et al. (2006) conceptually define habitability as the benefits that buildings provide to their occupants concerning dignity, health, and safety, while highlighting spatial organisation factors such as the dimensions and arrangement of spaces. Castro (1999) correlates habitability with the quality of life of inhabitants and the expectation that housing will provide

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superior levels of physical and mental health while meeting basic dwelling criteria. Habitability is evaluated from two primary perspectives: internal habitability at the housing unit level and external habitability, which examines the link between units and their neighbourhoods and the city.

Habitability studies are prevalent in fields such as social sciences, healthcare, and architecture, concentrating on aspects of inhabitants' well-being, including health (Dunn, 2000), quality of life (Ávalos, 2003), and residential satisfaction (Mohit, Ibrahim, & Rashid, 2010; Turkoglu, 1997). These studies illustrate how inadequate housing negatively impacts these dimensions of wellbeing. Numerous studies in the Global South experimentally evaluate habitability through diverse theoretical frameworks. Tarchópulos and Ceballos (2003) conducted a study examining the habitability of cheap housing in Bogotá through both physical and non-physical (intangible) characteristics. The findings indicated that the bulk of homes did not satisfy resident expectations, necessitating the demolition and re-adaptation of 85 percent of the housing inventory. Similarly, the research conducted by Landázuri and Mercado (2004) examines habitability by analysing spatial configurations and housing attributes in Mexico City, alongside the study by Molar-Orozco and Acosta (2013) that explores occupancy circumstances in low-income housing. The latter study determined that at least 69.52% of the studied housing stock met the criteria for habitability, based on room dimensions, quantity, and circulation efficiency. In the Asian context, studies on habitability have been conducted in Turkey (Sarıoğlu-Erdoğdu, 2015; Turkoglu, 1997), Malaysia (Mohit et al., 2010; Salleh, 2008), and China (Chen, 2003; Huang & Du, 2015), while in Africa, research has been undertaken in Nigeria (Ibem & Alagbe, 2015; Onibokun, 1974), Ghana (Baiden, Arku, Luginaah, & Asiedu, 2011), and South Africa (Aigbavboa & Thwala, 2012). These studies find that insufficient physical housing attributes negatively impact residents' habitability, health, and quality of life.

Alternative study evaluates habitability by analysing the sufficiency of physical and psychological dimensions of space, including privacy, residential overcrowding, and neighbourhood density (Gulyani et al., 2018; Pérez Pérez, 2011). The concept of privacy has been extensively analysed by scholars like Altman (1975), who defines it as the selective management of access to the self. In contrast, crowding can be assessed through objective physical-spatial metrics, including *floor area per person, individuals per room, occupants per bedroom, families per dwelling, people per square kilometre, and dwellings per acre*.

Further layers of meaning include social importance, highlighting the abstraction of housing as a social process that facilitates meaningful human interactions with the environment and addresses behavioural demands (McGuire & Schiffer, 1983; Rapoport, 1982). Social significances are intrinsic to the configuration of spaces and their utilisation patterns (Altman, 1975). O'Mahony (2012) underscores that the social implications of housing vary across situations, with elements such as control, privacy, and social identity perceived differently by diverse groups. Knox (1982) and Glaeser & Sacerdote (2000) underscore the relationship between home habitability and social connections, highlighting housing's critical role as a medium for sustaining social interactions. The fundamental element, the symbolic importance of housing, analyses the semantic and semiotic characteristics of housing and architecture, together with their role in facilitating communication and representation (Minai, 1984). Many studies contend that spatial configurations and architectural organisation can provide spatial cues and contextual frameworks for user

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interpretation, while also communicating symbolic dimensions and ideological significances, including values and identity (Krampen, 1979; Minai, 1984; Støa, 2017). The suburban residence may represent the nuclear family, private wealth accumulation, and class and age segregation, while high-rise structures and skyscrapers may be viewed as symbols of modernism and efficiency (Minai, 1984). Moreover, meaning can be detrimental and undesirable, as illustrated by the intrusive nature of high-rise apartment structures that detract from the aesthetic of rural suburbia (Rapoport, 1982). The ability of occupants to assign relevant meanings to their housing affects their perceptions of habitability, making the classification of meanings crucial in developing a habitability index.

A habitability framework for housing offers a systematic method for assessing the extent to which a housing environment fulfils the requirements of its inhabitants. The approach entails evaluating multiple dimensions that affect the physical, social, and psychological well-being of inhabitants (refer to Table 2).

Table 2: Processes of encoding and decoding mental schemata in relation to housing and built environment.

Process	Stage	Description In Housing & Built Environment Context	Influences	Examples	Remarks
Encoding	Perception and Attention	Residents perceive housing elements, focusing on aspects like layout, light, noise levels, and materials. Attention filters out less relevant stimuli to prioritize needs.	Personal preferences, cultural background, family structure	Focusing on windows for light, kitchen space for cooking, or soundproofing for quiet areas.	Attention influences first impressions, often shaping long-term feelings toward the space.
	Organization of Information	Individuals categorize spaces (e.g., private vs. shared, indoor vs. outdoor) based on previous experiences and needs, forming mental maps for functional use.	Past experiences, societal norms, spatial layout	Dividing a home mentally into areas for family, work, leisure, or public versus private spaces.	Familiar spatial organization can improve comfort and ease of adaptation, especially in complex housing layouts.
	Interpretation and Elaboration	People interpret and elaborate on spaces, associating them with values like safety, aesthetics,	Cultural expectations, social norms, lifestyle	Associating a large living room with comfort and hospitality or a balcony with	Interpretation can lead to specific preferences, e.g., valuing privacy in dense urban areas where space is

