

**EVALUATING
HABITABILITY
OF AFFORDABLE HOUSING PROJECTS
IN NAIROBI-KENYA**



A Thesis

by

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Submitted to the
Graduate School of Sciences and Engineering
In Partial Fulfillment of the Requirements for
the Degree of

Master of Science

in the
Department of Architecture

Özyeğin University
July 2019

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IN NAIROBI-KENYA**

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ABSTRACT

As Nairobi, and several cities within the Global South continue to experience severe housing shortages, urban planning authorities are in constant pursuit for housing interventions that are not only adequate towards the needs of low income urban households, but also meet the affordability thresholds of these households. This study's purpose is the empirical assessment of habitability of representative affordable housing projects in Nairobi, Kenya based on criteria such as physical housing characteristics, locational variables and quality of architectural space. No studies within the Kenyan context have approached residential evaluation from the theoretical perspective of 'meaning of housing', which explores dwellers' relationships and links to their housing, and how meaning provides the rationale for how housing is shaped and used by dwellers to derive satisfaction.

The primary method of inquiry was data collection in Nairobi during April and May 2019 using a 24 item questionnaire developed from a synthetic habitability index. A systematic sampling procedure, where household heads from every 10th unit within each development recruited 92 respondents from three projects, while data analysis on resident perceptions was done using descriptive statistics. Findings revealed that respondents derived most functional meaning from particular habitability variables such as locational variables (relation between housing and the city centre, workplaces and public amenities), circulation and access efficiency, sufficient daylight, good acoustic quality and appropriateness of height and density while social meaning was mostly derived from ability to stimulate interaction, sufficiency of privacy. On the other hand residents derived limited meaning from durability of housing and adoption of sustainable and renewable

systems. The three projects were further ranked based on which residents considered more habitable.

Secondary methods of inquiry included analysis of local and global dwelling standards using three checklists. All housing projects were found to be inadequate/overcrowded with respect to checklist one (floor area per person). The second checklist found evidence of crowding in the secondary bedrooms but not in the main bedrooms. The final checklist assessed minimum spatial dimensions and found majority of spaces, excluding kitchen met the specified standards. Semi-structured interviews with architectural, planning and health professionals were used to assess influence of planning system on habitability, with state housing officials more inclined to consider public housing habitable than public health or independent architects.

The findings have potential to inform policy makers in the Global South on what variables are most important and need prioritization when formulating housing policies to guide design and implementation of future affordable housing projects, as it is these issues that dwellers attach most meaning to.

Keywords: Affordable housing, Habitability, Design quality, Housing quality, Public housing, Minimum dwelling standards, Nairobi

ÖZET

Nairobi ve gelişmekte olan ülkelerdeki birçok şehir ciddi konut yetersizliği yaşamaya devam ettikçe, kentsel planlama makamları, sadece düşük gelirli kentsel hane halklarının ihtiyaçlarına yönelik olarak yeterli değil aynı zamanda uygun maliyetli olan konut müdahaleleri için sürekli çalışmaktadır. Bu çalışmanın amacı, Nairobi, Kenya'daki ekonomik konut projelerinin yaşanabilirliğinin, fiziksel konut özellikleri, mekan ve mekan kalitesi gibi kriterlere dayalı ampirik değerlendirilmesidir. Kenya'dan hiçbir çalışma, konut değerlendirmesine, konut sakinlerinin ilişkilerini ve konutlarıyla bağlantılarını ve konut sakinlerinden konutlarından memnuniyet elde etmeleri için anlamın nasıl kullanıldığını araştıran “konut anlamını” teorik bakış açısından ele almadı.

Veriler, 24 maddelik bir anket kullanılarak Nisan ve Mayıs 2019'da Nairobi'den toplanmıştır. Her bir gelişimdeki her 10. üniteye hanelerin başlarının üç projeden 92 kişiyi işe aldığı sistematik bir örnekleme prosedürü, yerleşik algılara ilişkin veri analizi tanımlayıcı istatistikler kullanılarak yapılmıştır. Bulgular, katılımcıların konum değişkenleri (konut ve şehir merkezi arasındaki ilişki, işyerleri ve kamu olanakları) gibi belirli yaşanabilirlik değişkenlerinden, dolaşımın verimliliği, yeterli gün ışığı, iyi akustik kalite ve yüksekliğin ve yoğunluğun uygunluğu gibi belirli fonksiyonel anlamlarından elde ettiklerini ortaya koyarken sosyal anlam çoğunlukla, insan etkileşimlerini uyaran barındırma kabiliyetinden türetilmiştir. Öte yandan, konut sakinleri, konutların dayanıklılığı ve yenilenebilir sistemlerin benimsenmesinden sınırlı anlam çıkarmıştır.

Diğer araştırma yöntemleri, üç kontrol listesi kullanarak yerel ve küresel konut standartlarının analizini içermektedir. Tüm konut projelerinin birinci kontrol listesine göre aşırı kalabalık olduğu tespit edildi. İkinci kontrol listesi ikincil yatak odalarında ve

ana yatak odalarında kalabalık olmadığını gösteren kanıtlar buldu. Final kontrol listesi asgari mekansal boyutları değerlendirdi ve mutfaklar hariç alanların çoğunluğunu belirtilen standartları karşıladı. Planlama sisteminin yaşanabilirlik üzerindeki etkisini değerlendirmek için mimarlık, planlama ve sağlık profesyonelleriyle yarı yapılandırılmış görüşmeler yapıldı; devlet konut yetkilileri, kamu konutlarını halk sağlığına veya bağımsız mimarlara göre daha yaşanılabilir olduğunu kabul etmeye meyilliydi.

Bulgular şehir yetkililerine hangi değişkenlerin en önemli olduğu konusunda bilgi verme potansiyeline sahip ve gelecekteki ekonomik konut projelerinin tasarımına rehberlik etmek için konut politikalarını formüle ederken bulgular öncelikli olmak zorundadır, çünkü bu, konut sakinlerinin en çok önem verdiği konulardır.

ACKNOWLEDGEMENTS

I want to thank the following individuals and institutions without whose support and assistance this thesis would not have been possible. To various individuals, including my supervisor, Assoc. Prof. Murat Şahin for his academic mentoring and guidance, and other graduate course instructors whose constructive criticism have helped hone my research skills

My family, including parents, siblings and in-laws for their moral and financial support that has made this journey more bearable. To Peter, Patricia, Herman, Hellen, Vianney, Charity, and the rest, may the Almighty continue to bless you all. I further owe gratitude to the staff and partners at UDesign Architects in Nairobi for the experience, mentorship and responsibilities bestowed upon me since joining in 2014. While all individuals contributed in different capacities, special thanks go to the partners especially Anthony Thimangu for his lessons and for the encouragement to pursue this Master's degree.

To my two research assistants from the University of Nairobi for their sacrifices and ability to step up to the task when called up with limited time and resources. Two other individuals; Vivianne and Matthew have made significant contributions to my education and work life by facilitating my constant movements between Istanbul and Nairobi, hence their efforts are much acknowledged and appreciated

To my classmates in the Master's programme at Özyeğin University, with whom we have trekked this journey. Thank you for your assistance both in and out of the classroom, and for your tips, counsel and recommendations on how to navigate life in Turkey as a foreign student

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CHAPTER ONE

INTRODUCTION

Previous research reveals that close to a billion people resided in inadequate, crowded and sub-standard housing conditions at the turn of the millennium, with this figure expected to steadily increase particularly in the Global South regions of Sub Saharan Africa (SSA), Latin America and Asia [1], [2]. Kenya's deficit for decent affordable housing was estimated at 150,000 units annually as of 2004, having risen from 60,000 units per year during the 1980's [3]. The severity of the housing deficit is evident provided combined efforts of both the state and the private sector are only capable of producing 20,000 - 30,000 units annually, which is still 120,000 units short of the expectations [3]. This housing deficit, categorised both as qualitative [4]–[6] and quantitative [7], [8] has compounded and accelerated the proliferation of informal settlements throughout the country's urban areas, particularly Nairobi, where urban dwellers options are limited to either wooden or galvanized sheet one roomed housing structures, or high dense tenement housing which are both associated with ill living conditions like poor sanitation, lack of clean flowing water, schools, healthcare and other essential public services [6], [9]

Various attempts have been made to address the global crisis of sustained affordability and availability of public housing, including policy interventions and programmes like rent control, subsidization of interest rates and subsidies towards home purchases to address the affordability aspect [1], [10]. Addressing the availability aspect in the Kenyan context has required the government to undertake the role of 'enabler', where it facilitates and enables the private sector to participate in housing production, or 'provider' that involves direct participation in the conceptualization, planning and

construction of new formal housing or upgrading existing informal housing [11], [12]. Under the direct participation delivery model, the National Housing Corporation (NHC) opts for a turnkey production arrangement, in which all aspects of conceptualizing, planning, design, costing and construction of houses are handled by the authority [4]. This model has faced criticisms for its shortcomings such as limited public participation of intended beneficiaries in the planning process, in addition to various researchers questioning the overall intent of the professionals involved, specifically architects, planners and contractors [4], [5]. The concerns arise from whether the professional's mission is serving the needs of the NHC (with regard to saving time and costs), or towards the realisation of adequate buildings tailored towards meeting spatial requirements of users thereby improving dwellers' quality of life.

These concerns ultimately underpin the background and research questions this study adopted, with focus on habitability of government - delivered public housing projects delivered in Nairobi over the past 30 years to solicit dweller opinions on what meanings they attach to their particular housing units, whether housing was adequate towards their needs, and whether habitable spaces in the housing met minimum dwelling standards based on national and global specifications. The relevance of habitability is significant and of primary importance, as it is one of the major necessities specified by the United Nations when defining or assessing 'adequacy' in affordable housing projects in addition to affordability, accessibility, security of tenure, location, cultural responsiveness and availability of services [13]. Due to limited evaluative housing research, particularly concerned with habitability and quality of architectural space in Nairobi's affordable housing projects, a research gap has been identified to which this

study responds by investigating issues of habitability, as well as the housing legislation and frameworks that influence development of this affordable housing.

1.1 Background to the study

This study emerges from Nairobi's acute shortage for adequate housing that dates back to the colonial periods where colonial policies, specifically of 1905 and 1927 encouraged racial and spatial segregation of Africans from the city and instead limiting them to informal settlements on the city's periphery zones [4], [14], [15]. The housing shortages were further aggravated in the post-independence era by mismanagement of resources like land that were handed back by the British, as well as economic forces and rapid urbanisation resulting in an urban demographic profile where roughly 1.5 million people (or 60% of the population) live amongst the 134 informal settlements spread throughout the city [16], [17]

Additionally, rapid urbanisation rates in Kenya's urban areas, where the urban population doubled from 9.9% in 1969 to 22% of the total population in 2010, fuelled by pull factors like improved social services and employment opportunities in urban areas, as well as push factors such as decreased productivity of rural agricultural land which ultimately drives rural dwellers into towns and cities [13], [18]. This rapid urbanisation was unfortunately not sufficiently backed up by appropriate planning and housing policies [13]. While inadequate housing is a global challenge, less developed countries like Kenya face more challenges due to rapid population growth and prevalence of a large informal sector that strain government planning efforts with regard to housing and infrastructure provision. This has been the case despite various efforts like acknowledging universal access to adequate housing as every citizen's fundamental human right [3], the

ratification of several international housing and human rights treaties, and initiation of different housing policy measures through authorities like the NHC. Consequently, the state has only been able to avail a handful of housing units over the last 30 years, as illustrated in Table 1.1

Table 1.1: Housing units delivered by the NHC 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	–	157	22	161	–	–	–
Eastern	–	128	–	–	–	–	–
Central	523	66	77	54	38	–	–
Rift Valley	237	40	–	39	–	–	–
Nyanza	105	–	–	–	138	40	500
Western	596	252	–	–	80	–	126
N. Eastern	–	0	–	–	–	–	–
TOTAL	2,187	1,613	272	587	1,182	1,407	2,226

Table 1.1 reveals that available supply of housing falls short of quantity demanded considering recent population and urbanisation figures, with statistics showing that Kenya’s housing deficit increased from 60,000 units annually during the 1980’s to an estimated 150,000 units annually in 2004 [3]. From Table 1.1, delivery figures of a 30 year period from 1986 have remained below 2,000 units for five-year periods except for two periods of 1986-1990 and 2016-2017. Table 1.1 further implies that on average, the state has only been capable of availing 1,353 units of decent public housing every five years, which can further be dissected into 270 units per year, which is extremely inadequate (less than 2%) relative to the annual shortage in comparison to other countries in the Global south, particularly Latin American ones like Colombia, Chile and Mexico,

where government input in housing production, through financing, supporting or building, accounts for more than 60% of housing in the formal sector [26]–[28]. This confirms claims from other researchers highlighting Nairobi’s quantitative demand for affordable housing [7], [8]. This thesis on the other hand seeks to investigate the qualitative dimension to housing through post occupancy evaluation, with emphasis on issues such as housing characteristics, quality of architectural space, and whether the spaces function as originally intended by planners

1.2 Statement of the problem

Often times, the architects and policy makers behind the conceptualization of public housing, especially under the turnkey delivery model regularly applied in Nairobi, lack awareness and sensitivity of the consequences of their design decisions on dwellers’ everyday lives. Ochieng [4] for example notes that the turnkey delivery model offers little insight into actual performance of housing spaces but rather relies on the professionals’ opinion of how spaces will and should be used, rather than through consultation with the intended dwellers through a briefing process. Design of new affordable housing is often times driven by economic factors and hence results in cheaply built dwellings that sacrifice basic living conditions through low quality and un-useable spaces [7].

Additionally, there are very limited studies in the Kenyan context regarding two major areas namely;

- i. Studies concerned with the relationships that affordable housing dwellers develop between themselves and their housing, and specifically at how users derive

‘meaning’, from their housing, in which case meaning refers to the processes through which built form is decoded into peoples’ minds as cognitive schemata from their housing [29].

- ii. Post occupancy evaluative studies aiming to provide insights on how affordable housing is shaped and used by dwellers to satisfy their everyday needs.

The major benefit provided by post occupancy evaluation studies, especially with regard to affordable housing is how results from previous/existing projects provide valuable data that is critical in informing decisions in future/newer projects [8]. This essentially means that a repeat of mistakes and irregularities from past projects can be avoided rather than carried over to future housing projects. Affordable housing should not only be adequate, but satisfactory, with the distinction between the two terms being the former has more to do with fulfilling the basic need for shelter, while the latter involves other desires like improved quality in terms of size of rooms, or location [30]. This research aims to address this distinction, as it has been relegated from current housing studies.

1.3 Aims, objectives and research questions.

The aim of this study is the evaluation of government-initiated affordable housing programmes and policies in the Kenyan city of Nairobi. The following objectives have been identified:

- To elicit dwellers’ subjective appraisals of habitability at both building and neighbourhood scales

- To ascertain whether habitable spaces in the housing fulfil minimum dwelling standards derived from objective national and global technical metrics
- To assess influence of the planning system and policies on housing habitability

The following research questions were formulated for the study based on the above objectives.

- Do public affordable housing dwellers consider their units habitable and appropriate towards their housing needs?
- How habitable are dwelling spaces based on minimum dwellings standards criteria?
- How has the planning system and policies influenced housing habitability?

1.4 Relevance of the study.

The earlier discussed urban demographic of Nairobi in which 60% of its urban dwellers reside in informal settlements implies there is no shortage of housing research in Kenya and Nairobi. However, as expected, a significant portion of the research is concerned with slums and squatter housing [9], [12], [18], [31], [32], affordability issues [4], [5] and privately developed urban housing [6]–[8], which is significantly comprised of multi-storey housing that are often times insufficient and unable to provide satisfactory living conditions to dwellers.

This study hopes to contribute to creation of new scholarly knowledge by identifying a number of gaps in existing literature that need to be filled. To the best of the researcher's knowledge, there is a wide gap for studies in the Kenyan context that

approach residential evaluation from the theoretical perspective of ‘meaning of housing/built environment’, whereby attention is drawn to how users derive satisfaction through attaching meaning to their residential environments. In addition, there is lack of evaluative studies that comprehensively (and comparatively) assess multiple affordable housing projects, with a lot of the current research focusing on a single housing project at a time. Finally, no studies have attempted to tackle the core subject of housing habitability through a combined methodological approach, where both dwellers’ subjective perceptions are assessed through an extensive habitability assessment index as well as an objective appraisal of habitable spaces against minimum dwelling standards

1.6 Limitations of the study

Some of this study’s major limitations included the inability to obtain comprehensive up-to-date population figures/records of all residents in each of the three housing projects, since many of the current residents were not the intended beneficiaries at the delivery stage of the housing. A systematic sampling procedure based on number of blocks and housing units was instead used. In addition, the current political and administrative situation in Kenya, especially with regard to compulsory registrations of citizens to different government programs creates discomfort and hostile amongst residents towards any individuals engaging in surveys or data collection exercises. This was resolved by stating our intentions beforehand, as well as assurances to respondents of our intention to abide by research ethics of informed consent, guaranteeing anonymity and confidentiality and obtaining all necessary permissions from authorities

1.7 Research process

This study's research process is illustrated in Figure 1 below

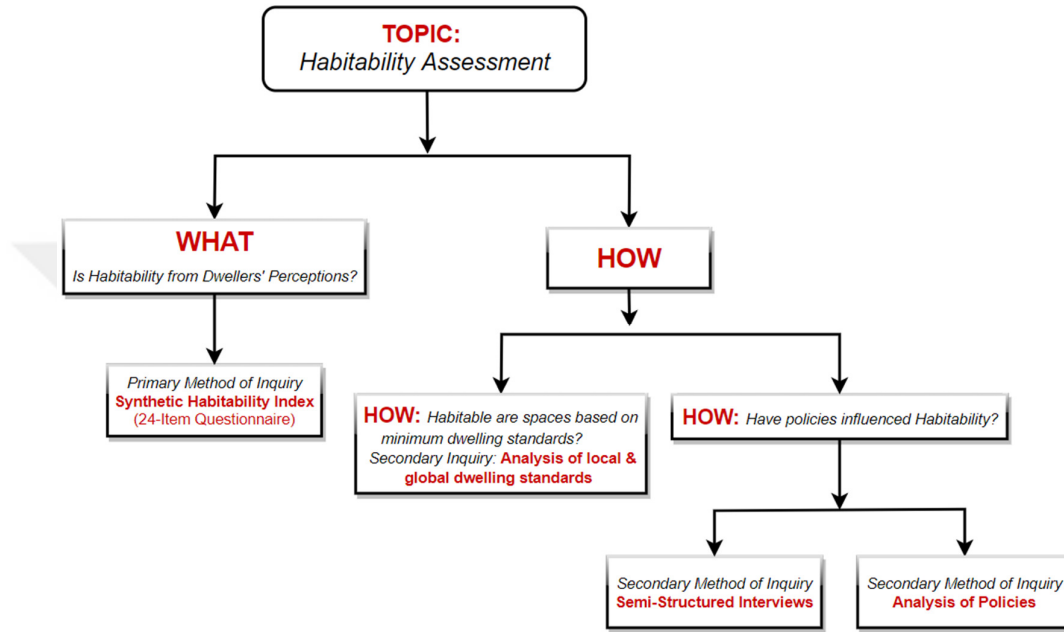


Figure 1.1: Research process used to guide the thesis

1.8 Structure of the thesis

This thesis is divided into five distinct chapters that are highlighted below;

Chapter 1: This chapter comprises the introductory sections of the thesis such as the study's background, problem statement, research questions and study objectives. The chapter further defines the key terms used in addition to highlighting the study's relevance, scope and limitations.

Chapter 2: The second chapter articulates literature reviewed for this thesis, as well providing context in evaluation of housing environments. Theoretical and conceptual

approaches to housing, based on Meaning of the housing and the built environment are explored.

Chapter 3: This chapter covers the research design and methodology, elaborating on the organisation of the research, types of data gathered and processes used in gathering, introduces the study area and housing projects, as well as highlighting data analysis procedures.

Chapter 4: This chapter undertakes analysis of findings such as respondents' characteristics, summarises their appraisals of housing characteristics, and housing performance against minimum dwelling standards.

Chapter 5: Conclusions and recommendations for further research, as per the findings of this thesis are presented in this final chapter.

CHAPTER TWO

LITERATURE REVIEW

This chapter reviews existing literature while providing context and background knowledge related to the evaluation of housing environments. This analytical review is done through exploring theoretical and conceptual approaches to dwellings, and the application of ‘meaning’ to the evaluation of housing environments.

The ideas in this study are shaped through a theoretical background developed by Professor Amos Rapoport in his 1982 work, *The Meaning of the Built Environment* which sought to provide an exploratory insight into peoples’ relationships and interactions with their designed environments, how environments provide context for human activities, how they help structure everyday life functions, and how meaning provides the rationale for how dwellings are shaped and used [29], [33].

Meaning with regard to the built environment directly ties into the field of environmental evaluation, whereby built form and physical elements create (encode) underlying cognitive taxonomies and schemata into people's minds that are then decoded so as to make sense or attach meaning to the world [29], [34]. This point of view is consistent with McIntyre et al’s [35] study which asserts that meaning is central to the understanding of how environments work and how interrelationships between occupants and their housing are never a one-way process but rather one involving continuous evaluation of past meanings and the re-making of new ones, as illustrated in Figure 2.1

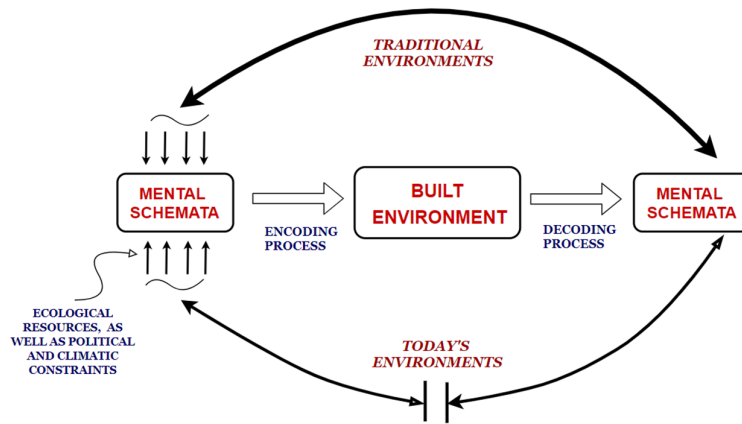


Figure 2.1: Processes through which users encode and decode mental schemata

Other scholars supporting Rapoport’s opinion are Lawton [36] and Mercado & Gonzalez [37] who refer to architecture as a vehicle for expressing complex meanings. Lawton states that meanings, especially in the housing context, are diverse rather than homogenous and that users’ meanings differ from designers’ meanings since the former are reinforced by emotional, personal and symbolic attachments through spatial organisations, forms, colours, furnishings and landscaping [34, p. 300], [36, p. 65]. Rapoport’s understanding of meaning is further underpinned to Blumer’s sociological perspective of symbolic interactionism that highlights the importance of ‘nonverbal communication approaches’ (or nonverbal cues). Blumer argues that people carry out their everyday activities based on their ability to read such cues [38], [39].

