A POST-OCCUPANCY EVALUATION OF DWELLING DENSITY IN MULTIFAMILY APARTMENTS IN PUBLIC HOUSING ESTATES IN LAGOS

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(MATRIC NO: 029053022)

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CERTIFICATION

This is to certify that the Thesis:

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By:

IWEKA, Anthony Chuks Okeibunor
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DECLARATION

I HEREBY DECLARE THAT I AM THE SOLE AUTHOR OF THIS RESEARCH PROJECT AND THAT IT HAS NOT BEEN PRESENTED BY ANY PREVIOUS APPLICATION FOR A HIGHER DEGREE.

I AUTHORISE THE UNIVERSITY OF LAGOS TO LEND IT TO OTHER INSTITUTIONS OR INDIVIDUALS FOR THE PURPOSE OF SCHOLARLY RESEARCH.

IWEKA, ANTHONY CHUKS OKEIBUNOR

November 2012

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DEDICATION

To my octogenarian father, Mr. Gabriel Iweka and my late mother Mrs. Margaret Iweka.

To all my brothers and sisters, including their spouses.

To my nephews and nieces.

To my dear wife and children.

To the entire Udogwu lineage of Ubulu-Uku, Delta State, Nigeria.

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Anthony C. O. **Iweka**

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ABSTRACT

This study is an attempt to establish how actual dwelling density during the habitation phase correlates with the programmed dwelling density during design phase in multifamily apartments in Lagos. In this regard, the research attempts to establish design density as the number of adult-equivalent persons intended to occupy an apartment. It further attempts to determine the actual dwelling density as the number of adult-equivalent persons occupying the same apartments during habitation. Using Post-occupancy Evaluation (POE), the two results are compared to determine the strength of the association between the outcome occupancy and the predicted occupancy for different prototype apartments. The study is restricted to low-income and medium-income mass housing estates built by Lagos State Development and Property Corporation (LSDPC) between 1973 and 2005, which contain multifamily apartments.

This investigation is a case study of LSDPC as a single unit entity, based on survey research design. Four large housing estates were purposively chosen for detailed study. Ebute-Metta estate is in the medium-income category, while the three low-income estates are Abesan, Iba, and Dolphin II. The unit of study is the original prototype apartments. The study population is 17,679. The sample frame is 7,764 comprising all the multifamily units in the four estates.

Data for this study were obtained from primary and secondary sources. Data collection was through triangulation approach comprising survey, physical measurements of "as-built" floor plans of existing apartments, and an assessment of archival drawings from LSDPC's database. The survey approach involved structured questionnaires, distributed to and collected from household heads. A probability sample design was employed to select apartments to be studied within each estate. A two-stage approach was applied to select representative sample sizes. In all, a 7.5% sample of the apartments was chosen from each estate as follows: Abesan (320), Dolphin II (43), Iba (179) and Ebute-Metta (40), totalling 582 apartments. These samples were then stratified according to the proportion of two-bedroom type, three-bedroom type, and four-bedroom type existing in each estate. A systematic random technique was finally applied to choose the eventual 582 units for detailed study. A total of 184 questionnaires were returned, giving an effective return rate of 32%.

The quantitative analytical technique was employed. Logic model was used for data analysis. Descriptive statistical methods including tables, column charts, means, modes, chi-square, and one sample t-tests, were also applied to analyze and compare quantitative data obtained from questionnaire. Five measurement criteria from the literature that stipulate suitable separation of rooms used for sleeping according to age, and sex of household configuration were applied to determine the number of rooms needed in each apartment. The five indicators are: Number of habitable Rooms; Number of Bedrooms; Combined Area of Habitable Rooms; Aggregate Area of Rooms for Cooking, Eating, and Living (CEL); and Total Area of Each Apartment. A major finding is the non-existence of a programme or theory that clearly states the rated capacity or estimated intensity of occupancy. This gap was addressed by obtaining the rated capacity for each of the six apartment types investigated. It was observed that the estimate of how each apartment was designed to be occupied varies remarkably across the five computation techniques applied in this research. Results from the study indicate that, contrary to widespread opinions which regard LSDPC's apartments as overcrowded, there is indeed higher spread of under-occupancy (78.7%) than over-occupancy (19.9%).