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		or functionality, which may reinforce cultural or personal expectations.		relaxation.	scarce.
	Storage	Information and experiences (e.g., comfort in open layouts or preferences for specific designs) are stored, forming long-term associations with particular architectural styles.	Repeated exposure, durability of materials, and satisfaction levels	Recalling comfort in a well-ventilated space, leading to future preference for similar designs.	Stored experiences contribute to "housing schema" – influencing preferences in design, layout, and materials in future housing searches.
Decoding	Retrieval Cues	External cues like building styles, colours, and materials activate stored memories, impacting initial impressions of housing spaces.	Sensory cues, context of environment	Seeing an apartment complex with brick walls may evoke memories of stability or warmth.	Retrieval is heavily influenced by familiarity; recognizable features in a housing environment can create a sense of belonging or comfort.
	Reconstruction and Inference	Past housing experiences are reconstructed, filling in gaps with inferred details, which helps adapt to new environments by applying familiar schemata to unknown spaces.	Schema compatibility, past experiences	Interpreting the function of a new room based on past experience with similar layouts.	Reconstruction can lead to assumptions, sometimes inaccurately, about a space's comfort, usability, or safety.
	Application and Interpretation	Residents apply retrieved information and schema to current spaces, assessing whether they meet functional needs like family use, privacy, or	Current lifestyle, spatial design, individual goals	Deciding on the suitability of a studio apartment for remote work based on layout and quietness.	Application may limit flexibility; individuals may Favor familiar layouts or resist unconventional designs due to schema limitations.

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work suitability.

MATERIALS AND METHODS

The research was conducted in Nairobi, the capital of Kenya, about 200 km south of the Equator at coordinates 1°9'S, 1°28'S and 36°4'E, 37°10'E (Mitullah, 2003). Two of the three projects are situated in the Kibera division, and the third is located in the Pumwani division, as illustrated in Figure 2.

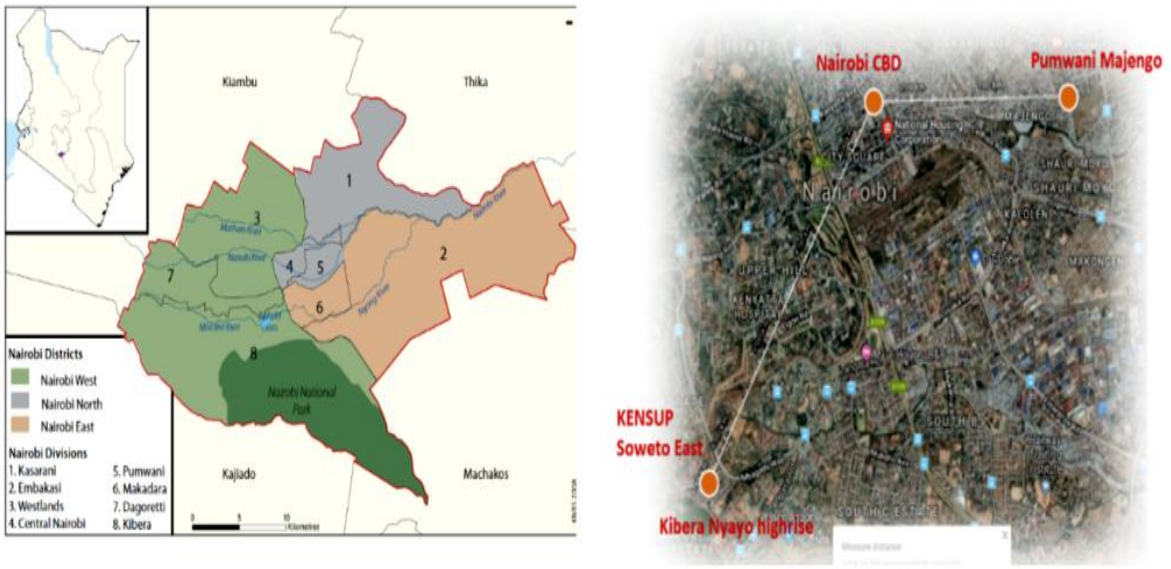

Figure 2: Nairobi's three districts and eight divisions (left), location of housing projects (right). (Tibaijuka, 2007).

The initial project, Kibera Highrise, was initiated in 1992 and consists of 194 housing units distributed across 50 medium-density blocks, while the subsequent project, KENSUP-Soweto, was conceived in 2013 as the pilot initiative of the Kenya Slum Upgrading Programme (KENSUP) in collaboration with UN-Habitat and the government (Fernandez & Calas, 2011; Schramm, 2017). It consists of 822 dwelling units, distributed among 13 clustered buildings of 144 three-bedroom, 570 two-bedroom, and 108 one-bedroom units. The condos were available for occupancy after July 2016, after a 13-year waiting period. Project 3 is Pumwani-Majengo, situated 2.5 km from the Nairobi Central Business District, in the nation's oldest informal colony, established in 1923 (Ochieng, 2007). The project consists of 444 apartments distributed among four-story housing blocks, as depicted in Figures 3, 4, and 5, and detailed in Table 3.

Table 3: Summary of housing projects.

Project	Year	Density	Units
Kibera-Highrise	1992	50 Medium-density blocks	1-bedroom (78), 2-bedroom (116) **T-[194]**
KENSUP-Soweto	2016	13 high-density blocks	Studio (108), 2-bedroom (570), 3-bedroom (144) **T-[822]**
Pumwani-Majengo	1968, 1987, 2002	21 Medium-density blocks	2 bedroom [444]

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Figure 3: Nyayo-Highrise.

Figure 4: KENSUP-Soweto and layout.

Figure 5: Pumwani-Majengo.

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Table 4: Comprehensive habitability framework.