The methodology for exploring the concept of ‘meaning’ in this thesis is to build on Rapoport’s work by specifically focusing on housing aspects of the built environment. Meaning is thus categorized into three overlapping sub-themes, with each sub-theme having its own concepts and theories. The first sub-theme, functional meaning of housing, is pegged on Mercado and Gonzalez’ [37] theory of habitability. The second sub-theme is concerned with the social meaning of housing and explores the abstraction of housing into a social process, where meaningful human relations with the environment are

mediated and accommodated. The third sub-theme deals with symbolic meaning of housing and tackles semantic and semiotic theoretical groundings of how the built environment facilitates communication and representation. Each of the three sub-themes are illustrated in Figure 2.2 and are discussed in detail later on in the chapter.

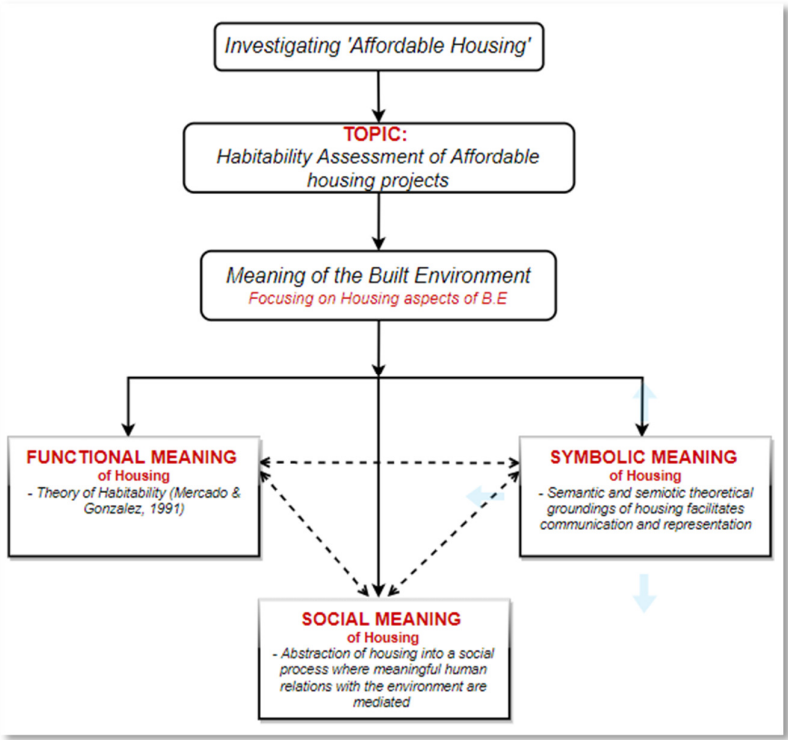


Figure 2.2: Theoretical approaches for investigating meaning

The end of this chapter ties will be able to combine all three sub-themes together and prepare the ground for the development of measuring instruments to be used in the evaluation of habitability and housing condition in Nairobi’s public affordable housing projects

2.1 The concept of habitability

As discussed above, the theory of habitability originates from functional meaning of housing, whereby functionality (used interchangeably with utility and practicality), is the criterion of purposefulness of a building towards satisfying the everyday needs of its inhabitants. McGuire & Schiffer [40, p. 280] refer to functionality in architecture as the basic utilitarian functions expected of architectural spaces, which are specified as; (i) act as a mediator between people, their artifacts and the natural environment, and (ii) to allocate space for executing everyday tasks. They further assert that certain prerequisites are required of spaces for the successful execution of these functions, such as ability to provide specific minimal floor dimensions for particular human activities. . Habitability forms one of the three key existing challenges prevalent in housing discourse in developing countries, together with affordability and availability [41]. In order to widen the scope of the functional meaning of housing, Mercado and Gonzalez' [37] theory of habitability is discussed in the following sections. The background to the theory of habitability is rooted in two aspects; evaluative processes of dwellers' housing and neighbourhood conditions towards the satisfaction of their dwelling needs, as well as assessment of physical aspects of habitable spaces against meeting basic minimum habitable standards [27], [42], [43].

Habitability is defined as the quality attributes of spaces and their potential to meet objective and subjective needs of users (provide satisfaction) while allowing for healthy biological, psychological and social development of residents [37], [44]. Similarly, Meng et al, [45] classify habitability into people, environment and buildings, and conceptually define the term as the affordances which dwellings bestow upon their inhabitants with

respect to safety, dignity, good health, protection against natural elements and structural hazards. Castro [44] associates habitability to quality of life, sustainability and dwellers' expectation of housing to deliver high standards of physical and mental health, and the objective potential of the housing to fulfil minimum dwelling requirements by facilitating the human right to adequate quality housing. The linkage between need and satisfaction is of critical importance in studies of habitability and man-environment studies in general, with need referring to the minimum conditions people must realize to sustain an acceptable quality of life while satisfaction refers to the potential to meet these needs [42], [46]. Other scholars' opinions of habitability point towards spatial organization issues such as size of habitable spaces, internal spatial layouts, and relationships between public and private spaces within housing, in addition to the influence of these issues on dwellers' perceptions towards their residential environments [42], [45].

To establish a conceptual framework of habitability, the term 'habitat' is of significance and is envisaged as a bio-physical-eco-socio-space-system comprising of living space, occupants, the physical-spatial environment, and the interconnections between all these elements [42]. Habitat may also be defined as the expression of the dynamics, nexuses and networks which human beings form with their surroundings, resulting in territories where the resident can 'be', attach meaning, symbols, perceptions and affection [29], [47]. Chardon & Suárez [47] further assert that in addition to habitat representing dimensions beyond the physical-spatial context, it also gives dwellers an opportunity to inhabit, occupy, appropriate, transform and condition their residential environments with the intention of improving their quality of life in a safe and sustainable manner.

The relevance in assessing habitability, housing characteristics and housing quality lies in their potential in acting as a ‘checks and balances’ system upon which urban housing deliveries and provisions can be critiqued [37]. Lessons from past experiences (both successes and deficiencies) are therefore critical in shaping/improving future housing developments, considering housing has a direct impact on users’ quality of life [48], [49]. Habitability assessment therefore acts as an avenue for foreseeing and predicting operation of future public affordable housing and neighbourhoods [26]

Habitability in this thesis will be assessed from two perspectives; both internal habitability at the housing unit scale, and external habitability, where focus is on the relationship between the housing unit and its surrounding/neighbourhood. The neighbourhood has been expanded by studies from Alcalá [50] and Zulaica & Ferraro [43] to include the urban scale, thereby creating the concept of ‘urban habitability’. Urban habitability examines the physical integration of housing within the city, including accessibility of housing from the city centre and public amenities. Habitable housing is therefore expected to be physically integrated within the city rather than located in periphery, marginal and distant-to-reach areas [50]. The concept of urban habitability closely relates to another concept, ‘neighbourhood quality’, defined by Rapoport as the locational quality conferred upon housing by virtue of the surroundings (roads, parks and open spaces) in which it is located [51, p. 150]. Urban habitability has potential to influence success of public affordable projects, such as in Mexico, where De Hoyos Martínez et al [46] highlighted fairly uninhabited units in public affordable housing developments in municipalities of Almoloya de Juárez and Conjunto Urbano Lerma, due to poor accessibility variables as the housing was situated near industrial zones and was out of reach of shopping, education and health services). De Hoyos Martínez further noted

that as a consequence of inappropriate location, 1284 units (or 52.05%) of the total 2678 units were uninhabited [46, p. 13]

The concepts of habitability and physical housing characteristics, and how these relate to satisfaction of dwelling needs have attracted the interest of researchers from diverse disciplines such as psychology, social sciences, healthcare, urban planning and architecture resulting in an extensive collection of empirical studies. These studies have focused on wellbeing aspects of inhabitants like health [52]–[54], quality of life [48], [49], [55] and residential satisfaction [56]–[58]. The general trend in these studies demonstrates how poor state, or insufficient housing and neighbourhood conditions adversely affects these wellbeing aspects. While a few studies have investigated housing and neighbourhood characteristics in public housing, they often target particular vulnerable groups within society, including the elderly [30], [36], [59] and persons with physical disabilities [60]–[63]. These studies argue that resulting from limitations in mobility, vulnerable persons attach more meaning to housing and are particularly sensitive to functional (layout of spaces, access and circulation) and locational variables of housing (distance from public spaces, and from family and friends). Other studies have focused on children, with several researchers investigating impacts of internal and external housing characteristics on children’s wellbeing, social functioning, formation of identity and search for home [33], [64], [65]. In addition, the methodologies adopted by these studies vary from objective assessment, where assessment indices are adopted as measuring instruments to investigate physical aspects of space like size, layout and circulation, number of dwellers per room, structure and building materials [28], [30], [45], [55], [66], [67] to subjective interpretative appraisals that seek dweller perceptions of living conditions and what housing means to them [48], [55], [57], [58].

The empirical assessment of habitability from a theoretical perspective has been the focus of a few studies, particularly in Global South regions of Sub-Saharan Africa, Latin America and Asia. In Latin America, research from Colombia includes Tarchópulos and Ceballos' seminal work [67] that investigated habitability at an architectural and urban scale in low income housing of Bogotá, Colombia. The study investigated quality of housing using physical and non-physical dimensions (intangible meanings of dwellers' relation to housing), and found that the housing to a great extent failed to fulfil dweller expectations resulting in demolition of a vast number of the housing stock, and hence the re-adaptation of 85 percent of the stock so as to meet users' needs [67, p. 61]. Similar shortcomings were noted from a second unrelated study commissioned by the Colombian Society of Architects' Permanent Commission for Habitat Quality to assess habitability conditions in 124 social housing units in Bogotá. The findings revealed housing fell short of user needs, poorly related to neighbourhood context and the city, offered no improvements in quality of life and resulted into socio-spatial segregation [26, p. 98].

Studies from Mexico include Landázuri and Mercado's [68] work investigating housing habitability through analysis of spatial layouts and housing characteristics in Mexico City's metropolitan areas, as well as Molar Orozco and Aguirre Acosta's [28] study conducted in the city of Saltillo, Coahuila that investigated the relation between levels of habitability and occupancy conditions in low income housing. The latter study found that at least 69.52% of the sampled housing stock qualified as habitable based on the criteria of available square footage, number of rooms, and efficiency of circulation [28, p. 12]. The study further stands out from the literature by adopting a theoretical underpinning to environmental psychology, whereby spatial layouts relate to user satisfaction through transactional between inhabitants and their housing (ibid, p. 5). Their

argument reinforces Rapoport's [29] position that transactional processes form the background of housing habitability and help define the interrelations between physical and psychological (or social) dimensions of housing

Furthermore, studies investigating physical housing characteristics and habitability of affordable housing projects have been undertaken in the Asian context for countries such as Turkey [57], [69], [70], Malaysia [58], [71], China [72]–[74] and Papua New Guinea [75]. The African context has studies from Nigeria [56], [76], [77], Ghana [78] and South Africa [79]. The conclusion from these studies is that inadequate physical housing characteristics adversely affect dwellers' habitability, health and quality of life.

Other studies systematically approach habitability through sufficiency of physical and psychological (or social-situational) dimensions of space like privacy, residential (over)crowding, household density and neighbourhood density [8], [26], [80]. These spatial concepts are investigated either through objective minimum dwelling standards or subjective experiences of dwellers on whether they have or lack sufficient privacy and personal space. Studies on the concept of privacy have been extensively researched by scholars such as Altman [81] who defines it as “the selective control of access to the self” [81, p. 24] and Westin [82] who discusses privacy as a dynamic process whose regulation of interactions is based on momentary needs and consists of varying conditions (where users can have too little or too much privacy). Furthermore, Myers et al [83] argue that overcrowding may be assessed through objective aspects based on physical-spatial dimensions such as floor area per person, number of persons-per-room (PPR), people per bedroom, number of families per dwelling unit, number of rooms adapted to functions not originally intended, number of people per square kilometre, and average number of dwellings per acre.

Despite the objective nature of these (over)crowding standards (such as PPR), their evaluation processes are at most subjective, and change over time based on different factors [83]. Myers et al [83, p. 68] for example point out changes in the PPR standard in the United States from 2.00 persons in 1940 to 1.50 persons by 1950, 1.00 persons by 1960 and by the century's turn adoption of a completely different measure - households per housing unit . Other significant objective standards include Unit Square Footage-Per Person (USFPP) which recommends 155 square feet per person as an acceptable minimum space for household purposes [65]. Elaborating on the earlier discussed concept of urban habitability, Baldassarre [84] highlights the perceived benefits to residential (and neighbourhood) density, such as provision of mass transit systems and recreational facilities while the negative aspects included congestion.

While overcrowding remains rampant developing countries, it is also present in developed countries like the United States, as indicated in Gilderbloom and Appelbaum's study [85] derived from the 1983 Annual Housing Survey. The study revealed 3 million American households experienced overcrowding conditions, while a further 700,000 experienced extreme overcrowding conditions of 1.51 or more persons-per-room [85]. Additionally, a survey done by Wilson [86] in England and Wales identified 1.1 million households experiencing overcrowding in their housing, accounting for 4.5% of the population of England and Wales as per 2011 census data [86, p. 9]

2.2 *Other sub-themes of meaning*

In addition to functional meaning of housing, which was discussed in earlier sections of this chapter, the two other subthemes of social meaning and symbolic meaning of housing, which are critical for development of the habitability index used in the methodology section of this thesis, will now be discussed.

2.2.1 Social meaning of housing

Habitability in dwellings is not limited to physical design standards, and should enable abstraction of housing into a social process, where meaningful human relations with the environment are mediated, utilitarian needs are met, and behavioural requirements are accommodated [29], [40], [87]. Social meanings are imbedded in the design and configuration of spaces, and in how and when they are used [88], [89]. Fox O'Mahony [90] further stresses that social meanings of housing vary across different contexts, with issues such as control, privacy and social identity perceived differently by different cultural groups [90, p. 161]

While the influence of physical environment on social interaction has been of interest to several scholars [40], [91], [92], Castells' study [93] clearly articulates the significance of social ties and networks both in housing and the neighbourhood settings:

“people socialize and interact in their local environment, be it in the village, in the city, or in the suburb, and they build social networks among their neighbours. On the other hand, locally based identities intersect with other sources of meaning and social recognition, in a highly diversified pattern that allows for alternative interpretations”

[93, p. 60]

The focus of this section is social practice, use of space and the overall social implications arising out of residence in different housing settings (such as single family homes, high or low rise apartment complexes) on users and assessing potential of housing characteristics to meet dwellers' social requirements through a symbiotic relationship. The link between housing habitability and social relations is further highlighted in the works of Knox [92] and Glaeser & Sacerdote [91] who explore the pivotal role of housing as a medium through which social relationships (both at household and neighbourhood level) are sustained, reproduced and modified. Using theories of social connection, Glaeser & Sacerdote [91, p. 13] investigate the interaction between individual housing units, how physical-spatial shortages of public outdoor spaces in multi-unit blocks are negotiated by users, and the relation between costs and social connections, whereby increased costs of connection (time, distance, money) result in decline of social interaction. Since habitability can be regarded as a by-product of social interactions and affective/emotional connections between users, their dwellings and the neighbourhood, such interactions will be under investigation with regard to Nairobi's public affordable housing projects, as well as the contribution of such interactions to the overall satisfaction of users.

2.2.2 Symbolic meaning of housing

The symbolic role of buildings is one of the most well documented relationships in man-environment studies [92]. Minai [94] notes that dwellings carry symbolic meanings while discussing the semantic and semiotic theoretical foundations of how architecture facilitates communication and representation. Minai and other scholars further highlight how spatial forms and architectural organization can provide spatial cues and context for

interpretation by users as well as communicate symbolic dimensions and ideological meanings such as values and identity [94]–[96]. The suburban residence may for example represent nuclear family, private accumulation of wealth and class/age group segregation while high rise blocks and skyscrapers may be regarded as symbols of modernism and efficiency [97]. In addition, meaning can be negative and undesirable, such as the obtrusiveness brought about by high-rise apartment blocks in American suburban areas is looked down upon for ‘destroying’ the rural suburban image, and for those fleeing city life as a ‘tentacle of the city’ that follows them [29]. Meaning in the built environment may also be illustrated through availability of recreational parks and outdoor public spaces which communicate symbolic meanings of positive environmental quality for the areas they are located, even when empty/ used by very few people [98]. Prak [99] explores the concept of ‘language of architecture’ in which he posits that similar to languages, architecture comprises a system of signs for communicating information through a logic of structure and form [100], [101]. The ability of dwellers to attach relevant symbolic meanings to their housing has implications on their perceptions of habitability and residential satisfaction. Symbolic meaning forms an important component of dwellers’ perception of their housing, and its application will be during development of a habitability assessment index in Chapter 3.

2.3 Related concepts: Architectural Quality

This thesis acknowledges the overlap between assessments of habitability and architectural (or environmental) quality, as both are concerned with psychological and socio-cultural attributes of habitual environments and their provision of meaning and satisfaction to inhabitants [30], [43], [68], [102], [103]. Environmental quality, according

to Rapoport's [102] argument, should be at the forefront (the what and why) of any planning and design processes of residential environments.

With regard to appropriate methods of quality assessment, King et al [104] and Cook [105] argue that objective criteria (top-down approaches) often result in dehumanization of housing policy and practice, and often do not provide a holistic picture of quality conditions as they exclude residents' experiences. They instead recommend a bottom-up approach that undertakes quality assessment through residents' perceptions of their housing. Due to the multidimensional structure of environmental quality, a classification structure of attributes is done to capture physical, associational, perceptual, social and cultural aspects of housing and neighbourhoods [26], [29], [68], [106], [107]. This argument is further supported by [108, p. 70].

Buckenberger [108, p. 70] acknowledges presence of more than one type of 'quality' in the built environment, a statement supported by Cook [105], and an influencing factor in this study's classification of quality into two separate areas of design quality and housing quality. The significance in assessing design quality and housing quality, according to [107] is their association to post occupancy evaluation, a process concerned with both performance of buildings and dwellers' levels of satisfaction with the built environment to solicit feedback that can inform future designs.

Of the two categories of quality, design quality is the broader one, with three approaches ('judgement-based', manage-and-measure and rational-adaptive approaches) that focus on housing evaluation based on expert's opinions and measuring tools [105]–[107]. Design quality is assessed for various architectural spaces such as schools, healthcare complexes and housing environments. The term 'design quality' is used as a

multi-faceted phenomenon whose investigation dates back to the days of Roman architect Marco Vitruvius, and is considered a modern day interpretation of his *firmitas, utilitas* and *venustas* framework (commodity, firmness, delight). This framework stipulates design quality is achieved by fulfilling three fields of functionality, build quality and impact [109], [110]. These three fields also form the background to the measuring instrument for design quality, the Design Quality Indicator (DQI) developed by the UK's Construction Industry Council (CIC) based on published standards and consensual best practices [107]. The criteria assessed under design quality is illustrated in Figure 2.3

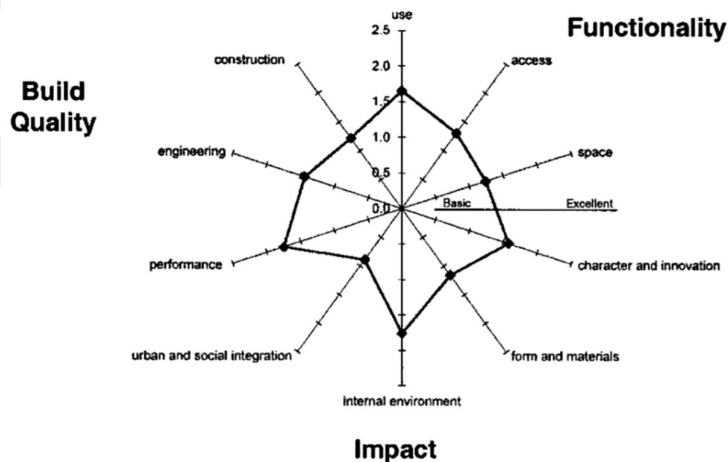


Figure 2.3: Assessment criteria that comprises the Design Quality Indicator

Despite the second quality classification of housing quality having a narrower scope than design quality with its exclusive focus on housing, housing quality is still a diverse concept with diverse interpretative approaches depending on scholars, and geographical context of studies being undertaken [55]. A variety of housing quality interpretations are illustrated in figures 2.3 and 2.4. While various studies have their own methodologies and measuring indices for assessing housing quality, this thesis adopts an integrated approach that is concerned with; (1) inclusion of dwellers' perceptions of their housing experiences, and (2) investigation of physical design standards based on

quantitative, objective and/or technical measures of adequacy pegged to what a ‘good’ or ‘habitable’ dwelling should be

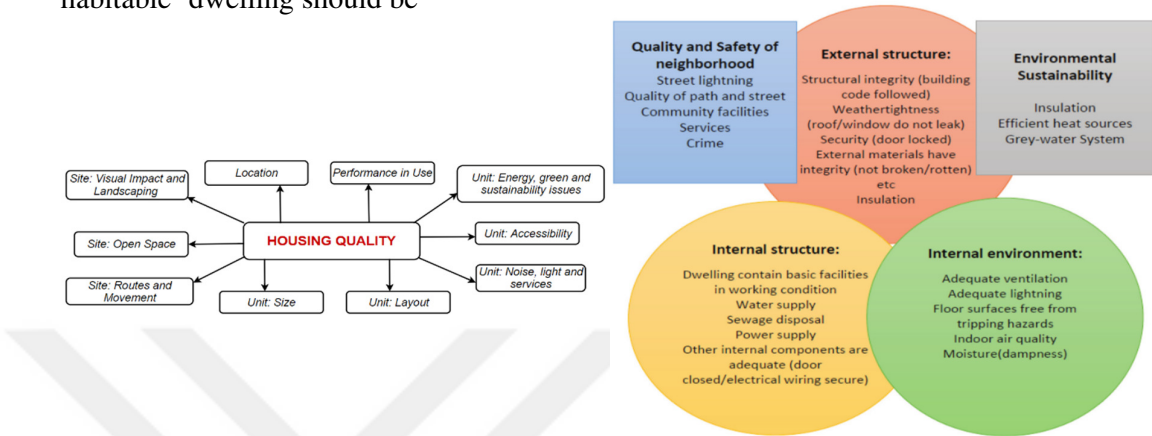


Figure 2.4 & 2.5: Various assessment criteria for measuring housing quality

This chapters first sections introduced and discussed habitability, and its underlying concept of meaning. The overlap between habitability and environmental quality (design quality and housing quality), both in terms of their assessment methodologies and measuring instruments was also discussed. These measuring instruments were crucial to the development of a synthetic habitability assessment index in the methodology section.

2.4 Housing, planning and habitability in Nairobi

The provision of affordable and/or low-income housing by the state in Kenya (and in many countries of Sub-Saharan Africa) is limited to slum upgrading and building staff housing for civil servants [11]. The role of the state in achieving this provision has been to act as either ‘enabler’, where the private sector is facilitated to participate in housing production, or ‘provider’ where the state itself (or through public bodies) directly participates in conceptualizing, planning and construction of housing [12], [111]. Urban housing in Kenya has generally been categorised by Gulyani et al [8] into four categories;

single family houses, multi-story structures with shared facilities, single-storey-single-roomed blocks with facilities in a single compound and multi-story (self-contained) apartments/tenements. The most notable affordable housing projects realized to date (and hence selected as case studies for this thesis) fall under the category of multi-story apartments, having been delivered through either the NHC (e.g. Pumwani housing project and Nyayo High-Rise) or through partnership programs with donor organisations like the UN-Habitat/KENSUP or Kenya Slum Upgrading Programme (e.g. Soweto East Zone A).