The study found that the effect of apartment type and location on dwelling density is not significant, at 95% confidence level. Similarly, the use of seven household characteristics as parameters for assessing the intensity of dwelling density in LSDPC's apartments has weak significance. These are: gender of household head, socio-economic status of household head, marital status of household head, ethnicity of household head, age of household head, length of stay in an apartment, and mode of purchase of apartment. On the contrary, three household characteristics were seen to have significant effect on dwelling density. These are: education level of household head, employment level of household head and tenure. These findings suggest that for LSDPC to enhance the dwelling density of its apartments, social policy concerns in the areas of education and employment should be integrated into the agency's housing provision initiatives.

Key Words: crowding, dwelling density, multifamily apartment, post-occupancy evaluation, public housing.

CHAPTER ONE

1.0 INTRODUCTION AND BACKGROUND OF STUDY

Public housing projects, like other projects, can be evaluated to determine their success by comparing achievements to project objectives, with a focus on who the user or occupant is. The history of residential development is replete with planning and design errors that create poor fit between people and their environment, and which adversely impact on residents' quality of life. Many cases exist where buildings and spaces had to be torn down and re-designed because the spaces and their users were incongruent. Peg (1994), for example, points out that in the United States of America, the Pruitt-Igoe housing scheme built in St Louis, Missouri in the 1950s was hailed in architecture circles for its attractive physical design. He, however, argues that the facility served its residents so poorly that the government found no other remedy than to blow-up the buildings in 1972, due to security problems arising from chronic spatial dysfunction (Figures 1.1A; 1.1B; 1.2A; 1.2B) .

Figure 1.1A:
2,740-unit Pruit-Igoe public housing project, 11 floors, 33 blocks, on 57 acres of land, designed by eminent architects and was hailed as the new enlightenment. Source: Newman, (1996), P.10

Figure 1.1B:
Pruitt-Igoe in the process of being torn down. Source: Newman, (1996), P.12

Figure 1.2A: The architects vision of how the 3rd floor communal corridor would be.
Source: Newman, (1996), P.10

Figure 1.2B: The 3rd floor communal corridor as it actually turned out to be.
Source: Newman, (1996), P.11

In enhancing the quality of life of housing residents, it has been identified that three main aspects impact the quality of housing, namely the quality of the dwelling, the quality of the close environment and the quality of the urban site (Mohit, Ibrahim & Rashid, 2010). Thus it can be inferred that the concept of quality varies according to the perspective from which it is considered, hence the existence of several methods for measuring an entire housing project's quality.

In the housing sector, certain key measurement techniques such as dwelling density has been developed to measure the success of housing as a product. Hence, the quality of life of households in human settlements is greatly affected by the dwelling density, which in this study, is taken as a measure of household crowding. Housing space adequate to the needs and desires of a household is a core component of quality of life.

Some scholars have argued that the way internal spaces are utilized remains the most important indicator among five residential quality index factors, the other four being facility infrastructure, maintenance and management, social environment, as well as visual factors (Haeseong, Jaehyuk, Seongwoon & Sung-Woo, 2007). The design stage of housing projects is generally regarded as a stage where the benchmark is established or determined for dwelling density (or crowding).The occupancy stage, on the other hand, provides an opportunity to obtain an actual measurement of crowding in different design models of housing units. Furthermore, the experience of residents during occupancy provides a basis for assessing the sufficiency of the spaces available in each model of housing unit. Tipple (1987) justifies this claim by arguing that housing is a basic need and should fit the spatial requirements of its occupants as its primary function. Thus the degree of spatial deprivation associated with particular design models can be determined. Deprivation in this context refers to the existence of a gap between what is available and what is needed in terms of adequate spaces for a household's daily living. The availability of sufficient living area in a housing unit is central to household's functionality and productivity, social harmony and the development of a healthy and sustainable economy (Tshitereke, 2009).

In Lagos, Nigeria, the government has been involved over the years, in the provision of residential units through the Lagos Executive Development Board (LEDB), now Lagos State Development and Property Corporation (LSDPC). Since its inception in 1972, LSDPC has been involved in construction of housing estates for different income levels. Like what is obtained in many other countries, the housing units available in LSDPC's housing estates were designed and built without empirically determining who the tenants or owners will be. In many cases, LSDPC utilizes a few prototype housing units in large quantities to serve three dominant groups of income earners, namely low-income, medium-income and high income. The use of income level by LSDPC without due regards to the demographic experiences of households is seen as a conceptual inadequacy. Studies of housing estates in Ghana, Zimbabwe and Bangladesh, point out that such inadequacies of original concepts prompt people to resort to housing adjustment mechanisms called transformations (Tipple, & Korbee, 1998; Tipple, & Ameen, 1999; Tipple, 2000; Tipple, Owusu, & Pritchard, 2004). In a closely related study, Sibley-Behloul (2002; 2005) identified lack of space within the dwelling units as a major trigger for various adaptive alterations by the residents of formal housing estates in Algiers and Cairo.