DIMENSION	KEY FACTORS	DESCRIPTION	SOURCE	REMARKS
Physical Quality	Structural Safety and Durability	Ensures buildings are stable, durable, and comply with safety standards.	Building codes, structural standards	Critical for resident safety and long-term sustainability.
	Building Materials and Construction	High-quality, sustainable materials ensure longevity and reduce maintenance.	Sustainable building standards	Use of eco-friendly materials can reduce maintenance costs.
	Indoor Comfort	Adequate ventilation, insulation, and lighting contribute to comfort.	Indoor Air Quality guidelines	Enhances resident well-being and satisfaction.
Environmental Quality	Pollution Control	Evaluation of air, water, and noise pollution levels in the vicinity.	Environmental Protection Agency (EPA)	Essential for mental and physical health.
	Green Spaces	Parks, gardens, or natural areas improve air quality and mental well-being.	World Health Organization (WHO) guidelines	Provides recreational spaces and enhances quality of life.
	Energy Efficiency	Use of sustainable design elements to reduce energy costs.	Energy Star, LEED standards	Helps reduce environmental impact and operational costs.
Spatial Adequacy and Density	Dwelling Size and Layout	Adequate space for household needs like cooking, sleeping, and storage.	International Residential Code (IRC)	Avoids overcrowding and supports household functions.
	Population Density and Open Spaces	Balanced density with communal spaces to support healthy social interactions.	Urban Planning guidelines	Reduces strain on infrastructure and promotes social cohesion.
Basic Amenities and Infrastructure	Water, Sanitation, and Waste Management	Reliable access to water, waste disposal, and management systems.	Public Health Acts, UN-Habitat	Crucial for sanitation and health standards.
	Electricity and Connectivity	Reliable, affordable access to electricity and internet.	UN-Habitat, local utility standards	Increases access to information and supports work, education.
	Roads and Transport	Good road networks and access to public transportation options.	Transportation Infrastructure guidelines	Reduces isolation, promotes economic opportunities.
Health and Safety	Hazard Protection	Location and design features protect	FEMA, National Fire	Minimizes risks related to natural and

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		residents from natural and industrial hazards.	Protection Association	man-made hazards.
	Physical and Mental Health Amenities	Facilities like gyms and parks support physical and mental well-being.	WHO, American Society of Landscape Architects	Contributes to resident health and stress reduction.
	Crime Prevention and Security	Design elements like lighting and visibility promote safety and reduce crime risks.	Crime Prevention Through Environmental Design	Creates a safer, more welcoming environment for residents.
Social and Cultural Suitability	Community Integration and Social Spaces	Communal areas like courtyards and playgrounds encourage social connections.	Community and social planning guidelines	Fosters a sense of community and belonging among residents.
	Cultural Compatibility	Designs align with cultural norms and family lifestyle patterns.	Social and cultural standards	Encourages community acceptance and alignment with local lifestyles.
	Sense of Ownership and Personalization	Allow residents to modify spaces, fostering ownership and satisfaction.	Resident engagement studies	Promotes personalization, which can improve resident satisfaction and investment in the space.
Affordability and Financial Sustainability	Cost of Housing Units	Affordable pricing relative to residents' income levels.	Housing affordability indexes	Essential for economic sustainability and resident stability.
	Maintenance Costs	Durable materials and design reduce maintenance costs.	Construction industry standards	Helps residents manage housing costs in the long term.
	Access to Livelihoods	Proximity to job centres reduces commuting costs and enhances income opportunities.	Urban development and economic studies	Supports affordability through reduced travel costs.
Accessibility and Mobility	Universal Accessibility	Design considers accessibility for elderly, disabled, and families with children.	ADA Compliance, Universal Design guidelines	Promotes inclusivity for residents of all abilities.
	Proximity to Services	Close proximity to essential services like schools and healthcare.	Urban planning and public health guidelines	Reduces travel time and promotes convenience.

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	Transportation Options	Reliable public transport links to economic and social opportunities.	Public transportation standards	Increases residents' mobility and access to opportunities.
Resilience and Adaptability	Climate Resilience	Design to withstand climate impacts, like flooding or extreme heat.	IPCC Climate Adaptation guidelines	Reduces climate impact risks and enhances habitability in changing environments.
	Adaptability to Future Needs	Flexible layouts allow for modifications as resident needs change.	Future-proofing and adaptable housing studies	Supports changing resident needs and demographics over time.
	Community Preparedness	Disaster planning and community support systems improve resilience.	FEMA, local emergency management guidelines	Increases community safety and resilience during emergencies.
Governance and Policy Compliance	Regulatory Compliance	Ensures compliance with local and international building standards.	Building and safety codes	Provides a base level of habitability through regulation.
	Resident Involvement	Involving residents in decision-making fosters ownership and community engagement.	Resident engagement literature	Enhances satisfaction, long-term investment, and ownership in the community.
	Long-term Monitoring and Evaluation	Regular assessments maintain and improve habitability over time.	Housing quality and monitoring standards	Ensures housing quality is maintained and responsive to resident needs.

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The study employed a 24-item questionnaire based on a synthetic habitability index, citing similar research focused on either objective housing characteristics or inhabitants' subjective assessments. The term synthetic is utilised as the variables are extracted from various measurement indices in the literature. The four indices that informed the creation of this synthetic index are: i) Habitability Measuring Methodology (Pérez Pérez, 2011), ii) Index for Architectural Design Quality (Gann, Salter, & Whyte, 2003), iii) Habitability Conditions Index (Phillips, Siu, Yeh, & Cheng, 2005), and iv) Index of Habitability & Architectural Design (Mercado & Landázuri, 2004). The questionnaire comprised two sections: the first collected demographic information, encompassing economic data, education, and household structures, while the second required respondents to assess their perceptions using a 5-Point Likert scale, from 0 (Strongly Disagree) to 4 (Strongly Agree). Responses were subsequently converted into numerical values and percentages, alongside the computation of the Severity Index (SI) using the formula proposed by Al-Hammad and Assaf (1996).

$$SI = \frac{\sum_{i=0}^{4} a_i x_1}{4\sum_{i=0}^{4} X_i} \cdot (100\%) \quad (1)$$

Whereby: a_i = index of class (the weight of class); x_i = Response frequency with i = 0,1,2,3, and 4 translating into x_0, x_1, x_2, x_3, and x_4 that correspond to a_0, a_1, a_2, a_3, and a_4

Table 5 categorises the 24 habitability characteristics into three distinct dwelling classifications. Functional meaning encompassed 19 variables related to either exterior or internal habitability, whereas social meaning included 4 variables, and symbolic meaning had 1 variable. The questionnaire was distributed to household heads in April and May 2019. The evaluation of the responses was conducted using the scale established by Majid and McCaffer (1997), as presented in Table 6.