While several studies explore urbanism, planning and affordable housing issues within Kenya and Nairobi, the scope of many of these studies are often narrower as they focus on particular issues, such as physical spatial planning [112], [113] informal housing issues [12], [32], privately developed urban housing in Kenya [7], [8] or living conditions in particular affordable housing developments [4], [5], [11]. There is therefore a shortage of studies comprehensively examining attributes of habitability in affordable housing projects, studies that explore planning legislation and delivery models guiding the provision of this affordable housing, as well as those exploring the influence of housing policies on attributes of habitability within affordable housing projects. The few studies incorporating habitability aspects include Gulyani et al's [8] large-sample household survey (n=14,204) of 15 representative Kenyan cities that investigated housing type, characteristics, quality, neighbourhood conditions and locational variables for urban housing (mainly privately developed). The study's findings revealed despite housing policy recommendations of minimum spatial requirements of two habitable rooms, sanitary facilities and cooking area in a minimum gross floor area of 40 square metres per household [3, p. 9], average urban households sampled comprised 1.8 rooms and an average household size of 3 persons. While these values translate into an average

overcrowding value of 2.2 persons-per-room, (PPR) which is above the recommended standard of 1.5 PPR in developing countries [85], [86]. Additionally, Huchzermeyer's research [6] that investigated habitability in private low income housing developments (tenements) in the suburbs of Umoja and Huruma found extensive overcrowding with regard to both household and neighbourhood density, poor access and circulation, insufficient sanitation facilities (up to 14 rooms sharing one toilet), and a lack of public social amenities resulting from incompetency of local authorities in enforcing building regulations [6, p. 724]

An integral function of town, city and national planning system of Kenya is the development of mechanisms that allow for a continuous supply of affordable housing that is both habitable and affordable [114]. This section thus explores Kenya's planning system, comprising various legal and institutional apparatus used both at national and sub-national levels to formulate and implement human settlement plans. Kenya's governance and planning structure has provisions for both national and local governance systems, with the local governance system being rooted in the 1963 Local Government Regulations that later converted into Local Government Act, Cap 265 [113]. Authority was decentralised from the Ministry of Local Government into 175 local authorities (municipal, town, urban or county authorities) to ensure improved and localised planning and delivery of social services and infrastructure, as well as overseeing urban development in their respective localities [3]. While such a governance structure has had associated benefits, several scholars such as Majale [113] and Gulyani et al [8] argue it foregoes an opportunity for integrated planning, where a single strategic vision helps to guide urban development. The result is fragmented planning where each local government independently makes and adopts their own planning decisions [115]. Based

on data from the government’s earlier economic surveys and development plans, it was evident that housing production was not a priority. For instance, public expenditure towards housing relative to total government expenditure was less than 4 percent, trailing other sectors like health (4.9%), agriculture (11.5%), energy and regional development (15.5%) and transport and communication (22.6)% [116], [117]. Four important planning and housing legislations are highlighted in this section, and are highlighted in Table 2.1 below;

Table 2.1: Relevant legislative and policy frameworks

Policy	
i)	Physical Planning Act, Cap 286 of 1996
ii)	1966/1967 Sessional Paper No. 5
iii)	1967 Housing Act Cap 117
iv)	Sessional Paper No. 3 of 2004 on National Housing Policy
v)	Housing Bill of 2011 (based in the 2010 Kenyan Constitution)

The first legislation is the Physical Planning Act, (Cap 286 of 1996), which is the main law governing spatial planning in Kenya through provision of national, regional and local physical planning guidelines for the control of land use and building developments. The act’s objectives include harmonization of planning procedures and requirements, providing legal frameworks for protecting public land gazetted for public amenities and utilities as well as creating frameworks for public participation in planning and implementation procedures [118]. Key sections of the act include sections 4 and 5 that created the office of the Director of Physical Planning to head the Department of Physical Planning at the Ministry of Lands and Settlements, and whose tasks include production of physical development plans and overseeing matters regarding physical planning and

approval of various developments. Furthermore, sections 16, 29 and 30 that grant local authorities (such as counties, townships and municipalities) statutory power to ensure appropriate and orderly physical development of government, trust and private land. [119]

The second legislation is the 1966/1967 Sessional Paper No. 5, considered the first attempt at creating and regulating housing through a comprehensive housing policy. Arising out of rapid population increase in urban areas following independence, this policy officially recognized the need for subsidized public housing for urban dwellers through its main policy objective, which was provision of adequate shelter and a healthy living environment to the “maximum number of people at the lowest possible cost” [120]. This policy has however been criticized for advocating and justifying demolition of informal settlements to pave way for formal housing development through approving forced mass eviction of slum dwellers without negotiations, compensation or resettlement options, a practice the United Nations considers a gross violation of human rights [121]. Programmes resulting from this particular policy failed in their attempts at reducing informal settlements, as the evictees simply relocated to other informal settlements, thereby exacerbating poverty levels since their previous social solidarity connections, vital income sources and capital assets had been lost through the evictions [122]. Sessional Paper No. 5 was however responsible for enacting Housing Act Cap 117 in 1967 as an Act of Parliament to facilitate policy implementation through establishment of the National Housing Corporation (NHC) [114].

The third policy is Sessional Paper No. 3 of 2004 on National Housing Policy, developed in acknowledgement of the need to address Kenya’s rapid urbanisation, population growth and widespread poverty [3]. The policy referenced the 2000

Millennium Development Goals (MDGs) and shifted its emphasis towards pro-poor delivery models, contrary to the earlier retrogressive housing policy, the 1966/1967 Sessional Paper No. 5 which advocated for informal settlement demolition [114]. Among the 2004 policy objectives was facilitation of progressive and equitable housing opportunities through strategies such as increasing access to cheap housing finance, ensuring security of land tenure especially towards disadvantaged groups of the population, provision to infrastructure particularly access routes, water, garbage disposal, appropriate drainage and electricity [114]. Notable sections include section 30 which specifically called for minimal displacement of informal settlers during slum upgrading exercises and the consideration of dwellers' socio-economic status through inclusion of income generating activities into housing development schemes so as to improve livelihoods and alleviate urban poverty, and section 32 that encouraged participatory inclusion of all relevant stakeholders, especially the benefitting communities in policy development [114]. The Ministry of Lands, Housing and Urban Development was tasked with coordination and implementation of this policy, providing expertise in areas of land use management, construction materials research and financing options [118]. Sessional Paper No. 3 of 2004 was instrumental by paving way for a number of the country's flagship projects as it provided satisfactory provisions under which donor funding (for Kenya Slum Upgrading Programme, KENSUP and Kenya Informal Settlement Improvement Programme, KISIP) could be secured to facilitate informal settlement upgrading [114].

The fourth and final policy is the Housing Bill of 2011 conceptualized to enhance efforts of realizing adequate and accessible housing, as stipulated by Article 43(1) (b) of the 2010 Constitution in which every citizen is guaranteed a right to adequate housing

with reasonable standards of sanitation [123]. Improved access to housing was to be achieved through coordination with two key institutions, the National Land Commission and county governments, which are quasi-independent decentralized administrative units, to secure land and develop infrastructure through strategies like repossessing undeveloped public land parcels whose allotment periods have expired and the re-allocating these towards new entities, the Kenya Housing Authority, KHA and National Housing Development Fund, NHDF, that were tasked with providing financing for housing and infrastructure development [23]

Having discussed four relevant planning and housing legislations, later sections (section 4.5) of this thesis will investigate the influence of these legislations on attributes of habitability in Nairobi's public affordable housing projects.

CHAPTER THREE

RESEARCH DESIGN AND METHODOLOGY

This chapter describes the research methodology adopted for this thesis, with initial sections justifying the strategies used in data gathering and analysis. This research was implemented in three affordable housing projects all located within Nairobi city, the Kenyan capital. Therefore information from the three study areas, such as selection of participants, socio-demographic profiles of selected samples, descriptions of research instruments, reliability tests for these instruments, and data collection processes are presented.

Selection of a research strategy should always be informed by the nature of the research question and specific goals of the research [124]. The research goal, as earlier stated in chapter one is to evaluate government-initiated affordable housing programmes and policies in Nairobi. This study was guided by the research questions stated below:

- Do public affordable housing dwellers consider their units habitable and appropriate towards their housing needs?
- How habitable are dwelling spaces based on minimum dwellings standards criteria?
- How has the planning system and policies influenced housing habitability?

Since the research intends to make generalizations about entire populations of housing residents, sampling techniques were considered important [125]. Furthermore, a quantitative research approach comprising fieldwork case studies was adopted, making use of questionnaire surveys for data gathering due to nature of data being collected

(technical standards that form minimum dwelling requirements, qualities of spaces and so forth), numerical analysis, and emphasis on measurement using validated data collection instruments (or indices). Creswell [126] argues that despite case studies being traditionally categorized under qualitative approaches, they are complementary to data collection and are essential to understanding why and how events unfold in a particular context

3.1 The study area

Information about the physical setting and research processes is presented in the sections below.

3.1.1 Geographical setting

This study was carried out in Nairobi, the capital and largest city in Kenya, where it lies close to 200 km south of the Equator and is situated along the coordinates of 1°9'S, 1°28'S and 36°4'E, 37°10'E [31]. The city occupies a total area of approximately 696km² (or 0.1 percent of Kenya's total surface area) with altitudes varying between 1600 and 1850 metres above sea level [112]. Furthermore, Nairobi's topographic structure is such that the western part is at a higher altitude with a rugged topography while the eastern part has a lower profile and is generally flat. The city further has three main rivers (the Nairobi, Mathare and Ngong) which traverse several of its neighbourhoods. Of the three selected housing projects, two are situated in Kibera division while the third is in Pumwani division, with the distance all three being less than 40 kilometres.

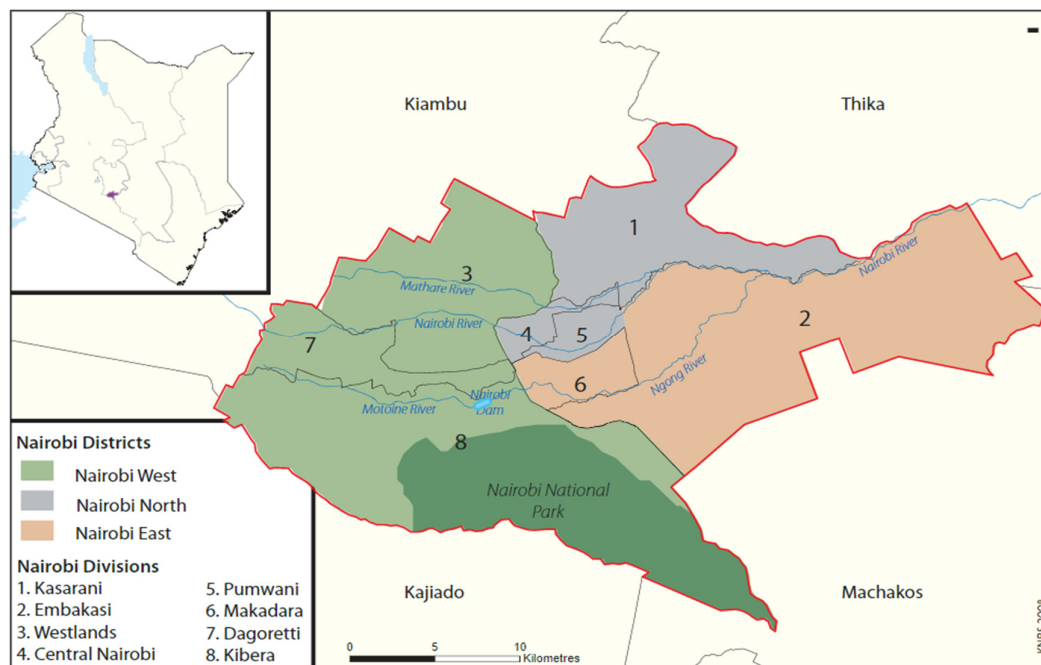


Figure 3.1: Map of Nairobi showing the city’s three districts and eight divisions

3.1.2 Sampling procedure and sample characteristics

This study’s target population are all households residing in each of the three public affordable housing projects, despite the lack of an explicit method of ascertaining their approximate total number. Consequently, the total number of housing blocks and apartment units for each project was used as the reference sampling frame. Sampling is a necessary procedure during data collection, and while several sampling techniques (both probability based and non-probability based) are in existence, specific ones were more suited towards this study.

Systematic sampling, defined by Babbie [125, p. 228] as a form of probability sampling where every k th unit is selected for inclusion in a given sample was adopted for the three projects, based on each project’s total number of blocks. (50 blocks for Kibera

Nyayo Highrise, 13 blocks for KENSUP Soweto East Zone A and 21 blocks for Pumwani Majengo). Babbie further argues that sample sizes should seek to achieve representativeness of the entire study population so as to enable generalization of findings [125, p. 226]. In a systematic sampling procedure adopted by Alnsour & Meaton [127] and Phillips et al, [30], site layouts for all projects are analysed and directly observed such that blocks and units are chronologically numbered from first to last. An initial unit was selected and thereafter every 10th unit (counting from ground floors upwards to the upper floors) was selected for inclusion. In the event of non-response from the selected kth unit, neighbouring unit(s) were instead selected for data collection. Sample sizes at the end of the sampling procedure were 31 units in Kibera Nyayo Highrise, 34 units from KENSUP Soweto East Zone A and 27 units in Pumwani Majengo. This translated into a total of 92 units from across the three different housing projects.

3.2 Housing projects and their building typologies

As indicated earlier in this chapter, two of the three selected housing projects are located in Kibera division while the third is in Pumwani division. Although the housing profile and typologies comprising each project are individually discussed below, the average housing profile noticed through fieldwork observation are several standalone medium density housing blocks comprising two bedroom apartment units. Rarely has the National Housing Corporation (NHC) engaged in development of other typologies, such as single family detached or semi-detached housing [7]

Project 1 is Kibera Nyayo highrise. This housing development comprises 194 housing units, in 50 blocks of medium density (4-6 floors depending on topography) with the main typologies being one and two bedroom apartment units. It was established in

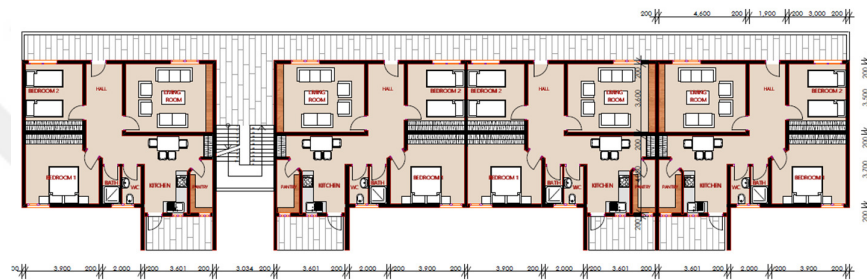
1992 on a site previously occupied by informal settlements within the Kibera slum and while it was intended as formal housing for low income households who could not afford housing at market rates, the project has over the years transformed into middle income housing on land that originally gazetted for housing the city's urban poor [12, p. 21]. One of the consequences is lack of enough parking spaces since not many car owners were conceptualized into the project. The average housing block has 10 two bedroom units each with a living room, kitchen and ablution spaces that are serviced by three external staircases, as illustrated in figures 3.2-3.6



Figures 3.2, 3.3, 3.4, 3.5 and 3.6: Photos, floor layout and site layout of a two bedroom block in Kibera Nyayo highrise

Project 2 is KENSUP Soweto East Zone A, which neighbours the Nyayo highrise housing development, but with a differing typology and language. It comprises 822 housing units, spread out in 13 clustered housing blocks of 144 three bedroom, 570 two bedroom and 108 one roomed apartment units [5] as seen in figures 3.7 – 3.10. It is the

pilot project of the Kenya Slum Upgrading Programme (KENSUP) having developed from a Memorandum of Understanding between UN-Habitat/World Bank Cities Alliance and the Kenyan government in 2003 with the goal of improving the livelihoods of people residing in informal settlements [5], [11]. The units only became available for occupation after July 2016, after a 13 year waiting period.



Figures 3.7, 3.8, 3.9, and 3.10: Photos, floor layout and site layout of a two bedroom block in KENSUP Soweto East

Project 3 is the Pumwani Majengo housing, which is located in the Pumwani area, 2.5 km from the Nairobi Central Business District and is considered the oldest informal settlement in Kenya, having been established in 1923 [4]. The project comprises 444 apartments spread out in 21 housing blocks developed by the NHC over three phases,

with the original phase having commenced in 1968 while the consequent phases happened in 1987 and 2002. The building forms are four storied blocks comprising two bedroom apartment units, as seen in Figures 3.11 – 3.14



Figures 3.11, 3.12, 3.13, and 3.14: Photos, floor layout and site layout of a two bedroom block in KENSUP Soweto East

A summary providing background information of on all housing projects is presented in Table 3.1

Table 3.1: Summary of all three housing projects

Housing project	Year of occupation	Density & Number of units	No of bedrooms
Kibera Nyayo High Rise	1992	50 Medium high density with 194 units	1 bed (78) 2 bed (116)
KENSUP Soweto East	2016	13 clustered high density with 822 units	Studio/bedsit (108) 2 bed (570) 3 bed (144)
Pumwani -Majengo	1968, 1987 & 2002	21 Medium high density with 444 units	2 bed (444)

3.4 Research Process and Instruments

The data collection process was tailored towards gathering residents' perception of their housing spaces and neighbourhood, calling for application of several research instruments

The primary method of inquiry was data collection in Nairobi during April and May 2019 using a 24 item questionnaire developed from a synthetic habitability index (see Appendix II). Synthetic is used in the sense that the structure, including variables, sub variables, parameters and indicators are constructed from sections of other measuring instruments/indices. Four measuring instruments contributed to the development of this synthetic index and include; i) Habitability measuring methodology [26], ii) Index for architectural design quality [110], iii) Habitability Conditions Index [30] and iv) Index of habitability & architectural design [68]. The synthetic index provided an avenue for exploration and operationalization of what exactly represents 'habitability' and helped develop the questionnaire used in obtaining dwellers' perceptions. The index consists of variables (which are a classification criteria for distinguishing different units of analysis) and are measured through indicators, which provide information about related to a phenomena [30]

The 24 item questionnaire comprised two major sections, with the first collecting respondents' demographic characteristics such as economic data, level of education and household structures/family sizes. The second part required respondents to rate their perceptions against a 7 point Likert scale for Strongly Agree=1; Moderately Agree=2, Slightly Agree=3, Neither Agree nor Disagree=4, Slightly disagree=5, Moderately disagree=6 and Strongly Disagree=7. The questionnaire categorized the 24 habitability variables into the three sub-themes of *meaning of housing*. Functional meaning had 19

variables under either external or internal habitability). Under a similar categorization structure, social meaning had 4 variables while symbolic meaning had 1 variable. Administration of the questionnaire was to heads or co-heads of households and was conducted in the months of April and May, 2019 with the aid of two 3rd year Bachelor of Construction Management students from the University of Nairobi as research assistants. Prior to administering the questionnaire, a two day pre-test session with a small sample (n=11) of respondents from Kibera Nyayo highrise was done, where the researchers and their intended study objectives were introduced, permissions and various forms of assistance obtained as well as identification of potential obstacles. As a result of the pre-test stage, the number of questions were reduced from 40 to 24.

It is recommended for research instruments, especially regarding qualitative research to fulfil two vital concerns of validity and reliability. Reliability (or internal consistency) is concerned with application of methods used in the investigation, and their ability to produce similar results under similar conditions while validity questions conclusions and assumptions from a specific researcher are in line with the research aims and objectives [125]. Reliability analysis was carried out for the questionnaire in each of the three housing projects using the Cronbach's alpha coefficient. The resulting coefficient alpha coefficients were 0.842, 0.844 and 0.881 for Kibera Nyayo High Rise, KENSUP Soweto East and Pumwani-Majengo projects respectively, in line with the recommended Cronbach's alpha of > 0.70 [128]

Secondary methods of inquiry included analysis of local and global dwelling standards using three checklists and 12 interviews were conducted with professionals. These included policy makers and technocrats from the State Department for Housing and Urban Development (n=3), practicing architects (n=4), planners and corporate liaison

officers from the NHC (n=3), and Nairobi city council public health professionals (n=2) to obtain their insights towards housing standards. This was backed up with literature analysis of technical standards and planning legislations on issues such as on health, crowding, density and spatial dimensions both in developed and developing countries

Further analysis of the quantitative data was done through both descriptive and inferential statistical analysis using Microsoft Excel and SPSS 24.0 while the qualitative analysis from interviews and observation schedules was achieved using content analysis.

CHAPTER FOUR

FINDINGS, ANALYSIS AND DISCUSSION

This chapter presents major findings obtained from the three affordable housing projects. Residents' perceptions of their housing conditions and characteristics were sought, and these were rated against Likert scales based on the extent that residents agreed or disagreed with questions.

The analysis begins with descriptions of profiles of the study's respondents and discusses results of the findings relative to the research aim, objectives and key questions set out at in the chapter one. The quantitative data has been presented through tables, frequencies and percentages

4.1 Socio-demographic characteristics of respondents

4.1.1 Age of respondents

The five age categories under investigation were fairly balanced, with no particular age group maintaining a consistent composition throughout all three projects. It was instead a common trend for a particular group to maintain a high percentage in two projects, only to score lowly in the third project, such as respondents aged 65 and over comprised a significant 23% and 29% of respondents in Kibera Nyayo High Rise and KENSUP Soweto East respectively, but only formed a minority 15% in Pumwani-Majengo housing, or the reverse whereby the 35-44 year category is under-represented in both KENSUP Soweto East and Pumwani-Majengo (15% and 19%) but represented significantly in Kibera Nyayo High Rise at 29%

It was also evident that middle aged respondents (in the 45-54 and 55-64 years categories) were less represented in the samples when compared to those below 35 years and those above 65 years, with a possible explanation being the country's official demographics figures where 60% of the population is below 25 years [129]. Other possible explanations include increased demand for decent housing by young middle class families, who possess financial independence and are at the most productive stages of their lives [8]

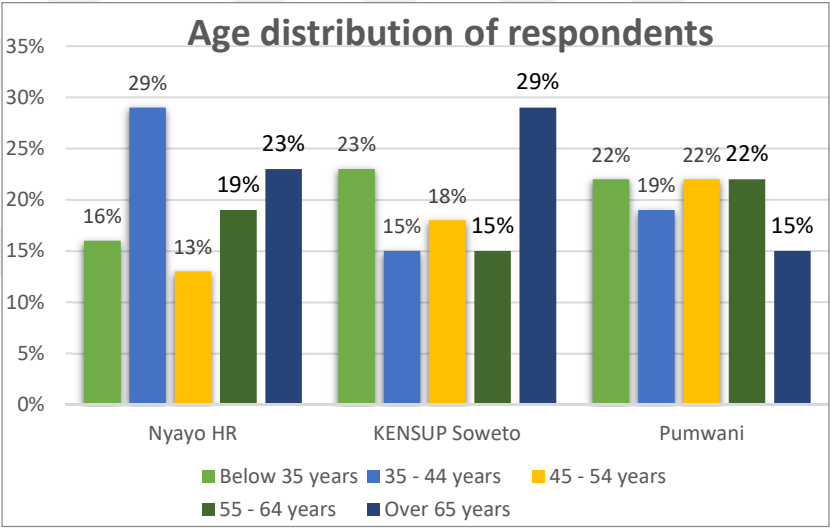


Figure 4.1: Distribution of respondents in the three projects by age

4.1.2 Gender profiles of respondents

In all three housing projects, more female respondents than males were included in the sample, with the biggest difference seen in Pumwani (63% against 37% for males). This was followed by Kibera Nyayo High Rise (58% against 42% for males) and KENSUP Soweto East where females comprised 56% of the sample while males made up 44%.