Table 5: Categorization of variables into meaning.

Categorization		Variable	
	External Habitability (E.H)	VAR-1	The proximity of houses to the city centre is advantageous.
		VAR-2	The proximity between residence and workplace is advantageous.
		VAR-3	The proximity between residential areas and public amenities is advantageous.
		VAR-4	The location is suitable for habitation and secure from adverse situations.
		VAR-5	Sufficient provision of infrastructure
Functional Meaning		VAR-6	The dimensions of the spaces/rooms are suitable.
		VAR-7	The typology and quantity of rooms adequately meet my requirements and those of my family.
		VAR-8	Access and circulation across rooms, other units, and floors is efficient.
		VAR-9	Universal access principles are accommodated
	Internal Habitability (I.H)	VAR-10	Housing has provisions for secondary functions
		VAR-11	Building allows flexibility/conversions to changing needs.
		VAR-	The structure endures deterioration and minor acts

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		12	of vandalism.
		VAR-13	The structure and materials are suitable for the local climate.
		VAR-14	Spaces possess sufficient daylight and natural illumination.
		VAR-15	Interior environments provide enough thermal comfort.
		VAR-16	The structure possesses adequate acoustic quality.
		VAR-17	Finishes and fixtures are well integrated.
		VAR-18	Structural system is efficient
		VAR-19	Building uses sustainable/renewable systems
Social Meaning	**(E.H)**	VAR-20	Housing stimulates local activity
		VAR-21	Balanced distribution of public and private spaces
		VAR-22	Design and layout promote security against crime
	(I.H)	VAR-23	Housing provides sufficient privacy
Symbolic Meaning	**(E.H)**	VAR-24	Building form, height & density fit within neighbourhood

Table 6: Rating system for mean values.

Strongly-Disagree (SD)	Disagree(D)	Neutral(N)	Agree(A)	Strongly-Agree (SA)
0.00≤SI<12.5	12.5≤SI<37.5	37.5≤SI<62.5	62.5≤SI<87.5	87.5≤ SI<100

The reliability analysis of the questionnaire was conducted for each of the three housing projects utilising the Cronbach's alpha coefficient. The computed coefficient alpha values were 0.842, 0.844, and 0.881 for Kibera-Highrise, KENSUP-Soweto, and Pumwani-Majengo, respectively, conforming to the recommended threshold for Cronbach's alpha of > 0.70 (Ibem & Alagbe, 2015). Supplementary tools encompassed 12 interviews with professionals, including policymakers from the Department for Housing and Urban Development (n=3), practicing architects (n=4), NHC planners (n=3), and public health professionals from the Nairobi City Council (n=2), to gather further insights on habitability in public housing. Additionally, the housing spaces were evaluated to determine their compliance with minimum dwelling criteria at both national and international levels.

RESULTS

Socio-Demographic Characteristics

Table 7 indicates that the age categories were rather balanced, with no specific age group consistently dominating across all projects. Specific groups were extensively sampled in two projects, but to a lesser extent in the third, while middle-aged respondents (45-54 and 55-64) were under-represented relative to those under 35 years or over 65 years. This may be attributed to

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the demographic statistics of the country, where 60% of the population is under 25 years of age (KNBS, 2014). A greater number of female respondents were questioned across all projects, with the most significant disparity observed in Pumwani (63% female compared to 37% male). The majority of respondents had attained some level of education, with only 6% in Nyayo Highrise, 3% in KENSUP Soweto East, and 7% in Pumwani-Majengo lacking formal schooling. In both Nyayo Highrise and KENSUP-Soweto, secondary education represented the highest percentages (39% and 50%), while a university degree was predominant among the Pumwani-Majengo population (44%). The primary household composition comprised married couples with children, representing 52%, 38%, and 52% of households in Kibera-Highrise, KENSUP-Soweto, and Pumwani-Majengo, respectively. A predominant percentage of 44%, 39%, and 44% in Kibera-highrise, KENSUP-Soweto, and Pumwani-Majengo earned between KES 50,000 and KES 200,000. Aside from KENSUP-Soweto (68%), a lesser percentage of inhabitants from Kibera-Highrise (32%) and Pumwani-Majengo (26%) have been in their apartments for more than five years. Renters constituted 58%, 56%, and 48%, whereas owners represented 42%, 44%, and 52% for Kibera-Highrise, KENSUP-Soweto, and Pumwani-Majengo, respectively.

Table 7: Households' descriptive statistics.

	Kibera-Highrise (n=31)		KENSUP-Soweto (n=34)		Pumwani-Majengo (n=27)	
	Freq.	Percentage	Freq.	Percentage	Freq.	Percentage
Age						
<35	5	16%	8	23%	6	22%
35-44	9	29%	5	15%	5	19%
45-54	4	13%	6	18%	6	22%
55-64	6	19%	5	15%	6	22%
>65	7	23%	10	29%	4	15%
Gender						
Male	13	42%	15	44%	10	37%
Female	18	58%	19	56%	17	63%
Education						
No studies	2	6%	1	3%	2	7%
Primary school	6	19%	10	29%	5	19%
Secondary school	12	39%	17	50%	8	30%
University	11	36%	6	18%	12	44%
Household-type & size						
Single-person	3	10%	5	15%	1	4%
Married couple without children	6	19%	5	15%	3	11%
Married couple with children	16	52%	13	38%	14	52%
Single-parent	4	13%	6	17%	3	11%

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Others	2	6%	5	15%	6	22%
Av. monthly income						
<50,000	9	29%	11	32%	10	37%
KES50,000-KES200,000	12	39%	15	44%	12	44%
>200,000	10	32%	8	24%	5	19%
Employment status						
Full-time	16	52%	18	58%	13	48%
Part-time	10	32%	9	29%	10	37%
Unemployed	5	16%	4	13%	4	15%
Duration of residence						
< 1 year	7	23%	11	32%	2	7%
1-3 years	9	29%	23	68%	12	45%
4-5 years	5	16%	0	0%	6	22%
> 5 years	10	32%	0	0%	7	26%
Tenure						
Owner	13	42%	15	44%	14	52%
Renter	18	58%	19	56%	13	48%

Where 1 $US=101 KES

Functional Meaning Variables

Table 5 indicates that a total of 19 variables were categorised under functional meaning, comprising 5 variables related to exterior habitability and 14 variables pertaining to interior habitability. Table 8 displays the calculated SI values for all variables derived from equation (1). In terms of external habitability, the three convenience variables were highly ranked overall. Variable 1 (proximity to the city centre) achieved the highest overall score, with a mean SI score of 90.58% across all projects, falling into the Strongly Agree range (87.5≤SI<100) as per the scale proposed by Majid and McCaffer (1997). Variable 3 (accessibility to public amenities) was ranked second, receiving a 'Agree' score with a mean SI value of 74.63%. The subsequent variable, convenience between dwelling and employment, exhibited a mean SI value of 71.87%, similarly categorised as Agree. Variable 5 (infrastructure) received the lowest ranking, with a mean SI score of 57.02%, categorising it as 'Neutral.'

Table 8: Categorization of the 24 habitability variables.

Variable		Kibera-Highrise(n=31)						KENSUP-Soweto(n=34)						Pumwani-Majengo(n=27)					
		0	1	2	3	4	SI (%)	0	1	2	3	4	SI (%)	0	1	2	3	4	SI (%)
Functional meaning: External Habitability																			
VAR-1	**NR**	0	0	1	11	19	89.52	0	0	2	8	24	91.18	0	0	0	10	17	90.74*
	PR	0	0	3	36	61		0	0	6	23	71		0	0	0	37	63	
VAR-2	**NR**	1	4	2	10	14	75.81	1	4	1	11	17	78.68	2	5	5	9	6	61.11
	PR	3	13	7	32	45		3	12	3	32	50		7	19	19	33	22	

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VAR-3	NR	1	2	3	17	8	73.39	0	2	3	10	19	83.82	3	4	1	10	9	66.67
	PR	3	6	10	55	26		0	6	9	29	56		11	15	4	37	33	
VAR-4	NR	4	8	2	7	10	58.87	5	7	0	9	13	63.24	3	8	2	5	9	58.33
	PR	13	26	6	23	32		15	21	0	26	38		11	30	7	19	33	
VAR-5	NR	4	4	2	8	13	67.74	8	6	2	12	6	51.47	4	9	0	9	5	51.85
	PR	13	13	6	26	42		23	18	6	35	18		15	33	0	33	19	
Functional meaning: Internal Habitability																			
VAR-6	NR	1	10	2	9	9	62.10	2	10	0	6	16	67.65	5	8	1	4	9	53.70
	PR	3	32	7	29	29		6	29	0	18	47		18	30	4	15	33	
VAR-7	NR	4	8	2	10	7	56.45	4	9	0	13	8	58.82	8	7	1	5	6	44.44
	PR	13	26	6	32	23		12	26	0	38	24		30	26	4	18	22	
VAR-8	NR	2	0	2	17	10	76.61	0	5	3	18	8	71.32	1	2	1	14	9	75.93
	PR	7	0	6	55	32		0	15	9	53	23		4	7	4	52	33	
VAR-9	NR	6	17	0	3	5	37.10	16	10	1	2	5	27.94	7	13	1	2	4	34.26
	PR	19	55	0	10	16		47	29	3	6	15		26	48	4	7	15	
VAR-10	NR	3	12	3	4	9	53.23	15	5	0	4	10	41.91	3	10	1	6	7	53.70
	PR	9	39	10	13	29		44	15	0	12	29		11	37	4	22	26	
VAR-11	NR	12	7	3	7	2	33.87	7	16	0	6	5	39.71	5	9	2	6	5	47.22
	PR	39	23	10	22	6		20	47	0	18	15		19	33	7	22	19	
VAR-12	NR	10	8	4	6	3	37.10	5	14	3	5	7	46.32	9	6	3	5	4	39.81
	PR	32	26	13	19	10		15	41	9	15	20		33	22	11	19	15	
VAR-13	NR	2	5	2	8	14	71.77	2	1	4	12	15	77.21	2	3	4	11	7	66.67
	PR	7	16	6	26	45		6	3	12	35	44		7	11	15	41	26	
VAR-14	NR	2	3	3	16	7	68.55	5	2	1	7	19	74.26	2	1	1	14	9	75.00
	PR	6	10	10	52	22		15	6	3	20	56		7	4	4	52	33	
VAR-15	NR	7	6	3	12	3	48.39	4	2	4	17	7	65.44	3	5	4	13	2	55.56
	PR	22	19	10	39	10		12	6	12	50	20		11	15	19	48	7	
VAR-16	NR	3	4	1	8	15	72.58	1	1	2	13	17	82.35	3	2	0	13	9	71.30
	PR	10	13	3	26	48		3	3	6	38	50		11	8	0	48	33	
VAR-17	N	2	1	2	8	9	59.68	1	5	0	11	17	77.94	3	7	3	5	9	59.26