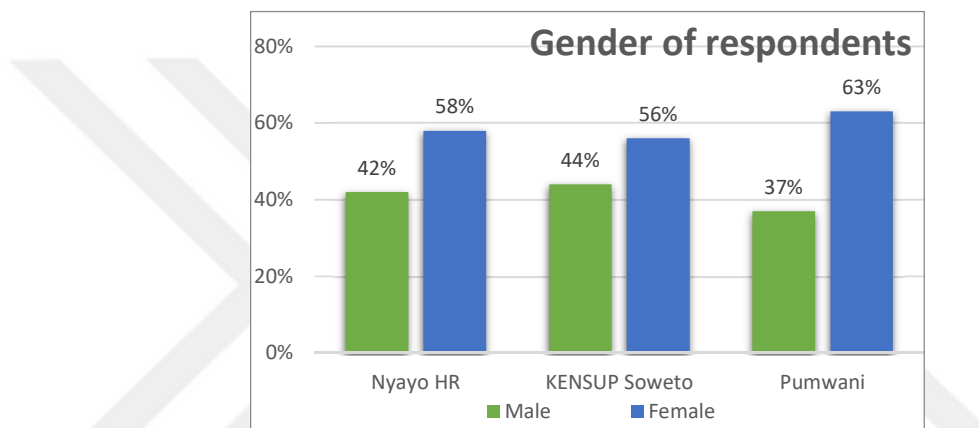


Figure 4.2: Distribution of respondents in the three projects by gender

4.1.3 Education attainment

The majority of respondents had attained up to a given level of education, with only 6% in Nyayo highrise, 3% in KENSUP Soweto East and 7% in Pumwani-Majengo no having received formal education. In both Nyayo highrise and KENSUP Soweto East, the highest category of education was secondary school (39% and 50%) while this changed to a university degree in the case of Pumwani-Majengo (44%). Primary school level was fairly low in all projects except KENSUP where it scored second after secondary school level (29%)

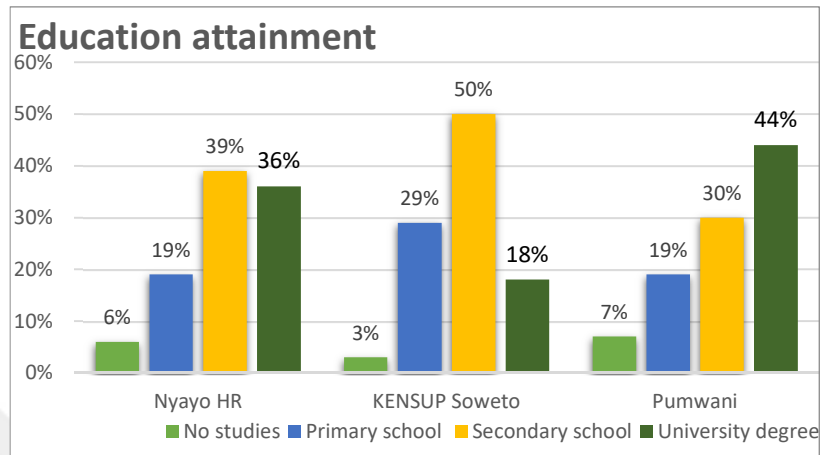


Figure 4.3: Levels of education attained by respondents

4.1.4 Household type and size

The observed pattern from all housing projects was that the most prevalent household type was married couples with children, who comprise 52%, 38% and 52% of households in Kibera Nyayo highrise, KENSUP Soweto East and Pumwani-Majengo respectively. An interesting pattern was the presence of living arrangements categorised under ‘other household types’ which attempted to cover other living arrangements other than the regular single/married categories. These was intended to capture residents living with friends, relatives from extended families or siblings, people in dating stages and people subletting their housing units. While this category was fairly low in Nyayo highrise and KENSUP Soweto East, it recorded a significant number of respondents in Pumwani-Majengo at 22%.

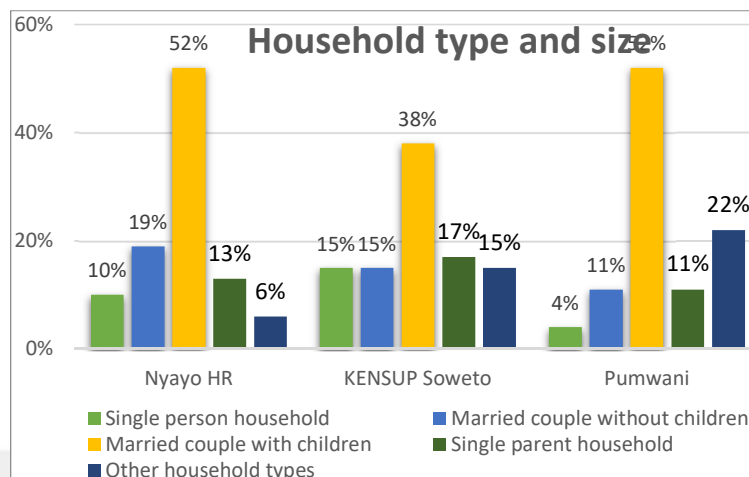


Figure 4.4: Distribution of household types throughout all projects

With regard to size of households, covered in detail under objective minimum dwelling standards, the household sizes ranged from 2 to 6 members/household for Kibera Nyayo highrise, 1-6 members/household for KENSUP Soweto East and 3-8 members/household in Pumwani-Majengo. This accounts for 65%, 49% and 62% of households respectively comprising 4 or more members, which corresponds to the national figures of 4.4 people per household [129]

Table 4.1: Household sizes in the three projects

Housing project	Range of household size
Kibera Nyayo highrise (n=31)	2-6
KENSUP Soweto East (n=34)	1-6
Pumwani-Majengo (n=27)	3-8

4.1.5 Monthly household income

As depicted in Figure 4.8, majority (44%, 39% and 44%) of respondents in Kibera Nyayo highrise, KENSUP Soweto East and Pumwani-Majengo earned between KES 50,000 and KES 200,000 (translating into between USD 494 – USD 1976) while high income earners comprise the minority of residents (19% 32 and 24% respectively). The lowest income

category (less than KES 50,000) was also fairly captured amongst respondents, which indicates that majority of the housing was being inhabited by the intended respondents (low income earners). This conclusion is based on national affordable housing guidelines, where four economic income brackets have been established to enable categorization of affordable housing, which are KES 0- KES 19,999 that are regarded low income earners, followed by the category of KES 20,000 to KES 49,000. The consequent categories of KES 50,000 to KES 149,000 and those above 150,000 are considered middle and high income earners and hence qualify for mortgages [3]

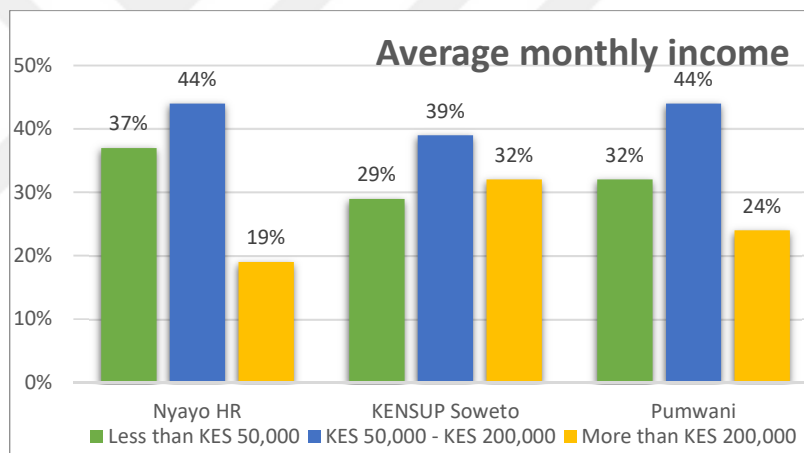


Figure 4.5: Income profiles of respondents

4.1.6 Current employment status

Majority of respondents were engaged in full time across all housing projects, comprising 52%, 58% and 48% of respondents from Kibera Nyayo highrise, KENSUP Soweto East and Pumwani-Majengo respectively. This category was followed by respondents working part time (32%, 29% and 37% for all projects respectively). Unemployment was also evident across all projects (16% in Kibera Nyayo highrise), 13% in KENSUP Soweto East and 15% in Pumwani-Majengo. Many of the unemployed residents reported they

were seeking work while old age and disability were the other reasons for the significant unemployment figures.

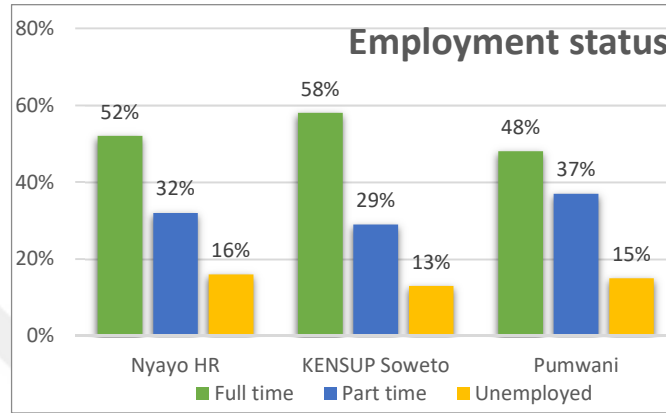


Figure 4.6: Employment status of respondents

4.1.7 Duration of residence in housing

The different timelines within which the projects were delivery for occupation had an influence on the respondents’ duration of residence. In the case of KENSUP Soweto East, which is the newest amongst the three projects, a significant number (68%) had lived in their units between 1 and 3 years. This takes into the account the fact that the bulk if the housing project was completed for occupation in July 2016 hence implying that this percentage were intended beneficiaries (former slum dwellers residing in Kibera). In the case of Kibera Nyayo highrise (completed in 1991) and Pumwani-Majengo (latest phase of 2002), duration of residence figures were evenly distributed throughout all categories, where 32% and 26% of respondents had been in living in their units for more than five years. However, based on direct observation of resident lifestyles and possessions, as well as from past studies [11], [12], it is evident that a significant portion of current residents of Kibera Nyayo highrise fall under the middle class, and hence not the poor urban dwellers the government had in mind during the conception of the project

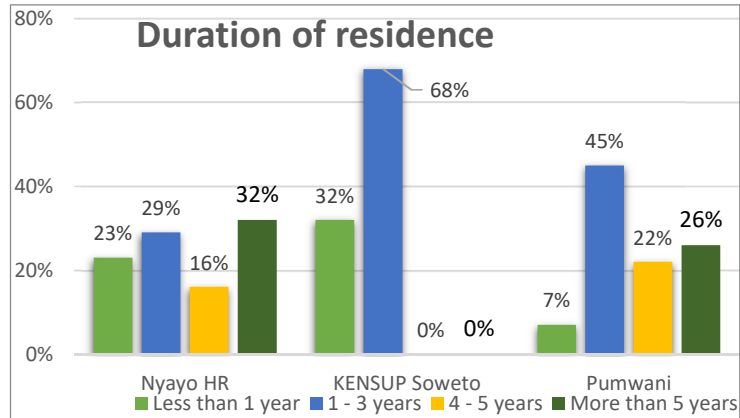


Figure 4.7: Duration of residence

4.1.8 Tenure status

Tenure status within all projects was closely matched, with both Kibera Nyayo highrise and KENSUP Soweto East having 42% and 44% owners, and 58% and 56% renters respectively. There were cases of both tenure situations within single housing units, especially in Pumwani-Majengo and KENSUP Soweto East, where owners opted to sublet rooms within their unit to other households. This practice was considered legal and even encouraged by the government to enable beneficiaries raised enough money to pay off their mortgages to the NHC. The tenure status in Pumwani was even more balanced at 52% owners and 48% renters

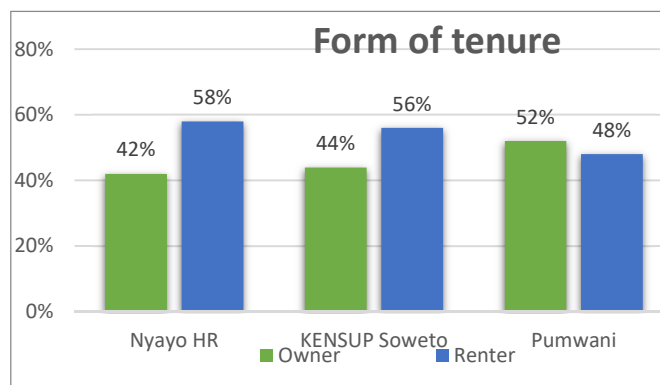


Figure 4.8: Tenure status in all three projects

4.1.9 Regular mode of transport

Majority of respondents, accounting for 48%, 47% and 48% of users in Kibera Nyayo highrise, KENSUP Soweto East and Pumwani-Majengo respectively used public transport when getting around. This can be attributed to low economic profiles of majority of respondents, as well as to the proper physical integration of all housing projects within the city whereby all projects have access to roads and cheap public transportation to different parts of the city. Furthermore, all projects had respondents who got around by walking. (16%, 21% and 11% respectively)

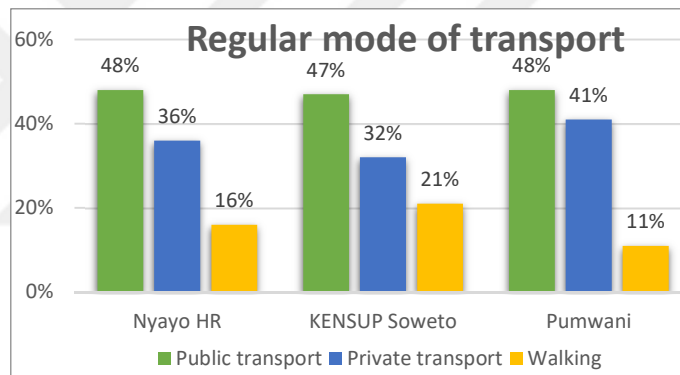


Figure 4.9: Employment status of respondents

A summary of the socio-demographic characteristics of respondents is summarised in Table 4.2 below

Table 4.2: Descriptive statistics of households from the three housing projects

Characteristics	Kibera High Rise (n=31)		Nyayo KENSUP East Zone A (n=34)		Soweto Pumwani- Majengo (n=27)	
	Freq.	Percentage	Freq.	Percentage	Freq.	Percentage
Age						
Below 35 years	5	16%	8	23%	6	22%
35 - 44 years	9	29%	5	15%	5	19%
45 - 54 years	4	13%	6	18%	6	22%
55 - 64 years	6	19%	5	15%	6	22%
Over 65 years	7	23%	10	29%	4	15%
Respondent's gender						
Male	13	42%	15	44%	10	37%
Female	18	58%	19	56%	17	63%
Education attainment						
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 degree	11	36%	6	18%	12	44%
Household type and size						
Single person household	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 household	4	13%	6	17%	3	11%
Other household types	2	6%	5	15%	6	22%
Average monthly income						
Less than KES 50,000	9	29%	11	32%	10	37%
KES 50,000 - KES 200,000	12	39%	15	44%	12	44%
More than KES 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						
Less than 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%
More than 5 years	10	32%	0	0%	7	26%
Form of tenure						

Owner	13	42%	15	44%	14	52%
Renter	18	58%	19	56%	13	48%
Mode of transport						
Public transport	15	48%	16	47%	13	48%
Private transport	11	36%	11	32%	11	41%
Walking	5	16%	7	21%	3	11%

4.2 Questionnaire findings

Table 4.3 shows the categorization of the 24 variables from the questionnaires into the three categories of meaning of housing. 19 variables were categorised under functional meaning, 4 under social meaning while 1 variable was categorized under symbolic meaning of housing.

Table 4.3: Categorization of meaning into variables

Meaning Categorization	Variable	
External Habitability (E.H)	Variable 1	Distance & time between housing and the city centre is convenient
	Variable 2	Distance & time between housing and work is convenient
	Variable 3	Distance & time between housing and public amenities (sports centres, parks) is convenient
	Variable 4	The site is appropriate for residence and safe from poor conditions (e.g. flooding, pollution, unstable soil)
	Variable 5	Sufficient provision of infrastructure e.g. roads, parking and service utilities
Functional Meaning of Housing	Variable 6	Spaces/Rooms are of appropriate sizes (square footage)
	Variable 7	Typology and number of rooms are sufficient for my needs and family size
	Variable 8	Access & circulation between rooms, other units, floors & the outdoor environment works well
	Variable 9	Universal access principles are accommodated (physically & visually impaired users, elderly)
	Variable 10	Housing has provisions for secondary functions e.g. storage and other equipment (e.g. AC units)
	Variable 11	Building structure allows flexibility of spaces to changing needs. (conversions/alterations)
	Variable 12	The building withstands wear and tear, & minor vandalism (durability)
	Variable 13	Structure and materials are appropriate for local weather & climate
	Variable 14	Spaces have adequate daylight/natural lighting
	Variable 15	Interior spaces have sufficient thermal comfort

		Variable 16	The building has sufficient acoustics quality (against vibrations and noise)
		Variable 17	Finishes, fittings and fixtures (e.g. sockets, plumbing, wardrobes, kitchens, and railings) are well integrated.
		Variable 18	The building's structural system is efficient (walls, beams, slabs & columns)
		Variable 19	Building uses sustainable and renewable systems (orientation, shading, reusable/low embodied energy materials, solar energy)
Social Meaning of Housing	External Habitability (E.H)	Variable 20	Housing stimulates local activity (social interaction, trade)
		Variable 21	There is balanced distribution of both public (green areas, play spaces) and private spaces in the outdoors
		Variable 22	Housing design promotes security against burglary & robbery, assault, rape etc (e.g. through layouts, lighting, use of security hardware/fixtures)
	Internal Habitability (I.H)	Variable 23	Housing provides sufficient privacy (within interior spaces e.g. bathrooms/bedrooms and from neighbours)
Symbolic Meaning of Housing	External Habitability (E.H)	Variable 24	Building form, height & density fit within neighbourhood and are appreciated by local residents

4.2.1 Functional meaning variables: External Habitability

Five variables are categorised under external habitability. Variable 1 investigated the relationship between housing and the city centre, and revealed a significant majority of respondents in all three projects had a general acceptance that their housing was physically well integrated within the city, as seen in figure 4.10. A combined 87% of respondents in Kibera Nyayo highrise, and all respondents (100%) in both KENSUP Soweto East and Pumwani agreed to various extents that their housing was physically well integrated in the city. All the housing developments are less than 5 kilometres from Nairobi central business district (CBD), with Pumwani being the closest at 2.5 kilometres while Kibera Nyayo highrise and KENSUP Soweto East are approximately 4.8 kilometres from the CBD. With regard to urban habitability, the selected affordable housing projects perform better than several cases in the literature, such as in Colombia [26] where a significant number of projects were found to be located in periphery regions of the city with insufficient access.

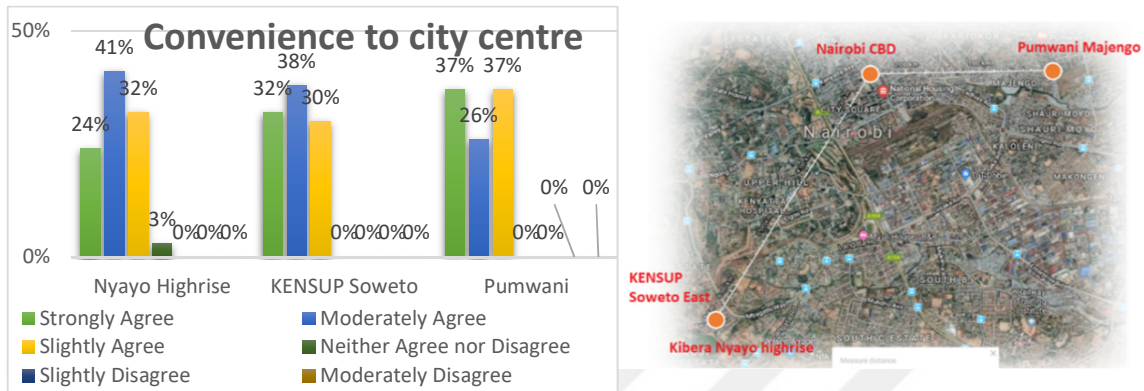


Figure 4.10 & 4.11: Distance between city centre and all three housing projects

Variable 2 was concerned with convenience between housing and work where 78% of respondents in Kibera Nyayo highrise reported convenience with regard to distance and time from work against 22% who reported inconveniences as seen in figure 4.12. Similar opinions were noted in KENSUP Soweto East where 71% of respondents reported convenience, 26% reporting inconvenience and 3% having a neutral opinion. Although Pumwani is the closest to the city, its residents more evenly distributed regarding convenience to work. While 50% considered distance to work convenient, the other 50% either found the distance to work inconveniencing or expressed a neutral opinion.