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	R		0																
	P	7	3	6	26	29		3	15	0	32	50		11	26	11	19	33	
	R		2																
VAR-18	N	2	3	4	7	15	74.19	3	4	6	10	11	66.18	1	2	9	6	9	68.52
	R																		
	P	6	1	13	23	48		9	12	18	29	32		4	8	33	22	33	
	R		0																
VAR-19	N	7	1	2	3	4	35.48	14	8	6	4	2	29.42	7	11	2	7	0	33.33
	R		5																
	P	23	4	6	10	13		41	23	18	12	6		26	41	7	26	0	
	R		8																
Social meaning variables: (E.H)																			
VAR-20	N	1	2	6	10	12	74.19	2	3	5	14	10	69.85	1	9	4	9	4	55.56
	R																		
	P	3	7	19	32	39		6	9	15	41	29		4	33	15	33	15	
	R																		
VAR-21	N	8	5	4	12	2	45.97	1	5	0	19	9	72.06	0	7	4	12	4	54.63
	R																		
	P	26	1	13	39	6		3	15	0	56	26		0	26	15	44	15	
	R		6																
VAR-22	N	4	6	4	7	10	60.48	5	7	0	9	13	63.24	3	7	3	5	9	59.26
	R																		
	P	13	1	13	23	32		15	21	0	26	38		11	26	11	19	33	
	R		9																
Social meaning: (I.H)																			
VAR-23	N	0	2	2	11	16	83.06	2	2	0	13	17	80.15	2	0	4	5	16	80.56
	R																		
	P	0	6	6	36	52		6	6	0	38	50		7	0	15	19	59	
	R																		
Symbolic meaning: (E.H)																			
VAR-24	N	1	4	1	10	15	77.42	3	5	2	13	11	67.65	4	4	2	3	14	67.59
	R																		
	P	3	1	3	32	49		9	15	6	38	32		15	15	7	11	52	
	R		3																

Where: NR-Number of respondents; PR-Percentage of Respondents

Sample calculation

$$^{*}SI = \frac{0(0)+1(0)+2(0)+3(10)+4(17)}{4(0+0+0+10+17)} \text{ x } 100 = 90.74$$

Out of the 14 variables pertaining to internal habitability, the three highest ranked are variable 16 (acoustic quality), variable 8 (access and circulation), and variable 14 (adequate daylight), with mean SI scores of 75.41%, 74.62%, and 72.60% respectively, all within the 'Agree' opinion range. The lowest rated elements are variable 11 (flexibility for changes), variable 9 (universal access principles), and variable 19 (sustainable and renewable systems), with mean SI scores of 40.27%, 33.10%, and 32.74%, respectively, within the opinion range of 'Disagree.' Among the 19 variables pertaining to functional meaning, KENSUP Soweto exhibited the highest performance with a mean SI of 62.88%, followed by Pumwani Majengo with a mean SI of 58.28%, and Kibera-Nyayo High Rise with a mean SI of 54.12%.

Social Meaning Variables

Four variables were categorised as social meaning. All three variables pertaining to external habitability received average rankings. Variables 20 (stimulating interaction) and 22 (security) had higher mean SI scores of 66.53% and 61%, respectively, compared to variable 21 (public vs private venues), which recorded a score of 54.63%. The solitary internal habitability variable 23 (privacy) attained

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the top ranking in its category, with a mean SI score of 81.26%. KENSUP Soweto exhibited the highest performance across the four factors related to social meaning, with a mean social index (SI) of 71.36%, followed by Kibera Nyayo High Rise at 65.93%, and Pumwani Majengo at 62.50%.

Symbolic Meaning Variables

Only one variable was categorised under this classification. The average score of variables 24 (height and density) was 70.89%. Kibera Nyayo High Rise (mean SI of 77.42%) had the highest performance overall, succeeded by KENSUP Soweto (mean SI of 67.65%) and subsequently Pumwani Majengo (mean SI of 67.59%).

Relationships to Socio-Demographic Characteristics

Three one-way ANOVA tests were conducted to evaluate the connections between specific habitability variables and socio-demographic parameters. P-values of 0.05 were deemed indicative of statistically significant connections. I conducted an ANOVA test to examine the relationship between variable 1 and age groups. Table 9 indicates that the sole statistically significant connection was identified in KENSUP-Soweto (P-Value of 0.047). This is based on the research conducted by Somenahalli and Shipton (2013), which indicates that elderly individuals are significantly less inclined to travel longer distances to workplaces and access services compared to younger individuals from the same setting.

Table 9: ANOVA of housing convenience from city centre against age.

	Variable	Groups	N	Mean	SD	F	Sig.
Convenience between housing and CBD	Age (Pumwani)	<35	6	3.83	.408	1.357	.281
		35-44	5	3.20	.447		
		45-54	6	3.67	.516		
		55-64	6	3.67	.516		
		>65	4	3.75	.500		
	Age (Nyayo-Highrise)	<35	5	3.60	.548	2.523	.065
		35-44	9	4.00	.000		
		45-54	4	3.25	.500		
		55-64	6	3.50	.837		
		>65	7	3.29	.488		
	Age (KENSUP)	<35	8	4.00	.000	2.745	.047
		35-44	5	4.00	.000		
		45-54	6	3.33	.516		
		55-64	5	3.20	.447		
		>65	10	3.60	.843		

The ANOVA test II examined the relationship between variable 11 (potential for flexibility and modifications) and period of residence. Table 10 demonstrates one statistically significant correlation in Pumwani-Majengo, indicated by a P-Value of 0.023. This corroborates the hypothesis stated by Omar et al. (2012) that the duration of residence in public housing correlates positively with the propensity to adopt diverse personalisation techniques and preferences over time.

Findings from Interviews and Comparisons to Minimum Dwelling Standards

Three checklists for assessing minimum dwelling standards were developed, with each discussed in this section.

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Minimum standards checklist-1

Checklist-1 is the floor area per person, endorsed by UN-Habitat as a metric for assessing the suitability of living spaces. Checklist-1 has been utilised in previous research by the United Nations across 96 nations (D.E.S.A, 2000), where a median floor area per person of $20m^2$ was deemed sufficient. The survey indicated that 89% of units in underdeveloped nations fell below the advised $20m^2$, whilst 58% of sampled units in affluent nations above this threshold. Tables 11 and 12 illustrate the findings of this study on floor space per person metrics.

Table 10: ANOVA of ability to make alterations against residents' duration

	Variable	Groups	N	Mean	SD	F	Sig.
Flexibility of spaces	Duration (Pumwani)	Less than 1 year	2	3.00	.000	2.896	.057
		1 - 3 years	12	1.08	1.240		
		4 - 5 years	6	2.67	1.366		
		More than 5 years	7	2.29	1.496		
	Duration (Nyayo-Highrise)	Less than 1 year	7	.86	1.464	1.266	.306
		1 - 3 years	9	1.00	1.225		
		4 - 5 years	5	2.20	1.304		
		More than 5 years	10	1.60	1.430		
	Duration (KENSUP)	Less than 1 year	11	2.36	1.567	5.745	.023
		1 - 3 years	23	1.22	1.166		
		4 - 5 years	-	-	-		
		More than 5 years	-	-	-		

Table 11: Number of households from three projects.

Household size	Kibera-highrise (n=31)	KENSUP (n=34)	Pumwani (n=27)
1-person	0	4	0
2-persons	4	5	0
3-persons	7	8	10
4-persons	13	12	6
5-persons	5	3	6
6-persons	2	2	4
7-persons	0	0	0
8-persons	0	0	1
Average	**6**	**6**	**5**

Table 12: Floor-area-per-person results.

Project	Av. size	Av. unit area	Remarks
Kibera-	6	$52m^2$	$8.7m^2(<20m^2)$-

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Highrise			Overcrowded
KENSUP-Soweto	6	83m^2	13.8m^2(<20m^2)-Overcrowded
Pumwani-Majengo	5	45m^2	11.25m^2(<20m^2) -Overcrowded

Table 12 indicates that although the dimensions of the housing units were not inadequate (refer to Table 13 for WHO comparison), the evaluation criteria classified all housing projects as overcrowded due to the elevated number of households per unit, a prevalent demographic trait in developing nations. Of the three projects, KENSUP-Soweto, being the most recent and largest in terms of square footage, exhibited somewhat superior performance compared to the other two. Pumwani, although its smaller size compared to Kibera-Highrise, exhibited superior performance owing to a lower household count than the latter.

Table 13: Standards based on people per bedroom area

Area(m^2)	Occupants
>11	2
9-10	1.5
7-9	1
5-7	0.5
< 5	0

(Source: WHO)

Table 14: Results from checklist-2.

Project	Bedroom-1	Nº	Remarks	Bedroom-2	Nº	Remarks
Kibera Highrise	11.8m^2	2	No-crowding	9.2m^2	3	Crowding
KENSUP-Soweto	13.4m^2	2	No-crowding	10.5m^2	4	Crowding
Pumwani-Majengo	9.6m^2	2	No-crowding	8.1m^2	2	Crowding

Checklist-2 was used in all bedrooms across all projects, as illustrated in Table 13. The primary bedroom, primarily designated for parents, had fewer inhabitants and was therefore not deemed overcrowded, however the secondary bedroom was classified as congested in all projects.

Minimum standards checklist-3

Checklist-3 is founded on the minimal spatial dimensions stipulated by affordable housing legislation and programs, namely the 2004 Sessional Paper No. 3 of 2004 (ROK, 2004). Table 15 indicates that the home projects frequently excelled for minimum spatial dimensions. Excluding kitchens, the units collectively, along with the individual bedrooms, living spaces, and baths, conformed to the established requirements. This indicates that the policymakers and architects at the NHC made a concerted effort to guarantee that housing met minimal spatial dimensions and proceeded to satisfy their criteria.

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Table 15: Minimum spatial dimensions of spaces.

Space/Unit	Minimum Areas	Kibera-Highrise	KENSUP	Pumwani
1-bedroom unit	$20m^2$	$30m^2$ -PASS	$42m^2$-PASS	-
2-bedroom unit	$40m^2$	$52m^2$-PASS	83 m^2-PASS	$45m^2$-PASS
Master (double)	$10.5m^2$	$11.8m^2$-PASS	14.4 m^2-PASS	$9.6m^2$-FAIL
$2^{nd}/3^{rd}$-bedroom	$6.5m^2$	$9.3m^2$-PASS	10.5 m^2-PASS	$8.1m^2$-PASS
Living	$10m^2$	$15.5m^2$-PASS	$16.6m^2$ (PASS	$13.5m^2$-PASS
Kitchen	$6m^2$	$3.6m^2$-FAIL	5.5 m^2-FAIL	$3m^2$-FAIL
Bathrooms	1700X760mm	PASS	PASS	PASS
Showers	800X800mm	PASS	PASS	PASS

Semi-structured interviews

Twelve interviews were performed with professionals in architecture, planning, and public health to gather their perspectives on the use and efficacy of public housing concerning habitability, as detailed in Table 16.

Table 16: Conducted interviews.

Organization	Designation(s)	Number
Department for Housing & Urban Development	Senior commissioner, admin. officer & planner	3
Architectural firms	Project architects	4
N.H.C	Planners & Corporate Liaison	3
N.C.C	Public health officials	2

The results showed that all interviewed groups had varied responses, as indicated below in Figure 6.