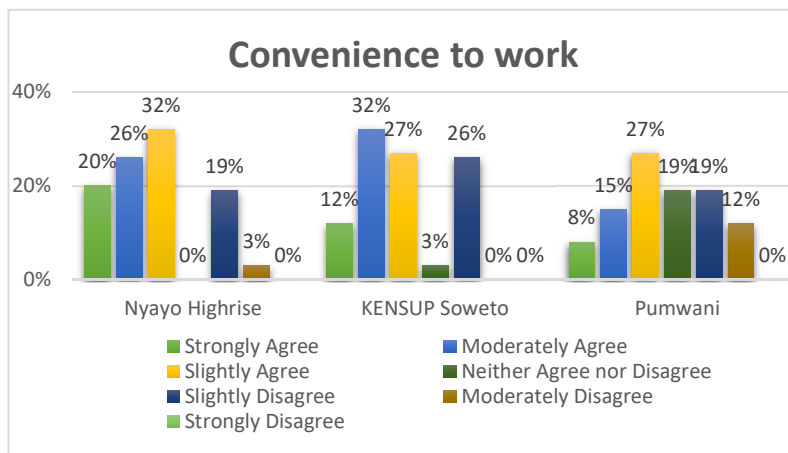


Figure 4.12: Convenience between housing and work

Variable 3 investigated convenience between housing to public amenities (such as parks, sports centres and community halls). Respondents found convenience in both Kibera Nyayo highrise and KENSUP Soweto East at 91% and 85% respectively, although lower in Pumwani-Majengo at 54%. More respondents (29%) from the Pumwani development opined that public amenities were inconveniently situated within the neighbourhoods, a significant higher figure than both Kibera Nyayo highrise and KENSUP Soweto East where a combined 15% (9% and 6% respectively) respondents reported inconvenience

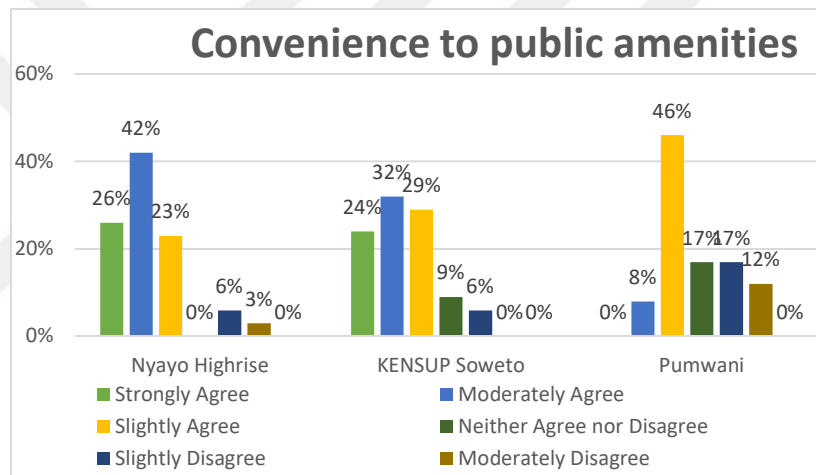


Figure 4.13: Convenience between housing and public amenities

Regarding Variable 4, more than half of residents from all projects, table 4.14 shows a combined 55% from Kibera Nyayo highrise, 64% from KENSUP Soweto East and 52% from Pumwani-Majengo believed the site and location of their housing was appropriate for residence and was free from factors such as flooding, unstable soils and pollution. These represented a bigger percentage than residents who considered the sites inappropriate, who accounted for 39%, 36% and 41% of respondents in Kibera Nyayo highrise, KENSUP Soweto East and Pumwani-Majengo respectively.

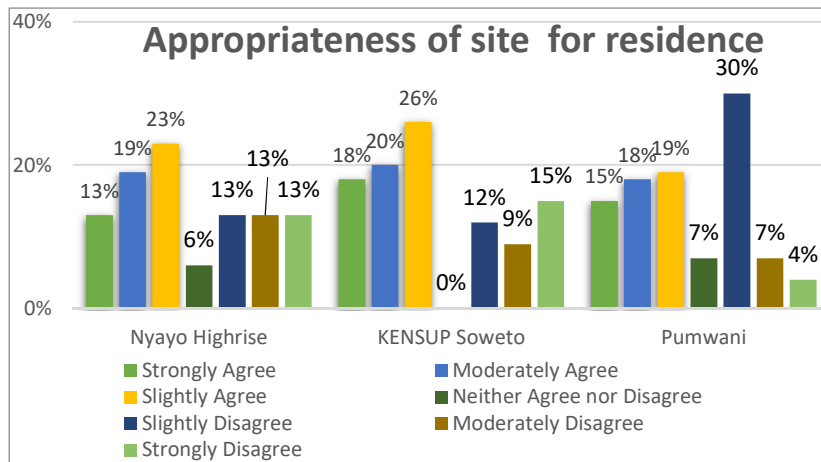


Figure 4.14: Appropriateness of site for residence

Respondents were divided on whether variable 5 (infrastructure) was sufficiently provided. Table 4.15 reveals similar patterns were obtained from Kibera Nyayo highrise and KENSUP Soweto East, where 68% and 52% of respondents agreed there was adequate provision of infrastructure against 26% and 42% in disagreement respectively, Pumwani was however a different case, where a slight majority of residents (52%) slightly believed infrastructure was insufficiently provided against the 48% who agreed to sufficient provision.

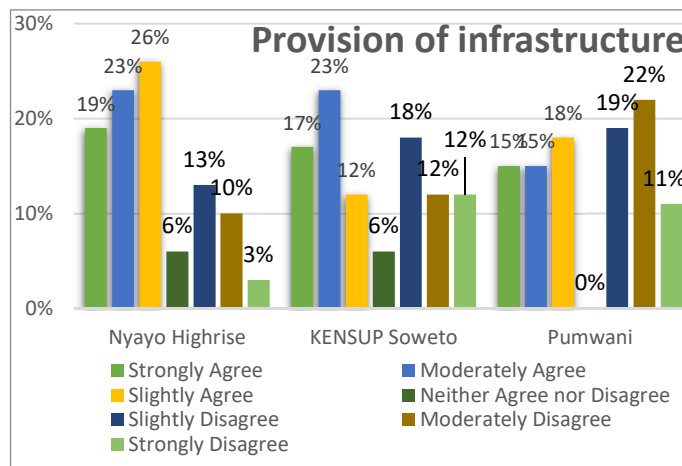


Figure 4.15: Appropriateness of height for the neighbourhood

A summary for the external habitability section is presented in tables 4.4 and 4.5

Table 4.4: Descriptive statistics for external habitability

Functional Meaning variable: (E.H.)	Rating	Kibera High Rise (n=31)		Nyayo East Zone A (n=34)		Soweto		Pumwani- Majengo (n=27)	
		Freq.	%	Freq.	%	Freq.	%	Freq.	%
Variable 1	St. A	8	24%	11	32%	10	37%	10	37%
	M. A	14	41%	13	38%	7	26%	7	26%
	Sl. A	11	32%	10	30%	10	37%	10	37%
	N	1	3%	0	0%	0	0%	0	0%
	Sl. D	0	0%	0	0%	0	0%	0	0%
	M. D	0	0%	0	0%	0	0%	0	0%
	St. D	0	0%	0	0%	0	0%	0	0%
Variable 2	St. A	6	20%	4	12%	2	8%	2	8%
	M. A	8	26%	11	32%	4	15%	4	15%
	Sl. A	10	32%	9	27%	7	27%	7	27%
	N	0	0%	1	3%	5	19%	5	19%
	Sl. D	6	19%	9	26%	5	19%	5	19%
	M. D	1	3%	0	0%	3	12%	3	12%
	St. D	0	0%	0	0%	0	0%	0	0%
Variable 3	St. A	8	26%	8	24%	0	0%	0	0%
	M. A	13	42%	11	32%	2	8%	2	8%
	Sl. A	7	23%	10	29%	11	46%	11	46%
	N	0	0%	3	9%	4	17%	4	17%
	Sl. D	2	6%	2	6%	4	17%	4	17%
	M. D	1	3%	0	0%	3	12%	3	12%
	St. D	0	0%	0	0%	0	0%	0	0%
Variable 4	St. A	4	13%	6	18%	4	15%	4	15%
	M. A	6	19%	7	20%	5	18%	5	18%
	Sl. A	7	23%	9	26%	5	19%	5	19%
	N	2	6%	0	0%	2	7%	2	7%
	Sl. D	4	13%	4	12%	8	30%	8	30%
	M. D	4	13%	3	9%	2	7%	2	7%
	St. D	4	13%	5	15%	1	4%	1	4%
Variable 5	St. A	6	19%	6	17%	4	15%	4	15%
	M. A	7	23%	8	23%	4	15%	4	15%
	Sl. A	8	26%	4	12%	5	18%	5	18%
	N	2	6%	2	6%	0	0%	0	0%
	Sl. D	4	13%	6	18%	5	19%	5	19%
	M. D	3	10%	4	12%	6	22%	6	22%
	St. D	1	3%	4	12%	3	11%	3	11%

Where St. A – Strongly Agree, M. A – Moderately Agree, Sl. A – Slightly Agree, N – Neither Agree nor Disagree, Sl. D – Slightly Disagree, M. D – Moderately Disagree, St. D – Strongly Disagree.

Table 4.5: Summary for external habitability

Variable	Attributes of habitability
Variable 1	Respondents overwhelmingly agreed that housing was physically well integrated into the city, that is 87% for Kibera Nyayo highrise and 100% for both KENSUP Soweto East and Pumwani-Majengo
Variable 2	78% of respondents in Kibera Nyayo highrise reported convenience with regard to distance and time from work. This was similar to KENSUP Soweto East where 71% of respondents reported convenience. However in Pumwani, the closest to the city, only 50% considered the distance to work convenient
Variable 3	Both Kibera Nyayo highrise and KENSUP Soweto East score highly at 91% and 85% of respondents respectively. Pumwani-Majengo scores less at 54%.
Variable 4	A combined 55% from Kibera Nyayo highrise, 64% from KENSUP Soweto East and 52% from Pumwani-Majengo believed the site and location where their housing is situated was appropriate for residence
Variable 5	68% and 52% of respondents of Kibera Nyayo highrise and KENSUP Soweto East respectively agreed there was adequate provision of infrastructure however only 52% of Pumwani residents agreed

The results of external habitability from tables 4.4 and 4.5 show the three locational variables (convenience) ranked highest overall. Variable 1 (convenience between housing and the city centre) ranked highest overall score of with 87%, 100% and 100% of respondents finding housing conveniently located to the city. Variable 3 (convenience between housing and public amenities) ranked second with 91%, 91% and 85% with variable 2 (convenience between housing and work) ranking third at 78%, 71% and 50% for respondents in Kibera Nyayo highrise, KENSUP Soweto East and Pumwani-Majengo respectively. Both variable 4 (appropriateness of site for residence) and variable 5 (infrastructure) ranked least for the category. Variable 4 scored 55%, 64% and 52 while variable 5 scored 68%, 52%, and 52% for Kibera Nyayo highrise, KENSUP Soweto East and Pumwani-Majengo respectively

4.2.2 Functional meaning variables: Internal Habitability

Fourteen variables were categorised under internal habitability. Variable 6 (appropriateness of room sizes) revealed divided opinions whereby Kibera Nyayo highrise and KENSUP Soweto East users agreed to given extent (58%, 64% respectively) that the room sizes in their housing were sufficient towards their dwelling needs against 35% and 36% who disagreed respectively as seen in figure 4.16. The division of opinions was most evident in the case of Pumwani where less than half (48%) of residents to various extents agreed that their room sizes were sufficient against a similar figure (48%) who found the room sizes small and inappropriate. An observation from this question is that respondents have high expectations of public affordable housing, despite the fact that some of them resided in informal settlements prior to allocation of their housing units. Housing unit sizes are further assessed under objective minimum dwelling standards in section 4.3

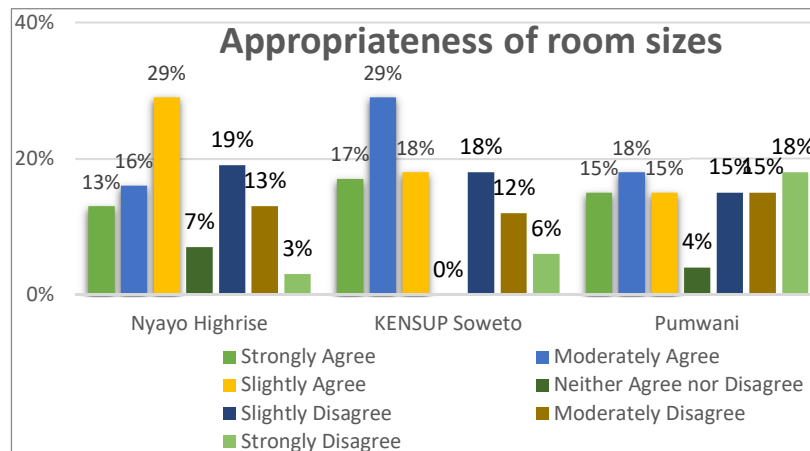


Figure 4.16: Appropriateness of room sizes



Figure 4.17 and 4.18: A tenant in her Pumwani-Majengo living room with dimensions (3m X 4.5m) which she indicated was insufficient for her dwelling needs

With regard to variable 7 (typology and number of rooms), only residents from Kibera Nyayo highrise (55%) and KENSUP Soweto East (61%) agreed that house typology was sufficient as seen in figure 4.19. In both cases, the number of respondents who found their typologies insufficient were 39%. In the case of Pumwani-Majengo, more users (55%) regarded their housing typology insufficient compared to those that agreed to sufficiency (41%). These figures are backed up by observations and architectural analysis, whereby amongst all three projects, KENSUP Soweto East provided the most diversified housing options through various typologies (studio, one, two and three bedroom options) while Kibera Nyayo highrise offered one and two bedroom units. In the case of Pumwani-Majengo, only two bedroom unit were provided, with the only differentiating factor among the different units being a reconfiguration of bathroom and toilet spaces either as a single unit or as separate entities.

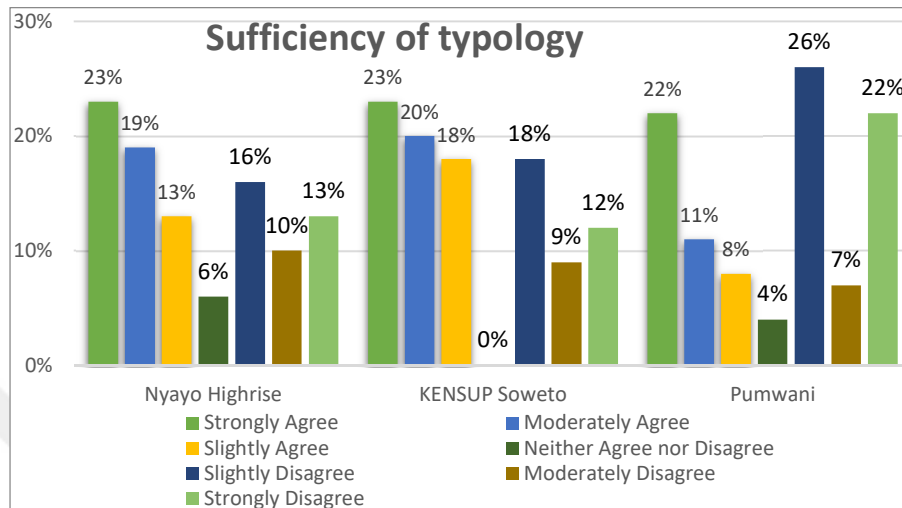


Figure 4.19: Sufficiency of typology and number of rooms

Users also overwhelmingly appreciated variable 8 (access and circulation between different rooms, other units on the same floor, with units on separate floors as well as to the outdoor environment). 87%, 82% and 85% of respondents from Kibera Nyayo highrise, KENSUP Soweto East and Pumwani-Majengo respectively agreed to sufficient access and circulation with only 10% for Kibera Nyayo highrise and a combined 15% for both KENSUP Soweto East and Pumwani-Majengo. Circulation passages, as well as staircases were considered sufficient in all projects are shown in Figures 4.20 - 4.23.

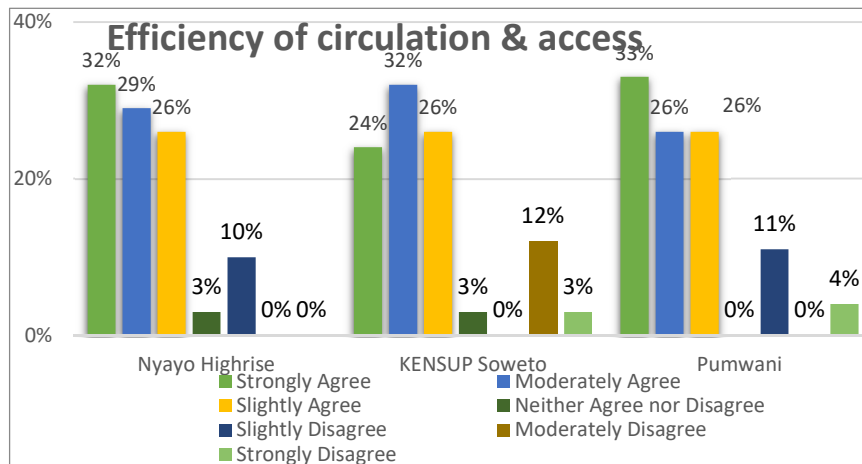


Figure 4.20: Efficiency of circulation and access between units



Figure 4.21, 4.22 and 4.23: Access staircases for Pumwani, Nyayo highrise and Soweto East respectively

Despite requirements to allocate a minimum number of units to special needs groups such as elderly, disabled and child headed families, none of the housing units paid particular attention to variable 9 (universal access principles). Ramps between the outdoor landscape and buildings, lifts, and disabled toilets were neither planned nor implemented into any of the housing schemes, as seen in figures 4.25 & 4.26. Figure 4.24 shows that 74%, 76% and 72% of respondents from Kibera Nyayo highrise, KENSUP Soweto East and Pumwani-Majengo respectively reported absence of these universal access principles.

Only a handful (26%, 21% and 35%) of respondents reported that disabled persons could get around with ease.

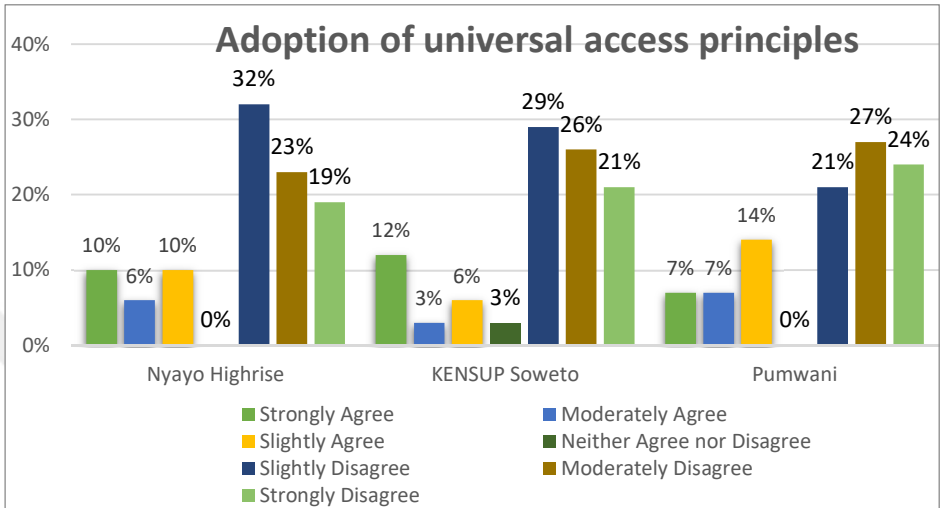


Figure 4.24: Efficiency of circulation and access between units



Figure 4.25 and 4.26: Lack of ramps within the landscape of Soweto East and Nyayo highrise despite the steep topography

Regarding variable 10, respondents were divided with regard to incorporation of secondary functions such as storage for household items within rooms and kitchens, and mechanical equipment like cooking gas cylinders. Figure 4.27 shows that in all housing

projects, just over half of each projects' respondents (52% both for Kibera Nyayo highrise and Pumwani-Majengo, and 59% for KENSUP Soweto East) agreed to provisions for secondary functions within their housing. On the other hand 42%, 41% and 48% of Kibera Nyayo highrise, KENSUP Soweto East and Pumwani-Majengo respondents respectively to various extents disagreed with provisions of such secondary functions.

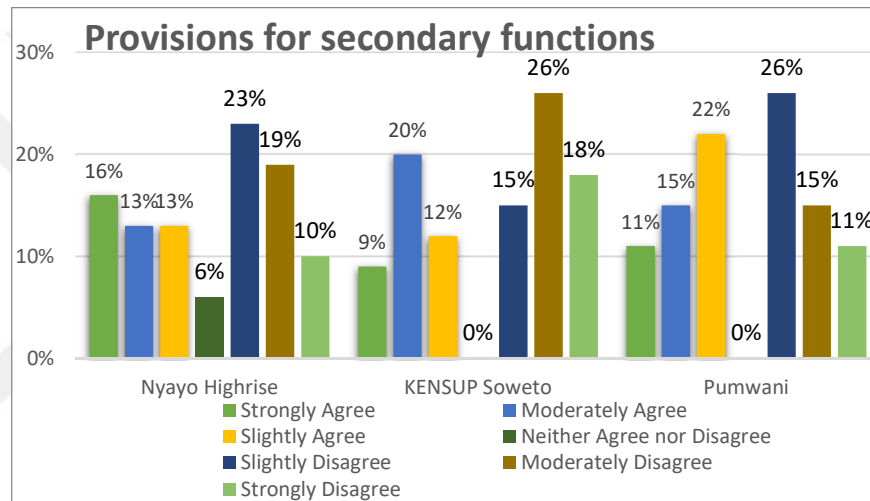


Figure 4.27: Provisions for secondary functions

Respondents were divided about variable 11 (ability of making conversions or alterations to their housing units in response to changing needs). Figure 4.28 reveals that 62% of residents in Kibera Nyayo highrise disagreeing with ability to make conversions against the 27% who agreed to having made some conversions to their housing. A similar situation was observed from KENSUP Soweto East where 67% of respondents disagreed with ability to make alterations to housing units against the 33% who agreed to ability to make such alterations/conversions. In Pumwani-Majengo housing however, the number of residents who agreed to having made conversions was slightly greater at 52% than those who had made any conversions to their housing (41%).

Although structural alterations are more common in particular housing typologies such as detached and semi-detached housing and bungalows as investigated in Nairobi’s Kaloleni estate [15], on site observations in all the three housing projects revealed that despite the projects being medium density apartment blocks, figures 4.29 – 4.31 showed users were making several alterations like closing off balconies with glass and aluminium to turn them into useable room spaces and converting living spaces into shops

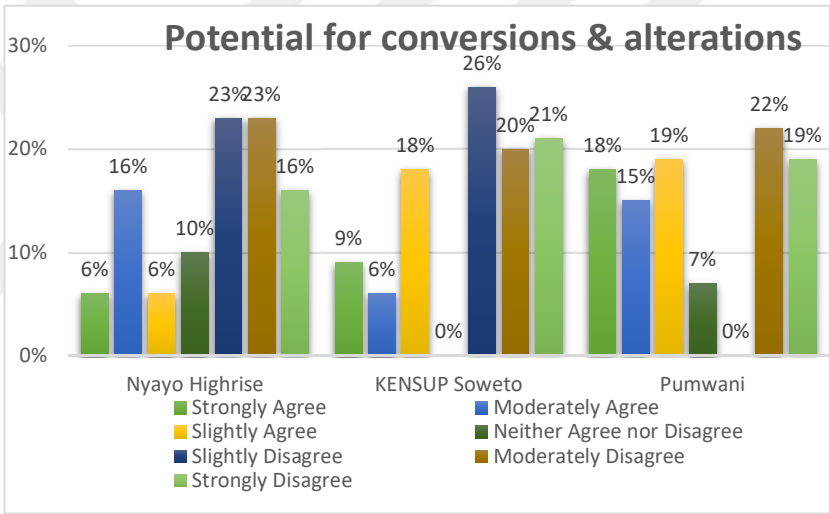


Figure 4.28: Ease of implementing conversions and alterations to housing



Figure 4.29, 4.30 and 4.31: Conversions added onto housing in KENSUP Soweto East, Nyayo highrise and Pumwani respectively

Respondents’ perceptions towards variable 12 (durability of housing against vandalism, wear and tear) generally were significantly towards disagreement. 56% if

respondents from KENSUP Soweto East to various extents disagreed that aspects of housing (such as finishes like tiles, painting, and fittings) were not durable over time while only 35% considered these aspects of housing durable as seen in figure 4.32. 58% and 55% of residents from Kibera Nyayo highrise and Pumwani-Majengo respectively disagreed with regard to durability in comparison to the 19% and 34% who were in agreement.