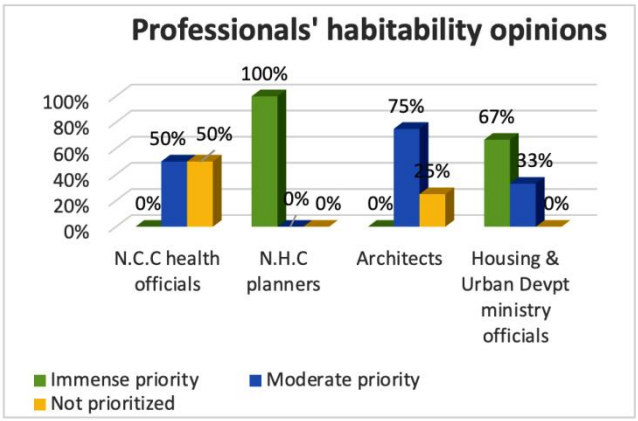

Figure 6: Planning professionals' opinions regarding habitability.

The two public health authorities asserted that there was minimal emphasis for implementing minimum dwelling standards in Nairobi's cheap housing initiatives. A health official, for instance, remarked:

Residents of the Pumwani houses expressed grievances years prior regarding the inadequacy of their rooms, kitchens, and bathrooms, citing their diminutive size and insufficient ventilation. Security is likely an issue there as individuals from the adjacent

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slums traverse the land daily. The new Kibera residences (KENSUP) are significantly larger than those in Pumwani.

The second official provided another perspective.

Maintenance difficulties may exist in Pumwani, although they may not necessitate immediate intervention. We would have been required to assess and, if feasible, supervise the demolition of housing deemed 'dilapidated' or 'defective,' as outlined in the 2012 Public Health Act. We are also mandated under section 125 to prevent overcrowding in residences and to ensure adequate light and ventilation.

The three planners from the NHC stated that habitability features were substantially prioritised in the design and execution of public housing, a foreseeable result considering the NHC's crucial role in delivering affordable housing initiatives generally.

Soweto East is a premier national initiative, and we are assured that the implemented policies, as well as the finished housing units, are appropriately aligned with user requirements. Similarly, high-rise estates predominantly accommodate middle-class inhabitants nowadays. This indicates that the quality is satisfactory.

Three of the four architects interviewed indicated a moderate emphasis on habitability, while the fourth reported a lack of prioritising. An architect remarked on the problems obstructing the implementation of basic dwelling requirements.

The government simply cannot commit a lot of resources to build bigger rooms, wider passages, lifts, and playgrounds as it assumes the new housing is already better than the original slums. Unfortunately, if the conditions are not significantly better, many beneficiaries rent them out and return to the slums.

Ultimately, two officials from the State Department for Housing and Urban Development emphasised the prioritisation of habitability in public housing, whereas the third official advocated for a moderate use of habitability factors. The recommendations issued by planning officials from the Housing and Urban Development Department included:

It may be apparent that once the structures are erected, there is insufficient space for green areas, such as children's play zones and communal meeting spaces. The existing acreage is inadequate to accommodate these. We are collaborating with the National Land Commission and several development partners (NGOs) to get funding for larger strategically positioned land parcels for home development.

One of architects further noted:

NHC is very reluctant towards sustainability. Many of these houses don't have cross ventilation, and they are against prefabrication, which would help in bringing down total housing costs. These are the people who would significantly benefit from reduced energy and water bills had they been incorporated at the start.

DISCUSSION AND CONCLUSION

This study aimed to evaluate government-initiated affordable housing projects executed in Nairobi via three case studies. The primary investigative approach to examine the initial research issue about the elements defining habitability for residents at both home and neighbourhood levels was a composite habitability index. The perceptions were conceptually linked to the importance residents assigned to their housing. Nineteen factors were assessed regarding functional significance, comprising five variables associated with exterior habitability and fourteen variables relevant to internal habitability. Residents predominantly recognised the importance of locational factors (convenience aspects of

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variables 1-3), suggesting that planning authorities successfully incorporated residences into the city and guaranteed closeness to employment and facilities. Residents placed significant emphasis on habitability attributes, including circulation and access efficiency, acoustic quality within dwellings, and sufficient daylight. Conversely, diminished importance was attributed to the durability of houses and the adoption of renewable alternatives. Four variables were assessed in relation to social significance, three variables relating outward habitability, and one variable related to interior habitability. Residents mostly recognised the relevance of housing in facilitating social connections and providing privacy, while attributing little significance to its role in crime prevention. The suitability of density was assessed according to the symbolic meaning ascribed to it by the local population. The study indicates that, based on inhabitants' subjective assessments, KENSUP-Soweto, perhaps due to its status as the latest development among the three, was considered the most livable. Kibera Nyayo Highrise was placed second, while Pumwani Majengo was considered the least habitable.

Secondary methods included the development of three checklists to assess local and global housing standards concerning issue 2 (performance in relation to minimal dwelling criteria). All housing complexes were classified as inadequate and congested based on checklist one. Checklist two discovered two symptoms of overcrowding in the secondary bedrooms, but not in the primary bedrooms. However, checklist three concluded that most places, save the kitchen, complied with the stated requirements. Semi-structured interviews with experts in architecture, planning, and health were performed to resolve question 3. Mixed results were noted, with state housing officials demonstrating a higher tendency to classify public housing as livable than public health experts or independent architects. This study primarily informs policymakers in the Global South regarding which variables should be emphasised in the formulation of future housing regulations, as these are the issues deemed most significant by residents. Moreover, by pinpointing underperforming variables, policymakers are informed of areas requiring significant improvements. Policy makers must develop awareness of people' demands by involving the intended beneficiaries of public affordable housing projects in a participatory approach. Subsequent research could augment this study's conclusions by employing hybrid methodologies that thoroughly encompass both physical and non-physical attributes (intangible significances). This study recommends that subsequent research expand the variety of housing typologies utilised herein to further investigate the habitability of inexpensive housing in Kenya and/or East Africa as a whole.

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