Personal observation, seen in figures 4.33 and 4.34 also revealed cases of both vandalism and wear and tear especially in Pumwani-Majengo, where residents revealed that the National Housing Council (NHC) was responsible for external and internal maintenance but had not implemented any for years. This responsibility was instead burdened upon the beneficiaries, many of whom were low income households. While KENSUP Soweto East since was the newest amongst the three projects, this did not necessarily translate into greater perceptions of durability amongst the respondents than other projects like Kibera Nyayo established in the 1990's.

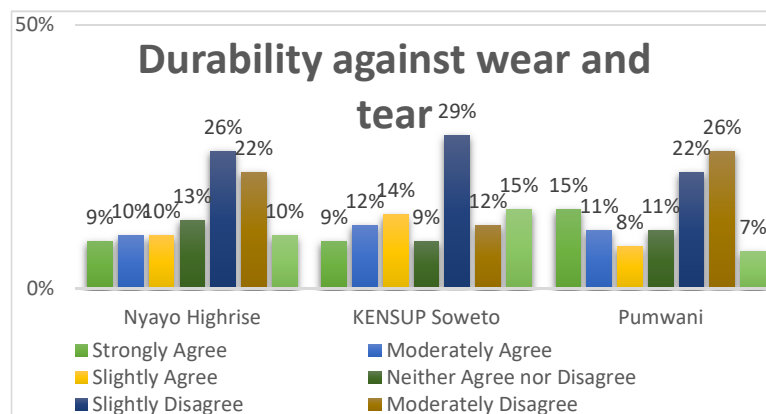


Figure 4.32: Durability against wear and tear



Figure 4.33 and 4.34: Evidence of vandalism like graffiti and lack of maintenance on structure walls in Pumwani-Majengo

To assess variable 13 (appropriateness of materials to local weather), construction reports of the projects were analysed which revealed that materials used in construction were consistent with majority of formal privately developed housing units. These included machine cut masonry stone for load bearing walls, in situ concrete for slabs, columns and staircases, and galvanized steel sheets for roofing. Figure 4.35 revealed 70% of respondents from Kibera Nyayo highrise were in agreement that materials used in construction were appropriate for Nairobi's weather and climate. Only 23% were of the opinion that the materials were inappropriate. In KENSUP Soweto East and Pumwani-Majengo respectively, 78% and 63% of respondents perceived their housing to have appropriate construction materials while only 9% and 15% of respondents respectively did not agree that housing had appropriate materials.

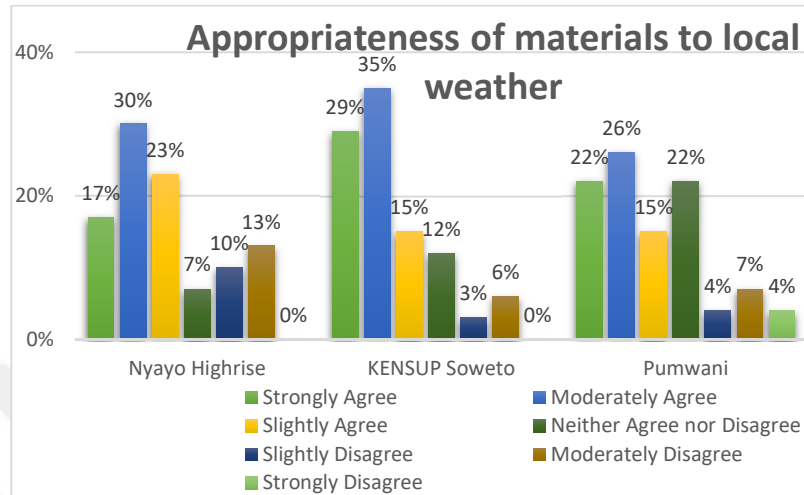


Figure 4.35: Appropriateness of materials to local weather

Regarding variable 14 (sufficiency of daylight and natural lighting), figure 4.36 shows 73% of respondents in Kibera Nyayo highrise, 76% in KENSUP Soweto East and 85% from Pumwani-Majengo agreed their units had adequate daylight. While respondents especially from the Pumwani project overwhelmingly perceived their housing to have sufficient daylight, direct observations (see figures 4.37 - 4.39) instead revealed the daylight was only sufficient in specific rooms and depended on orientation of block and its proximity to the nearest blocks. A number of rooms in some units, especially those on the ground floor suffered from poorly lit interior spaces. Additionally, drying lines especially in the courtyards where residents dried their laundry acted as visual obstructions (see Figure 4.55) that blocked sufficient daylight from reaching a number of internal units

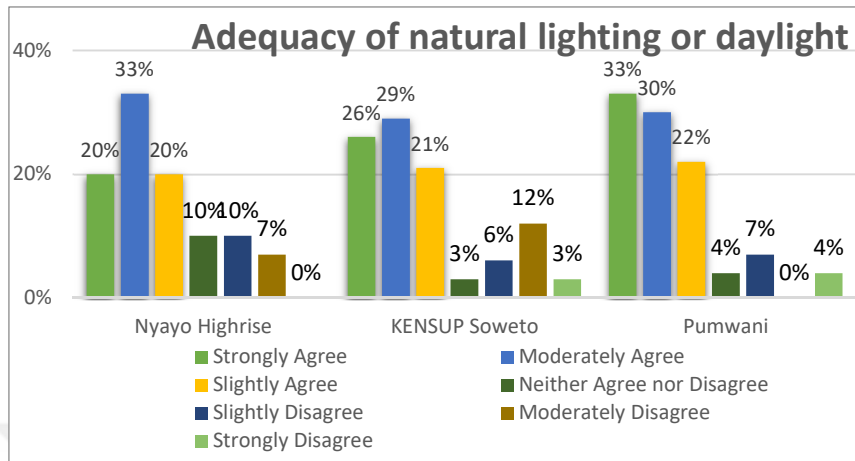


Figure 4.36: Adequacy of natural lighting or daylight



Figure 4.37, 4.38 & 4.39: Interior spaces especially in Pumwani were poorly lit in addition to obstruction from drying laundry

Respondents were divided regarding variable 15 (thermal comfort in housing). Figure 4.40 shows KENSUP Soweto East respondents were significantly more likely to approve of suitable thermal climate (70%) in comparison to the residents of Kibera Nyayo highrise and Pumwani-Majengo (48% and 56% respectively). Respondents who did not approve of the thermal climate, that is to say, 42% from Kibera Nyayo highrise, 21% from KENSUP Soweto East and 29% from Pumwani-Majengo reported heat build-up especially during hot afternoons resulting from a high thermal mass of the machine-cut stone used in all of the housing projects and the relatively small sized and poorly oriented

windows. Some respondents reported use of fans in their housing for better internal climatic conditions.

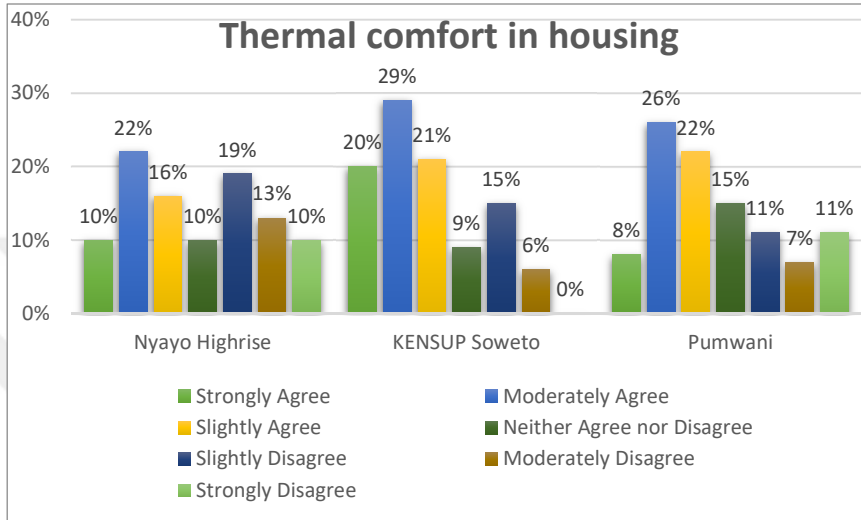


Figure 4.40: Thermal climatic conditions within interior spaces

Variable 16 (acoustic quality in the housing) was considered acceptable by the vast majority of surveyed people. Figure 4.41 shows 74% of respondents in Kibera Nyayo highrise, 88% of respondents in KENSUP Soweto East and 81% of respondents in Pumwani-Majengo agreed that acoustic quality was sufficient. The implication of these results is that respondents did not find noise and vibrations from neighbouring housing units and the outdoors a nuisance within their interior spaces. Possible explanations are the masonry stone masonry walls and fairly small windows act as sound buffers to keep noise at minimal levels. In addition, a big number of the respondents resided in informal settlements made from corrugated iron sheet structures which had performed extremely poorly with respect to acoustics, implying that the formal housing was already a significant upgrade [9]. Fewer residents held the opinion that housing had poor acoustic

quality, that is, 23%, 9% and 19% for Kibera Nyayo highrise, KENSUP Soweto East and Pumwani-Majengo respectively

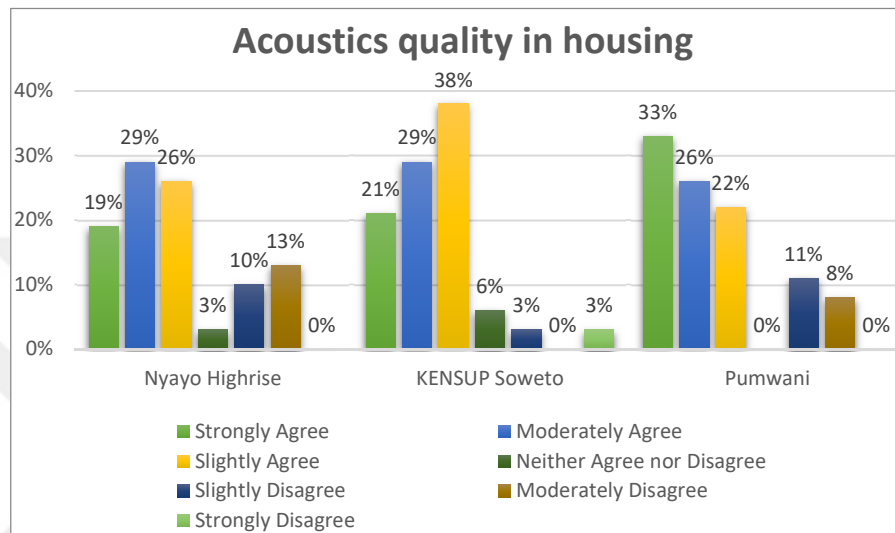


Figure 4.41: Acoustic quality in housing

Generally, variable 17 (integration of finishes and fixtures) was fairly sufficient across all housing projects. Figure 4.42 shows 55% of respondents from Kibera Nyayo highrise agreed that finishes, fittings and fixtures such as sockets, plumbing, wardrobes, kitchens and railings were well integrated against a 39% who believed finishes and fixtures were poorly integrated. In KENSUP Soweto East and Pumwani-Majengo, 82% and 52% of respondents found fixtures in their housing units well integrated compared to the fewer 18% and 37% respectively that found their units poorly integrated.

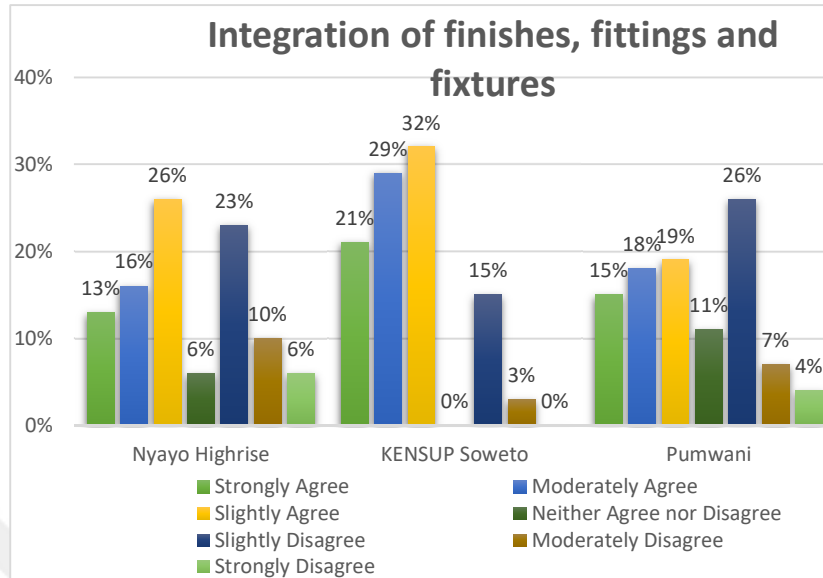


Figure 4.42: Integration of finishes, fitting and fixtures

71% of respondents from Kibera Nyayo highrise believed that variable 18 (the structural systems) was sound and efficient, and that they had no experiences with cracks within walls and floors. Only 19% disagreed with efficiency of the structural system. In KENSUP Soweto East, respondents in agreement were 61% against 21% in disagreement while Pumwani-Majengo recorded 55% of respondents who agreed the structural system in the building was efficient, 12%

A particular observation was a significant number of respondents especially in Pumwani-Majengo (33%) and KENSUP Soweto East (18%) who could neither agree nor disagree. This could possibly be explained by the technical nature of the question, where knowledge of structural aspects of construction is out of the respondents' levels of knowledge and competence, as well as aspects like slabs and columns being out of direct view but embedded within the building. This is shown in figure 4.43

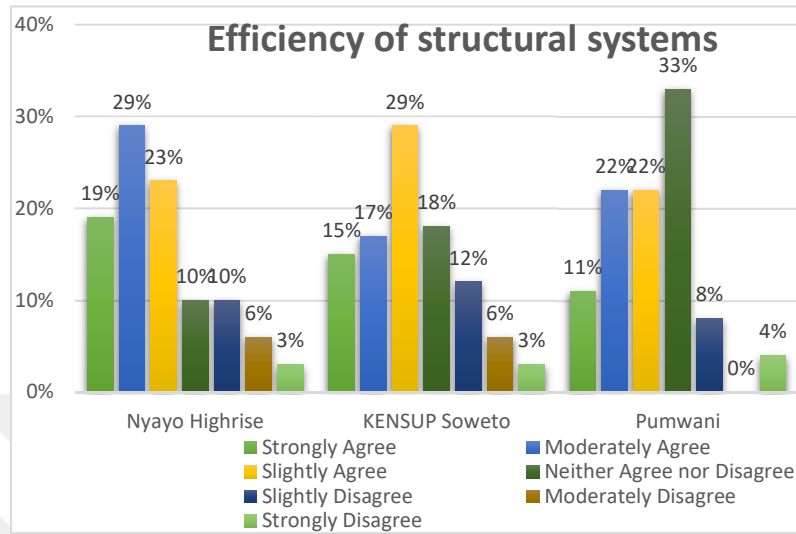


Figure 4.43: Efficiency of structural systems

Respondents from all housing projects did not believe variable 19, or adoption of sustainable and renewable strategies such as deliberate building orientation with respect to the sun’s movement, use of external shading devices or vegetation for shading, solar energy harvesting and use of low embodied energy materials. In Kibera Nyayo highrise, for example, only 23% of residents agreed to presence of any sustainable strategies while KENSUP Soweto East and Pumwani-Majengo reported 18% and 26%. On the contrary, respondents in disagreement were greater at 71%, 64% and 67% for Kibera Nyayo highrise, KENSUP Soweto East and Pumwani-Majengo respectively. From direct observations from all sites, there was no evidence of roof mounted or ground based solar panel systems.

Furthermore, despite the potential that lies in adoption of sustainable and cost-effective materials like rammed earth, interlocking stabilised soil blocks (ISSBs), or alternative construction technologies (ACTs) like prefabricated expanded polystyrene panels (EPS), all three housing projects were achieved using conventional systems of

machine cut stone, concrete and mortar. Results on sustainable strategies are presented in figure 4.44

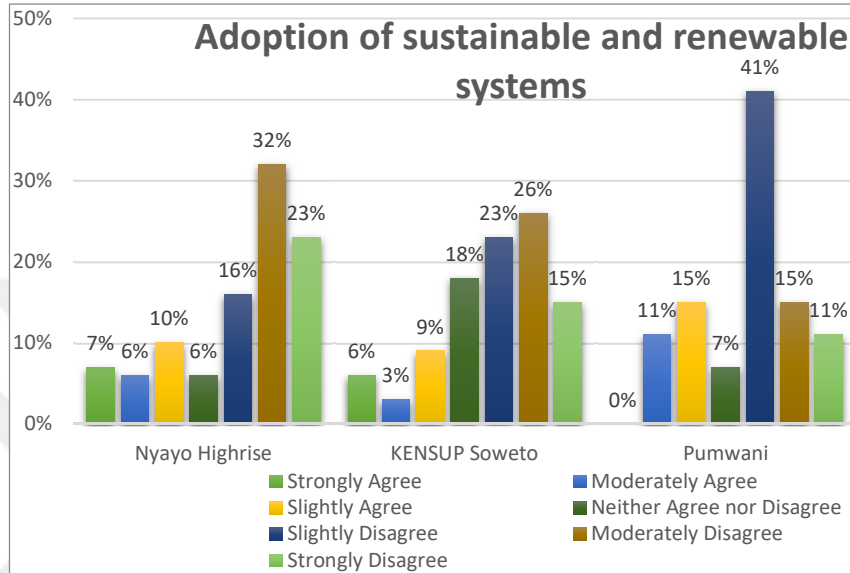


Figure 4.44: Adoption of sustainable and renewable systems

A summary of the internal habitability section is presented in tables 4.6 and 4.7

Table 4.6: Descriptive statistics for internal habitability

Functional Meaning variable (I.H)	Rating	Kibera Nyayo High Rise (n=31)		KENSUP Soweto East Zone A (n=34)		Pumwani-Majengo (n=27)	
		Freq.	%	Freq.	%	Freq.	%
Variable 6	St. A	4	13%	6	17%	4	15%
	M. A	5	16%	10	29%	5	18%
	Sl. A	9	29%	6	18%	4	15%
	N	2	7%	0	0%	1	4%
	Sl. D	6	19%	6	18%	4	15%
	M. D	4	13%	4	12%	4	15%
	St. D	1	3%	2	6%	5	18%
Variable 7	St. A	7	23%	8	23%	6	22%
	M. A	6	19%	7	20%	3	11%
	Sl. A	4	13%	6	18%	2	8%
	N	2	6%	0	0%	1	4%
	Sl. D	5	16%	6	18%	7	26%
	M. D	3	10%	3	9%	2	7%
	St. D	4	13%	4	12%	6	22%
Variable 8	St. A	10	32%	8	24%	9	33%
	M. A	9	29%	11	32%	7	26%
	Sl. A	8	26%	9	26%	7	26%
	N	1	3%	1	3%	0	0%
	Sl. D	3	10%	0	0%	3	11%
	M. D	0	0%	4	12%	0	0%

Variable 9	St. D	0	0%	1	3%	1	4%
	St. A	3	10%	4	12%	2	7%
	M. A	2	6%	1	3%	2	7%
	Sl. A	3	10%	2	6%	4	14%
	N	0	0%	1	3%	0	0%
	Sl. D	10	32%	10	29%	6	21%
	M. D	7	23%	9	26%	8	27%
St. D	6	19%	7	21%	7	24%	
Variable 10	St. A	5	16%	3	9%	3	11%
	M. A	4	13%	7	20%	4	15%
	Sl. A	4	13%	4	12%	6	22%
	N	2	6%	0	0%	0	0%
	Sl. D	7	23%	5	15%	7	26%
	M. D	6	19%	9	26%	4	15%
St. D	3	10%	6	18%	3	11%	
Variable 11	St. A	2	6%	3	9%	5	18%
	M. A	5	16%	2	6%	4	15%
	Sl. A	2	6%	6	18%	5	19%
	N	3	10%	0	0%	2	7%
	Sl. D	7	23%	9	26%	0	0%
	M. D	7	23%	7	20%	6	22%
	St. D	5	16%	7	21%	5	19%
Variable 12	St. A	3	9%	3	9%	4	15%
	M. A	3	10%	4	12%	3	11%
	Sl. A	3	10%	5	14%	2	8%
	N	4	13%	3	9%	3	11%
	Sl. D	8	26%	10	29%	6	22%
	M. D	7	22%	4	12%	7	26%
	St. D	3	10%	5	15%	2	7%
Variable 13	St. A	5	17%	10	29%	6	22%
	M. A	9	30%	12	35%	7	26%
	Sl. A	7	23%	5	15%	4	15%
	N	2	7%	4	12%	6	22%
	Sl. D	3	10%	1	3%	1	4%
	M. D	4	13%	2	6%	2	7%
	St. D	0	0%	0	0%	1	4%
Variable 14	St. A	6	20%	9	26%	9	33%
	M. A	10	33%	10	29%	8	30%
	Sl. A	6	20%	7	21%	6	22%
	N	3	10%	1	3%	1	4%
	Sl. D	3	10%	2	6%	2	7%
	M. D	2	7%	4	12%	0	0%
	St. D	0	0%	1	3%	1	4%
Variable 15	St. A	3	10%	7	20%	2	8%
	M. A	7	22%	10	29%	7	26%
	Sl. A	5	16%	7	21%	6	22%
	N	3	10%	3	9%	4	15%
	Sl. D	6	19%	5	15%	3	11%
	M. D	4	13%	2	6%	2	7%
	St. D	3	10%	0	0%	3	11%
Variable 16	St. A	6	19%	7	21%	9	33%
	M. A	9	29%	10	29%	7	26%
	Sl. A	8	26%	13	38%	6	22%
	N	1	3%	2	6%	0	0%
	Sl. D	3	10%	1	3%	3	11%
	M. D	4	13%	0	0%	2	8%
	St. D	0	0%	1	3%	0	0%
St. A	4	13%	7	21%	4	15%	

Variable 17	M. A	5	16%	10	29%	5	18%
	Sl. A	8	26%	11	32%	5	19%
	N	2	6%	0	0%	3	11%
	Sl. D	7	23%	5	15%	7	26%
	M. D	3	10%	1	3%	2	7%
	St. D	2	6%	0	0%	1	4%
Variable 18	St. A	6	19%	5	15%	3	11%
	M. A	9	29%	6	17%	6	22%
	Sl. A	7	23%	10	29%	6	22%
	N	3	10%	6	18%	9	33%
	Sl. D	3	10%	4	12%	2	8%
	M. D	2	6%	2	6%	0	0%
Variable 19	St. D	1	3%	1	3%	1	4%
	St. A	2	7%	2	6%	0	0%
	M. A	2	6%	1	3%	3	11%
	Sl. A	3	10%	3	9%	4	15%
	N	2	6%	6	18%	2	7%
	Sl. D	5	16%	8	23%	11	41%
	M. D	10	32%	9	26%	4	15%
	St. D	7	23%	5	15%	3	11%

Where St. A – Strongly Agree, M. A – Moderately Agree, Sl. A – Slightly Agree, N – Neither Agree nor Disagree, Sl. D – Slightly Disagree, M. D – Moderately Disagree, St. D – Strongly Disagree.

Table 4.7: Summary for internal habitability

Variable	Attributes of habitability
Variable 6	58% and 64% of Kibera Nyayo highrise and KENSUP Soweto East respondents agreed that the room sizes in their housing were sufficient towards their dwelling needs. However less than half (48%) of Pumwani residents were in agreement
Variable 7	55% of both Kibera Nyayo highrise and Pumwani-Majengo, and 61% from KENSUP Soweto East agreed that house typology was sufficient.
Variable 8	87%, 82% and 85% of respondents from Kibera Nyayo highrise, KENSUP Soweto East and Pumwani-Majengo respondents respectively reported sufficient access and circulation
Variable 9	74%, 76% and 72% of respondents from Kibera Nyayo highrise, KENSUP Soweto East and Pumwani-Majengo respectively reported that housing lacked provisions for universal access
Variable 10	In all housing projects, just over half of each projects' respondents (52% both for Kibera Nyayo highrise and Pumwani-Majengo, and 59% for KENSUP Soweto East) agreed to presence of provisions for secondary functions.
Variable 11	More respondents disagreed with ease and ability of making conversions to their housing, with Kibera Nyayo highrise at 62%, KENSUP Soweto East at 67%. However, in Pumwani-Majengo number of residents who agreed to having made conversions was slightly greater at 52%
Variable 12	56% if respondents from KENSUP Soweto East to various extents disagreed that aspects of housing were not durable over time while 58% and 55% from Kibera Nyayo highrise and Pumwani-Majengo respectively disagreed about durability
Variable 13	70% of respondents from Kibera Nyayo highrise were in agreement that materials used in construction were appropriate for Nairobi's weather and climate while 78% and 63% in KENSUP Soweto East and Pumwani-Majengo

	respectively, of respondents perceived their housing to have appropriate construction materials
Variable 14	73% of respondents in Kibera Nyayo highrise, 76% in KENSUP Soweto East and 85% from Pumwani-Majengo agreed their units had adequate daylight.
Variable 15	Respondents from KENSUP Soweto East significantly reported appropriate thermal comfort (70%) in comparison to the residents of Kibera Nyayo highrise and Pumwani-Majengo (48% and 56% respectively).
Variable 16	74% of respondents in Kibera Nyayo highrise, 88% of respondents in KENSUP Soweto East and 81% of respondents in Pumwani-Majengo agreed that acoustic quality was sufficient.
Variable 17	55%, 82% and 52% of respondents from Kibera Nyayo highrise, KENSUP Soweto East and Pumwani-Majengo respectively agreed to proper integration of finishes, fittings and fixtures in their units
Variable 18	71%, 61% and 55% of respondents from Kibera Nyayo highrise, KENSUP Soweto East and Pumwani-Majengo respectively believed the structural systems holding together their housing was sound and efficient.
Variable 19	Only 23% of residents from Kibera Nyayo highrise, 18% from KENSUP Soweto East and 26% from Pumwani-Majengo agreed to presence of any sustainable strategies

The results for internal habitability from tables 4.6 and 4.7 reveal that the three highest ranked variables are variable 8 (access and circulation) where 87%, 82% and 85% of respondents, variable 16 (acoustic quality) where 74%, 88% and 81% of respondents and variable 14 (adequate daylight) where 73%, 76% and 85% of respondents in Kibera Nyayo highrise, KENSUP Soweto East and Pumwani-Majengo respectively. The least ranked items were variable 12 (durability), where 56%, 58% and 55% of respondents, variable 10 (secondary functions), where 52%, 59% and 52% of respondents and variable 19 (sustainability and renewable systems), where 23%, 18% and 26% of respondents in Kibera Nyayo highrise, KENSUP Soweto East and Pumwani-Majengo respectively. Based on the entire 19 variables under functional meaning, KENSUP Soweto performed best overall, followed by Kibera Nyayo high-rise and finally Pumwani Majengo

4.2.3 Social meaning variables: External Habitability

Three variables are categorised under external habitability. Variable 20 (housing potential to simulate local activity like trade and social interaction) had varied responses, ranging from 71% in Kibera Nyayo highrise, 70% in KENSUP Soweto East and 89% in Pumwani-Majengo as seen in figure 4.45. This study picked interest from past studies (see [12] and [15]) that reported disruptions of residents’ strong social networks and interactions that existed in their informal settlements prior to the housing upgrading schemes through which the case study projects were realised. While respondents confirmed to losing past interactions, they reported having created new ones with their new neighbours, as well as several businesses and trade coming up as a result of the housing. This has been captured in figures 4.46, 4.47 and 4.48

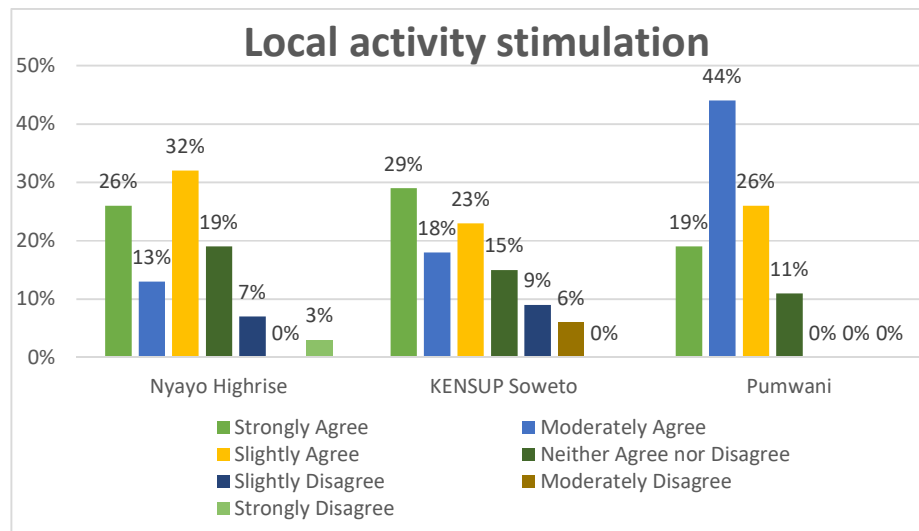


Figure 4.45: Whether housing helps stimulate local activity



Figures 4.46, 4.47 and 4.48: Children playing in Kibera Nyayo highrise; residents in Pumwani Majengo gather in evenings to prepare dinner; a soccer playground brings together residents from within the development and the neighbourhoods

All three projects reported varied results regarding variable 21 (availability of both public and private spaces). In the case of Kibera Nyayo highrise, respondents averagely responded at 50% while 40% were disagreed as seen in figure 4.49. In Pumwani-Majengo, 48% of respondents agreed to balanced public and private spaces against 37% in disagreement. In the case of KENSUP Soweto East however, a significant 82% of residents agreed to balanced availability of public and private spaces. An important observation was that amongst all three, it was only KENSUP Soweto East, the most recently completed, where public spaces such as a community meeting hall were incorporated (see figures 4.50 and 4.51), thereby justifying the overwhelming response in comparison to the other projects.

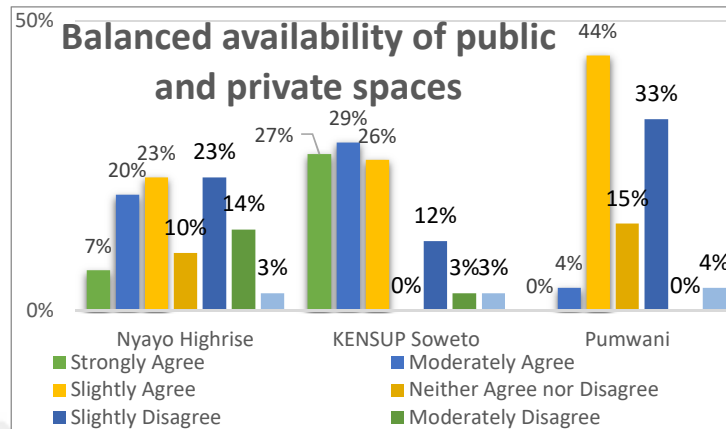


Figure 4.49: Balanced availability of public and private spaces



Figure 4.50 & 4.51: Community hall and training facilities in KENSUP Soweto East

Regarding Variable 22 (whether design aspects of housing such as site layout, use of lighting in public spaces, and security fixtures helped guarantee security from crime like burglary, robberies, assault and rape, or crime prevention through physical design). Respondents' opinions were divided across all projects, with 55%, 64% and 52% of respondents agreeing from Kibera Nyayo highrise, KENSUP Soweto East and Pumwani-Majengo respectively as seen in figure 4.52. Figures for respondents who disagreed with regards to security and crime were noted to be significant (i.e. 39%, 36% and 41% for the three projects respectively).

From the researcher’s direct observations, KENSUP Soweto East seemed to be the most secure amongst all three, with a boundary wall, security personnel and with majority of spaces lit by daylight to discourage criminal activity. Kibera Nyayo highrise was rated second and similarly had a boundary wall and security personnel within the development. Pumwani however completely lacked a boundary wall for enhanced security and there was no clear boundary between the neighbouring informal settlement and the affordable housing redevelopment, as seen in figures 4.53 and 4.54. The project could be accessed by any user and had many public paths cutting through the development. This particular question was significant since all three housing projects are surrounded by informal settlements which are recorded to have higher levels of unemployment and crime [4], [7], [12]. This section is justified for inclusion into habitability assessment based on research from three notable authors [130]–[132] who highlight the potential of housing design to either encourage or discourage crime.

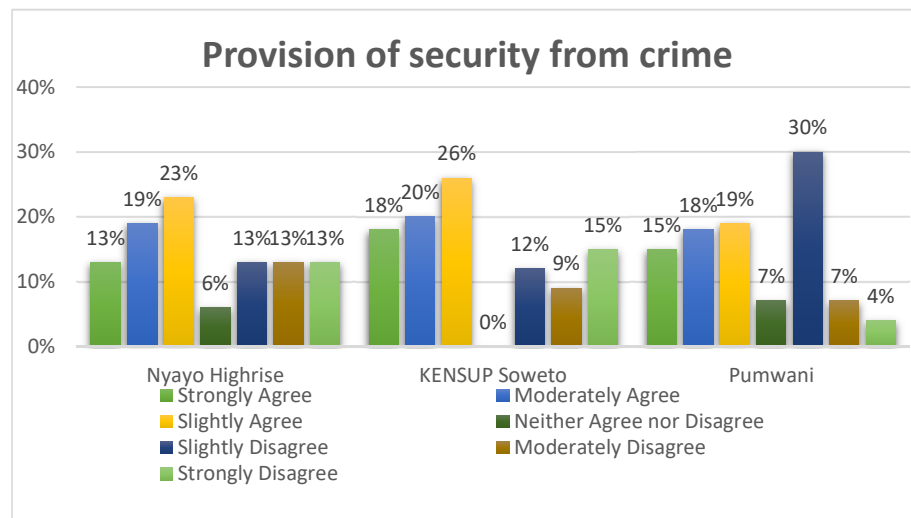


Figure 4.52: Provision of security from crime



Figure 4.53 and 4.54: Public spaces in KENSUP Soweto are visible from all units thus encouraging security however Pumwani’s layout lacks a boundary wall to demarcate it from the street and nearby informal settlements hence compromises security

A summary of the external habitability section is presented in tables 4.8 and 4.9

Table 4.8: Descriptive statistics for external habitability

Social (E.H)	Meaning variable	Rating	Kibera High Rise (n=31)		Nyayo Zone A (n=34)		KENSUP Soweto East (n=34)		Pumwani-Majengo (n=27)	
			Freq.	%	Freq.	%	Freq.	%	Freq.	%
Variable 20	St. A		8	26%	10	29%	5	19%		
	M. A		4	13%	6	18%	12	44%		
	Sl. A		10	32%	8	23%	7	26%		
	N		6	19%	5	15%	3	11%		
	Sl. D		2	7%	3	9%	0	0%		
	M. D		0	0%	2	6%	0	0%		
	St. D		1	3%	0	0%	0	0%		
Variable 21	St. A		2	7%	9	27%	0	0%		
	M. A		6	20%	10	29%	1	4%		
	Sl. A		7	23%	9	26%	12	44%		
	N		3	10%	0	0%	4	15%		
	Sl. D		7	23%	4	12%	9	33%		
	M. D		4	14%	1	3%	0	0%		
	St. D		1	3%	1	3%	1	4%		
Variable 22	St. A		4	13%	6	18%	4	15%		
	M. A		6	19%	7	20%	5	18%		
	Sl. A		7	23%	9	26%	5	19%		
	N		2	6%	0	0%	2	7%		
	Sl. D		4	13%	4	12%	8	30%		
	M. D		4	13%	3	9%	2	7%		
	St. D		4	13%	5	15%	1	4%		

Table 4.9: Summary for external habitability

Variable	Attributes of habitability
Variable 20	71% of respondents from in Kibera Nyayo highrise, 70% from KENSUP Soweto East and 89% from Pumwani-Majengo reported strong social networks with neighbours and trade coming up as a result of the housing
Variable 21	50% of respondents of Kibera Nyayo highrise, 48% of respondents from Pumwani-Majengo and a significant 82% of KENSUP Soweto East agreed to balanced availability of public and private spaces.
Variable 22	55%, 64% and 52% of respondents agreeing from Kibera Nyayo highrise, KENSUP Soweto East and Pumwani-Majengo respectively agreed that housing ensured crime prevention through physical design

The results for external habitability from tables 4.8 and 4.9 reveal that variables 20 (stimulating local activity) was the highest ranked items where 71%, 70% and 89% of respondents responded positively while the least ranked variables were 21 (public spaces) at 50%, 82% and 48%, and variable 22 (crime prevention) at and 55%, 64% and 52% of respondents for Kibera Nyayo highrise, KENSUP Soweto East and Pumwani-Majengo respectively

4.2.4 Social meaning variables: Internal Habitability

One variable was categorised under internal habitability. There were overwhelmingly positive responses regarding variable 23 (level of privacy). 88% of respondents in both Kibera Nyayo highrise and KENSUP Soweto East, as well as 81% of Pumwani-Majengo respondents found sufficient privacy from their housing. The main influencing factor for this response, especially in the case of KENSUP Soweto East and Pumwani-Majengo, was how it compared with prior living conditions in informal settlements that were too cramped to afford them any privacy. Respondents revealed how their current housing provided sufficient privacy within spaces like bathrooms and bedrooms, and from external intrusion of neighbours, as captured in figure 4.55

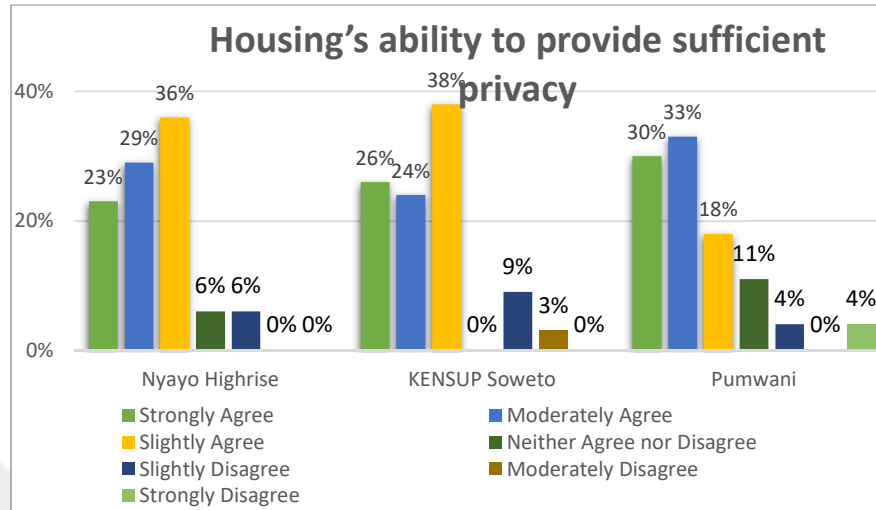


Figure 4.55: Ability of housing to provide sufficient privacy

A summary for the internal habitability section is presented in table 4.10 and 4.11

Table 4.10: Summary for internal habitability

Social Meaning variable (LH)	Rating	Kibera Nyayo High Rise (n=31)		KENSUP Soweto East Zone A (n=34)		Pumwani-Majengo (n=27)	
		Freq.	%	Freq.	%	Freq.	%
Variable 23	St. A	7	23%	9	26%	8	30%
	M. A	9	29%	8	24%	9	33%
	Sl. A	11	36%	13	38%	5	18%
	N	2	6%	0	0%	3	11%
	Sl. D	2	6%	3	9%	1	4%
	M. D	0	0%	1	3%	0	0%
	St. D	0	0%	0	0%	1	4%

Table 4.11: Summary for internal habitability

Variable	Attributes of habitability
Variable 23	88% of respondents in both Kibera Nyayo highrise and KENSUP Soweto East, as well as 81% of Pumwani-Majengo respondents positively responded that their housing afforded them the required level of privacy

The results show there was a single item for the section, variable 23 (level of privacy) which was highly ranked at 88%, 88% and 81% for Kibera Nyayo highrise, KENSUP Soweto East and Pumwani-Majengo respectively. Based on the entire four

variables under social meaning, KENSUP Soweto performed best overall, followed by Kibera Nyayo high-rise and finally Pumwani Majengo

4.2.5 Symbolic meaning variables: External Habitability

One variable (variable 24 – or appropriateness of building form, height and density) was categorised under symbolic meaning, where majority of respondents, that is, 71% from Kibera Nyayo highrise, 76% from KENSUP Soweto East and 63% of residents from Pumwani-Majengo found the density of their housing projects appropriate and not overcrowded as seen in figure 4.56. From direct observations and site layout analysis, the number of housing blocks in the projects were 50, 13, and 21 housing blocks for Kibera Nyayo highrise, KENSUP Soweto East and Pumwani-Majengo respectively. Only 29%, 18% and 33% of residents found the density unsuitable for residence. Density, and its relation to overcrowding will be further assessed in section 4.5 under minimum dwelling standards.

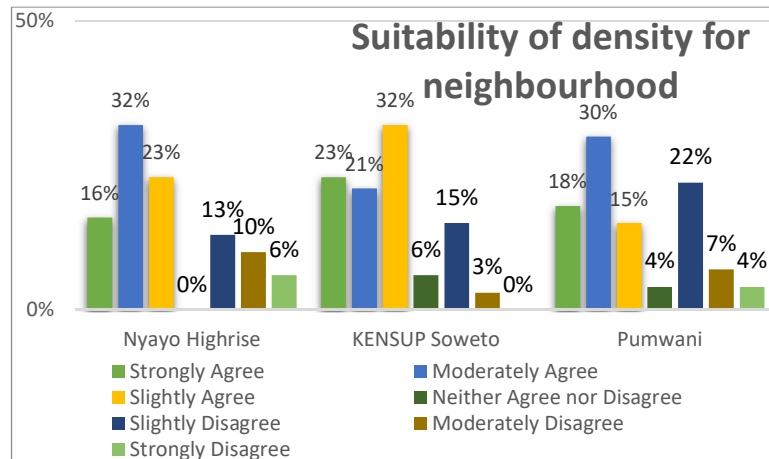


Figure 4.56: Suitability of density for neighbourhood

A summary for the internal habitability section is presented in table 4.12 and 4.13

Table 4.12: Descriptive statistics for external habitability

Symbolic Meaning variable (E.H)	Rating	Kibera High Rise (n=31)		Nyayo KENSUP Soweto East Zone A (n=34)		Pumwani-Majengo (n=27)	
		Freq.	%	Freq.	%	Freq.	%
Variable 24	St. A	5	16%	8	23%	5	18%
	M. A	10	32%	7	21%	8	30%
	Sl. A	7	23%	11	32%	4	15%
	N	0	0%	2	6%	1	4%
	Sl. D	4	13%	5	15%	6	22%
	M. D	3	10%	1	3%	2	7%
	St. D	2	6%	0	0%	1	4%

Table 4.13: Summary for external habitability

Variable	Attributes of habitability
Variable 24	Majority of respondents, that is, 71% from Kibera Nyayo highrise, 76% from KENSUP Soweto East and 63% of residents from Pumwani-Majengo found building form, height and density of their housing projects appropriate and not overcrowded.

The results show there was a single item for the section, variable 24 (appropriateness of form, height and density) which was fairly highly ranked at 71%, 76% and 63% of respondents for Kibera Nyayo highrise, KENSUP Soweto East and Pumwani-Majengo respectively. Under the symbolic meaning category KENSUP Soweto performed best overall, followed by Kibera Nyayo high-rise and finally Pumwani Majengo

Consequently, since this ranking pattern was similar throughout all the three meaning sub-categories, this study concludes that based on residents' subjective perceptions, KENSUP Soweto is considered the most habitable amongst the three projects. Kibera Nyayo high-rise ranks second while the final project, Pumwani Majengo is considered least habitable.

4.3 Interview findings and reference to minimum dwelling standards.

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

4.3.1 Minimum standards checklist 1

The first checklist adopted in this thesis is *floor area-per-person*, recommended by the United Nations Commission on Human Settlements (UNCHS) as a more accurate indicator for measuring adequacy of living spaces (in comparison to *people-per-room*, which has some limitations such as counting all spaces such as kitchens, living rooms as ‘rooms’)

This particular checklist/measure has been applied in past studies, such as in a survey conducted by the United Nations in 96 developed and developing countries, [133] in which a median *floor area per person* of 20m² was determined as adequate. According to the United Nations survey, 89% of units in developing countries (SSA, Asia and Latin America) having less than the recommended 20m² while in the developed countries about 58% of sampled units had more than the 20m². Furthermore, with emphasis on African countries, all 9 surveyed countries (100%) reported a *floor area per person* of less than 20m². In addition, 40% of the countries had an average floor area per person of 5-9 m². Table 4.14 and 4.15 highlight results of current floor area per person figures in the selected projects.

Table 4.14: Number of sampled households in all three projects

Household size	Kibera Nyayo highrise (n=31)	KENSUP Soweto East (n=34)	Pumwani-Majengo (n=27)
1 household	0	4	0
2 households	4	5	0
3 households	7	8	10
4 households	13	12	6
5 households	5	3	6
6 households	2	2	4
7 households	0	0	0
8 households	0	0	1
Average household size	6	6	5

Table 4.15: Table showing results of floor area per person

Housing project	Average household size	Average unit area	Remarks on evidence of crowding
Kibera Nyayo highrise	6	52 m ²	8.7 m ² (<20 m ²) - Overcrowded
KENSUP Soweto East	6	83 m ²	13.8 m ² (<20 m ²) - Overcrowded
Pumwani-Majengo	5	45 m ²	11.25 m ² (<20 m ²)-Overcrowded

While the sizes of the housing units did not perform poorly, the assessment criteria still categorised all housing projects as overcrowded resulting from the high household numbers per unit, a common demographic characteristic of developing countries. Amongst the three projects, KENSUP Soweto East, which is also the newest and the biggest with respect to square footage, performed marginally better than the other two. Although Pumwani was smaller than Kibera Nyayo highrise, it performed better due to having a lesser household figure than the latter.

4.3.2 Minimum standards checklist 2

The second checklist is developed from the World Health Organization (WHO) as seen in table 4.16, is *people per bedroom area* (in m²), based on public health regulations. In the methodology, children under 10 months are not counted while those between 1 and 10 years count as 0.5. Results are presented in table 4.17

Table 4.16: Standards based on people per bedroom area

Area (m ²)	Standard No of people
> or equal to 11	2
9 - 10	1.5
7 - 9	1
5 - 7	0.5
< 5	0

Table 4.17: Application of checklist 2 to the three housing projects

Project	Bedroom 1	No of occ.	Remark	Bedroom 2	No of occ.	Remark
Kibera Nyayo highrise	11.8 (m ²)	2	Not crowded	9.2 (m ²)	3	Crowded
KENSUP Soweto East	13.4 (m ²)	2	Not crowded	10.5 (m ²)	4	Crowded
Pumwani-Majengo	9.6 (m ²)	2	Not crowded	8.1 (m ²)	2	Crowded

Across all housing projects, minimum standards checklist 2 was applied for each of the two bedrooms. The first bedroom, which in most cases accommodated parents, had less occupants and hence was not considered crowded. The second bedroom however qualified as crowded across all housing projects.

4.3.3 Minimum standards checklist 3

The final checklist is based on minimum spatial dimensions based on government policies and affordable housing regulations, captured in the Sessional Paper No. 3 of 2004 on National Housing Policy for Kenya. [3], as well as from interviews with key personnel at the NHC and Ministry of Lands & Housing. Results are shown in table 4.18.

Table 4.18: Minimum spatial dimensions of spaces

Space/Unit	Minimum Areas	Kibera Nyayo highrise	KENSUP Soweto East	Pumwani- Majengo
1 bed unit	20 m²	30 m ² (PASS)	42 m ² (PASS)	Not applicable
2 bed unit	40 m²	52 m ² (PASS)	83 m ² (PASS)	45 m ² (PASS)
Double bed room/Master	10.5 m²	11.8 m ² (PASS)	14.4 m ² (PASS)	9.6 m ² (FAIL)
Twin bedroom	6.5 m²	9.3 m ² (PASS)	10.5 m ² (PASS)	8.1 m ² (PASS)
Living room	10 m²	15.5 m ² (PASS)	16.6m ² (PASS)	13.5 m ² (PASS)
Kitchen	6 m²	3.6 m ² (FAIL)	5.5 m ² (FAIL)	3 m ² (FAIL)
Bathrooms	1700 X 760 mm	(PASS)	(PASS)	(PASS)
Shower spaces	800 X 800 mm	(PASS)	(PASS)	(PASS)

This analysis reveals that on a general scale, the affordable housing projects performed well in relation to minimum spatial dimensions. The units as a whole, the individual bedrooms, the living rooms and bathrooms met the specified guidelines. However, kitchens did not meet the guidelines. This implies that the policy makers and architects at the NHC took deliberate effort to ensure that housing fulfilled minimum spatial dimensions, and went ahead to fulfil their requirements.

An important point to note from this section is that despite the strong evidence of overcrowding in affordable housing units in Nairobi, since it is a developing country, in many of them these values are not enforced or put into consideration since they could easily compromise the element of affordability within these housing and weaken incentives by developers (in cases of private public partnerships) to supply more housing.

4.5.4 Semi-structured interviews and analysis of planning legislation

Two additional tools of analysis were employed, with the first tool analysing three of the earlier discussed housing legislations and their influence on five core habitability attributes. This analysis from Table 4.19 reveals how increased attention towards habitability attributes has been witnessed with more recent policies in relation to the earlier ones.

Table 4.19: Table showing references of habitability within housing legislation

Core habitability attributes	Selected planning and housing legislations		
	1966/1967 Sessional Paper 5	Sessional Paper No. 3 of 2004 on N.H.P	Housing Bill of 2011
Locational convenience (work, city, amenities)	NO	YES	YES
	-----	-Policy statement: Building and maintaining housing in areas with adequate access.	-Roles of commissioner: Ensuring prospective sites are sufficient for settlement and extra guidelines for slopes, hilltops, earthquake areas
Appropriateness of materials, finishes and fittings	NO	YES	YES
	-----	-Policy statements: Promoting small-scale materials industry	-Roles of Kenya Housing Authority (KHA): The KHA to undertake research on building materials and technologies.
Provision of infrastructure	YES	YES	YES
	-Policy objectives: Providing roads and infrastructure	-Policy objectives: Supporting housing with roads, water,	-Act preliminaries: Facilitation of infrastructure provision and maintenance

	sewage, and social services		
	NO	YES	YES
Appropriate number and size of rooms	-----	-Policy objectives: Recommended sizes and number of rooms for low and middle-cost housing	-Policy objectives: Recommended sizes and number of rooms
	NO	YES	NO
Sufficiency of lighting, thermal comfort, ventilation and acoustics	-----	-Policy objectives: Both urban and rural housing to have sufficient lighting, ventilation and height	-----

The methodology for this section was analysis of the planning legislations for references to any or all of the core habitability concepts. Table 4.19 reveals that habitability concepts such as room size and typology, natural lighting within interior spaces, ventilation, quality of acoustics, infrastructure provision, appropriate material usage and convenient location were addressed within two of the more recent housing legislation (Sessional Paper No. 3 of 2004 and the 2011 Housing Bill). Earlier legislations such as the 1966/1967 Sessional Paper 5 were found to be lacking with respect to these concepts. What remains to be seen in future studies is how effective the implementation of such concepts from paper to practice

Additionally, 12 interviews with architecture, planning and public health professionals regarding their opinions on the application and performance of public housing with regards to habitability. The list and profiles of these professionals is illustrated in Table 4.15

Table 4.20: Table showing the 12 interviewed professionals and their designations.

Name of organization	Designation(s)	Number	Experience (years)
State Department for Housing & Urban Development	Senior commissioner, admin. officer & planner	3	3, 5 & 4
Architectural firms	Project architects, partners	4	9, 4, 5 & 3
National Housing Corporation	Planners & Corporate Liaison	3	6, 6, & 5
Nairobi City Council	Public health officials	2	2 & 4

The results showed that all interviewed groups had varied responses, as indicated below in Figure 4.57

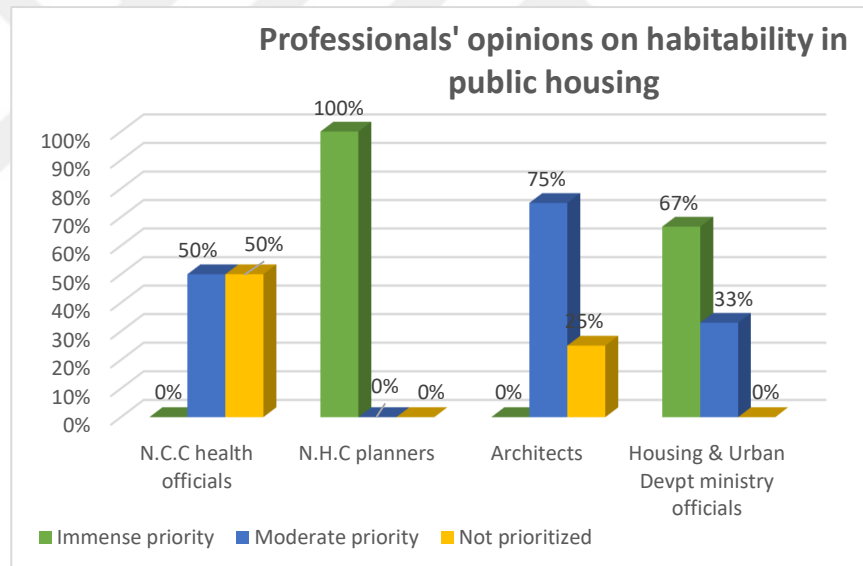


Figure 4.57: Opinions of planning professionals with regard to housing habitability

The two public health officials for example opined that there was moderate priority towards adopting minimum dwelling standards in Nairobi’s affordable housing projects. One of the health officials for example stated:

The people in the Pumwani houses complained years ago that their rooms, kitchens and even toilets were small and poorly ventilated. Security must be problematic there too since people from the nearby slums walk through the estate every day. The new Kibera houses (KENSUP Soweto) are much

better..... They looked very spacious during the project's opening ceremony, and the prime minister entered several units to confirm their size.

The second official supplemented this with a second opinion

There could be maintenance challenges in Pumwani, but not to the stage requiring urgent attention. We would otherwise have been summoned to inspect, and if possible oversee demolition of housing if conditions qualified as 'dilapidated' or 'defective', as stipulated in the 2012 Public Health Act which governs our work. We also have mandate through section 125 to ensure homes are not overcrowded, and have enough light and ventilation.

The 3 planners from the NHC reported that habitability attributes were highly prioritised during design and implementation of public housing, an unsurprising result provided the NHC played a key role in delivery of affordable housing projects within the country.

Soweto East is a flagship national project, and we are confident that policies used, and even the completed housing units and are well suited to user needs. A similar story is with Nyayo Estate, many of the residents here are middle class individuals. That must tell you something about the quality of housing spaces.

Three of the four interviewed architects stated there moderate prioritisation of habitability with the fourth reporting lack of prioritisation. When asked on the challenges hindering application of minimum dwelling standards, an architect argued that:

I think the government cannot commit too much resources in building big rooms, and other 'luxuries' such as lifts, considering their previous housing (indicating informal settlements).... I assume the government feels it has done them a big favour with new housing. Unfortunately, if the conditions are not exponentially better than their original squatter housing, many of them rent them out and return to the slums

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.

Finally, two officials from the State Department for Housing and Urban Development reported prioritization of habitability in public housing while the third's opinion was for moderate adoption of habitability attributes. Among the recommendations provided by planning officials from the Housing and urban Development department were:

You may have noticed that once the buildings go up, there is no space for greens spaces... things like children play areas, meeting spaces. The available land is not sufficient to include these. But we are engaging the National Land Commission and other development partners (NGOs) in looking to secure funds for bigger strategically located land parcels for housing development

This chapter presented analysis from each of the data gathering tools, including questionnaires, interviews, minimum dwelling standard comparisons and policy analysis. All these methods of analysis were in line with the research questions developed at the beginning of the study.

CHAPTER FIVE

CONCLUSIONS

The aim of the study was the evaluation of government initiated affordable housing projects delivered in Nairobi over a 30 year period using three representative case studies. Based on the research questions, a synthetic habitability index was the primary method of inquiry to answer question 1 of what constituted habitability both at housing (internal) and neighbourhood (external) scales based on residents' subjective perceptions. The perceptions were theoretically linked to the meanings residents attached to their housing, with meaning divided into three sub-themes.

19 variables were assessed under functional meaning, with 5 variables under external habitability while 14 variables were under internal habitability. Residents derived most meaning from locational variables (convenience aspects of variables 1-3), implying that planning authorities ensured that housing was physically well integrated within the city, and in close proximity to workplaces and amenities, which is often overlooked in the design of new affordable housing projects. Other habitability variables that residents derived significant meaning include circulation and access efficiency, good acoustic quality within housing and sufficiency of daylight while limited meaning was derived to durability of housing and adoption of sustainability and renewable strategies.

4 variables were assessed under social meaning, with 3 variables under external habitability while 1 variable was under internal habitability. Residents derived most meaning from housing's ability to stimulate social interaction, and ability to provide privacy while limited meaning was derived from housing ability to prevent crime. 1

variable, appropriateness of density was assessed under symbolic meaning, to which residents attached significant meaning. The study concludes that based on residents' subjective perceptions, KENSUP Soweto (likely due to being newest amongst the three) was the most habitable. Kibera Nyayo high-rise ranks second while the final project, Pumwani Majengo is considered least habitable.

Secondary methods of inquiry were used to answer the other research questions. For question 2 (performance against minimum dwelling standards), local and global dwelling standards were analysed using three checklists. All housing projects were found to be inadequate/overcrowded with respect to checklist one (floor area per person). The second checklist found evidence of crowding in the secondary bedrooms but not in the main bedrooms. The final checklist assessed minimum spatial dimensions and found majority of spaces, excluding kitchen met the specified standards. Semi-structured interviews with architectural, planning and health professionals, were used to answer question 3 (influence of planning system on habitability). Mixed results were noted, with state housing officials more inclined to consider public housing habitable than public health or independent architects. Question 3 was additionally addressed through analysis of planning and housing legislation was done to assess the impact of legislation on core habitability variables of current affordable housing. It was noted that the more recent legislation paid significantly more attention towards habitability than earlier post-independence legislations.

This study's main implication lies in its potential to inform policy makers in the Global South on what variables are most important and need prioritization when formulating housing policies to guide design and implementation of future affordable housing projects, as it is these issues that dwellers attach most meaning to. Additionally,

by highlighting poorly performing variables, policy makers are informed on where significant improvements are required. Policy makers further need to develop sensitivity towards dweller needs through participatory engagement of the intended beneficiaries of public affordable housing projects. As the study reveals, the turnkey delivery model employed in the provision of housing, where the NHC handles all aspects of planning, conceptualization and building housing without sufficient consultation raises concerns on whether professionals suppose beneficiaries' spatial requirements are homogenous with their own.

Future studies can build upon this study's findings and knowledge by adopting similar (or expanding) the assessment methodology to hybrid methodology that are more comprehensive by tackling both physical dimensions (e.g. spatial layout and internal housing characteristics) and non-physical dimensions (intangible meanings derived from the relationships between dwellers and housing).

APPENDICES

Appendix I: Definition of key terms

The key concepts used in this research are defined and described in this section

- i. **Affordable housing:** Refers to housing that is functional, adequate and affordable even for dwellers earning low and modest incomes whereby costs towards housing should not exceed 30% of the household's gross income [3].
- ii. **Habitability:** This refers to the quality attributes of spaces and their potential to meet objective and subjective needs of users (provide satisfaction) while allowing for healthy biological, psychological and social development of residents.
- iii. **Household:** The collective composition of persons occupying a dwelling establishment such as a house or apartment, including related (family) and unrelated members (e.g. servants)
- iv. **Built environment:** The built environment is defined as an abstract concept used to refer to the outcomes of human building activity, or in general terms any forms of physical alterations of the natural environment. It comprises both built forms, a general term for building types (such as dwellings, work/production buildings like office blocks, factories, places of worship etc.) and the spaces surrounded and defined by these built forms such as compounds, streets and plazas
- v. **Minimum dwelling standards:** These are building regulations to which internal spaces within dwellings ought to adhere to so as to guarantee safety and quality of life. They may also be referred to as minimum space standards.
- vi. **Urbanization:** This is the process through which populations expand so as to transform the environment from natural to built-up.

- vii. **Room:** Is defined as an enclosed interior space within a building that is divided off using partitions or walls. Several standards maintain that rooms comprise bedrooms, dining rooms, living rooms, enclosed porches and recreational/family rooms while excluding balconies, bathrooms, storage and utility, kitchens and halls. Habitable rooms however are those used for sleeping and living purposes
- viii. **Planning:** From an infrastructural perspective, planning refers to the process of laying down a course of action to be followed so as to achieve specific goals

Appendix II: Synthetic index of habitability

Index of HABITABILITY			
Variable	Sub Variable	Parameter	Indicator
Housing Relationship with the City	Provisions for social interaction	Housing relationship with physical centrality of the city	-Distance -Medium of Transport -Time
		Housing relationship with Work	-Distance -Medium of Transport -Time
		Housing relationship with Housing services	-Distance -Medium of Transport -Time
Housing Relationship with immediate Surroundings	Physical - Spatial Dimension	Morphology and urban typology	-Volumetric fit into context -Distribution of public and private spaces -Number of floors -Variety/Housing mix -Density (block nº)
		Infrastructure	-Mobility infrastructure and transport -Roads -Public domiciliary services (elderly/disabled care)
		Community Empowerment	-Spaces for demonstration -Spaces for trade/exchange
	Physical - Environmental Dimension	Green areas	-Availability of green spaces -Availability of public spaces
		Physical vulnerabilities of site	-Flooding potential -Poor and unstable soils
	Functionality and Spatial Adequacy	Space	-Size/sq. footage -Use and purpose -Provisions for equipment (HVAC, storage etc) -Flexibility (potential for conversions/alterations) -Spatial layout (relationships between spaces) -Privacy - <i>Overcrowding (PPR)</i> -Accessibility; <i>local access, Inter-floor access, Inter-unit access</i> <i>Disabled here?</i>

Quality of Habitable Spaces		Comfort	-Thermal -Lighting -Ventilation -Acoustic
		Form (volume)	-Typology -Number of floors -Lot/site (dimension & layout)
	Technical and Construction aspects	Adaptability	-Integration to the whole -Distinctive features -Positive contributions -Universal access
		Materials & Technologies	-Structural system -Fittings and furnishings -Façade -Solar shading strategies (external devices, installation etc) -Roof -Details (Joints/connections) -External & Internal finishes

Sources:

- i) Habitability measuring methodology (Pérez Pérez, 2011),
- ii) Index for architectural design quality (Gann et al, 2003),
- iii) Habitability Conditions Index; (Phillips et al, 2015)
- iv) Index of habitability & architectural design (Landázuri and Mercado, 2004)

Appendix III: Sample Questionnaire Schedule



Dear Respondent,

We would like to invite you to share your valuable opinions and experiences of your housing by completing a short survey. This survey is conducted as part of my Masters research thesis titled, *Evaluating habitability of affordable housing projects in Nairobi-Kenya* at Özyeğin University in Istanbul Turkey. Your housing unit has been selected through a systematic sampling procedure to achieve a representative figure of the entire housing development.

What is the study about?

The study investigates on habitability, housing quality and physical housing characteristics of public affordable housing projects completed in Nairobi within the last 30 years. Three housing projects have been selected for this study, including Pumwani-Majengo, Soweto East, and Kibera High Rise housing projects.

What does the survey involve?

This survey comprises three sections, where section 1 gathers basic information about individual and household attributes while Section 2 seeks your opinion on various housing issues through a questionnaire comprising 39 questions. Completing the survey will take between 5 and 8 minutes.

Information about your participation

Participation is voluntary and the information you provide will be treated with strict confidentiality and anonymity. The study findings will be shared with the respondents if requested.

Thank you very much for your assistance with this research.

Contact information

Please contact me if you have any questions or would like to know more about this study

Valerio Musiitwa

Master of Science in Architecture student

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SECTION A: Basic Information; Individual and household attributes

Name of Housing Estate

.....

How old are you?

- < 35 35 - 44 45 - 54 55 - 64 65 and above

Gender

- Male Female

Education Attainment

- No studies Primary school Secondary school University Deg.

Household type

- Single Person household Married couple without children
 Married couple with children Single parent household Other household types

What is the range of your average monthly household income

- < 50,000 KES 50,000 - 200,000 KES > 200,000 KES

What is your current employment status?

- Full time Part time Unemployed

How long have been living in this housing estate?

- Less than 1 year 1-3 years 4-5 years More than 5 years

What is your current ownership / tenure status?

- Owner Renter

What is your regular mode of transport

- Public transport Private transport Walking

SECTION B: Habitability, housing quality and physical housing attributes

		Strongly Agree	Moderately Agree	Slightly Agree	Neither Agree nor Disagree	Slightly Disagree	Moderately Disagree	Strongly Disagree
FUNCTIONAL MEANING: External Habitability								
01	Distance & time between housing and the city centre is convenient (<i>estimate kms and minutes</i>)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
02	Distance & time between housing and work is convenient (<i>estimate kms and minutes</i>)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
03	Distance and time between housing and public amenities (sports centres, parks, community halls) is convenient (<i>estimate kms and minutes</i>)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
04	The site is appropriate for residence and safe from poor conditions (e.g. flooding, pollution, unstable soil)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
05	Sufficient provision of infrastructure e.g. roads, parking and service utilities	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
FUNCTIONAL MEANING: Internal Habitability								
06	Spaces/Rooms are of appropriate sizes (square footage)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
07	Typology and number of rooms are sufficient for my needs and family size (<i>provide number of rooms & users to assess crowding</i>)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
08	Access & circulation between rooms, other units, floors & the outdoor environment works well	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
09	Universal access principles are accommodated (physically & visually impaired users, elderly)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
10	Housing has provisions for secondary functions e.g. storage and other equipment (e.g. AC units)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
11	Building structure allows flexibility of spaces to changing needs. (conversions/alterations)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
12	The building withstands wear and tear, & minor vandalism (durability)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
13	Structure and materials are appropriate for local weather & climate	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
14	Spaces have adequate daylight/natural lighting	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
15	Internal spaces have sufficient thermal comfort	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
16	The building has sufficient acoustics quality (against vibrations and noise)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

- 17 Finishes, fittings and fixtures (e.g. sockets, plumbing, wardrobes, kitchens, and railings) are well integrated.
- 18 The building's structural system is efficient (walls, beams, slabs & columns)
- 19 Building uses sustainable and renewable systems (orientation, shading, reusable/low embodied energy materials, solar energy)

SOCIAL MEANING: External Habitability

- 20 Housing stimulates local activity (social interaction, trade)
- 21 There is balanced distribution of both public (green areas, play spaces) and private spaces in the outdoors
- 22 Housing design promotes security against burglary & robbery, assault, rape etc (e.g. through layouts, lighting, use of security hardware/fixtures)

SOCIAL MEANING: Internal Habitability

- 23 Housing provides sufficient privacy (within interior spaces e.g. bathrooms/bedrooms and from neighbours)

SYMBOLIC MEANING: External Habitability

- 24 Building form, height & density fit within neighbourhood and are appreciated by local residents

THANK YOU VERY MUCH FOR YOUR COOPERATION

Appendix IV: Sample Interview format



Declaration: This information will remain confidential and will strictly be applied for academic use.

Organisation.....Designation.....
 Duration..... Interview N°.....

Question	Response		
	Immense priority	Moderate priority	Not prioritized
1. Have planning authorities prioritized minimum dwelling standards in Nairobi’s affordable housing? How has this been done?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
		
		
		
		
		
2. What are the main hindrances to application of minimum dwelling standards?		
		
		
		
		
3. What strategies may be employed to improve dwelling standards?		
		
		
		
		

Thank you very much for your assistance

Appendix V: Introductory letter to execute the research



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29th April 2019

To Whom It May Concern,

Mr. Valerio Musiitwa whose student number: S01443 is a registered graduate student of MSc in Architecture (Thesis) master program at Özyeğin University Faculty of Architecture and Design. This document is prepared to fulfill the request of the student.

Yours sincerely,

A handwritten signature in blue ink, appearing to read "Orhan", followed by a horizontal line.

Prof. Orhan HACIHASANOGLU (PhD)

Dean
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