Transformation process is a way by which households presumably improve their housing space. This explains the existence of some mismatch between households and their dwellings in these housing units. In an analysis of a current debate tagged "the mismatch argument" in Australia, Batten (1999) suggests that emphasis in housing problems should shift from a crisis of supply to a crisis of utilization. While some households live in overcrowded dwellings, others are underutilizing theirs, or appear to have surplus space.

The crowding context (i.e. dwelling density context) provides a basis for identifying LSDPC housing units where occupant households live in conditions that can be interpreted as deeply problematic. Crowding in the context of this study is attributed to an inadequate programming at design stage, and provides a basis for measuring how well the various multifamily housing units being provided by LSDPC are meeting the substantive living needs of occupant households.

Building Performance Evaluation (BPE) and Post-occupancy Evaluation (POE) are two methods that have been used by many researchers in seeking to understand how buildings perform during occupancy. The primary purpose of BPE is to improve design practice. BPE provides an opportunity to learn from the successes and deficiencies of built projects after some years of their completion and habitation. POE is often seen as a sub-process of BPE. It is the act of evaluating buildings and systematically comparing the actual performance to explicitly documented criteria for their expected performance. The level of crowding is taken as a manifestation of use of space in specific design types.

The Commission for Architecture and Built Environment (CABE) has stated that Post-Occupancy evaluation (POE) is the preferred means to assess how well constructed facilities meet the needs of consumers. In Britain, the Royal Institute of British Architects (RIBA) Plan of Work recommends post-occupancy evaluation for reviewing building performance in use (RIBA, 1991; Carthey, 2006).

To recognise the increasing importance of POE, public funding bodies in Scotland such as Scottish Funding Council has made POE mandatory on all building projects they fund.

If the post-occupancy performance of LSDPC's multifamily housing prototypes is to be measured and compared, objective and comparable criteria like dwelling density is needed. It is necessary to include dwelling density in the quality index at both the planning phase, and the operation/use phase of the housing units. Lessons learned from evaluating completed LSDPC's multifamily units will definitely be useful in the planning, design and construction of similar facilities and structures for the future.

1.1 PROBLEM STATEMENT

The pursuit of public housing in many developing countries, Nigeria inclusive, produces too few houses and inappropriate types (World Bank, 1996; Ademiluyi & Raji, 2008). Most of the available researches on LSDPC and other public housing providers in Nigeria focused on residents' satisfaction, accessibility to urban services and housing management issues (Illesanmi, 2005; Jiboye, 2009). Performance evaluation efforts in the field of public housing in Nigeria can therefore be described as few and inadequate. Dwelling density and crowding were merely addressed as narrow aspects of housing satisfaction. Hence, a more detailed understanding of crowded housing remains one of the major concerns of policy-makers and housing authorities in Nigeria that have not yet been adequately addressed.

As more and more people migrate to Lagos, the future designers of LSDPC's multifamily house types should take cognizance that LSDPC's estates will provide accommodation for most people who will be living in this megacity. This raises an important question regarding dwelling density. Despite the fact that there is a variety of dwelling unit prototypes in LSDPC's housing estates, there is inadequate knowledge of what the existing and emerging occupancy rates are, as a result of non-recognition of this factor at the programming, planning and design stage. Whether the dwelling unit prototypes are efficient in terms of density and better spatial qualities, is also not known. It has been observed that proper programme evaluation was scarcely done in Nigeria's public housing sector, thereby making it difficult to assess the actual outcome of different housing programmes (Obashoro, 2002).

Space inadequacy is regarded as one facet of poor housing and an indicator of un-met housing need. It is also regarded as a major barrier that has plagued policy-makers in an attempt to achieve a better quality of multifamily housing stock. The intended effect of public housing programmes is improved quality of life (Cole, 1999). There is hence an increasing interest in how LSDPC might improve the quality and habitability of its multifamily housing stock. It has been argued that there is a limit to the number of persons an apartment of a given size can physically and comfortably accommodate (Obateru, 2005). There is general apprehension that very little is known about the actual performance of the designed spaces in existing multifamily units, in comparison to what the designers expect their performance to be. It is curious that LSDPC as a large property management organization is rarely known to use POE for building diagnostic purposes or for improving services to occupants. Though a number of studies have been undertaken in the context of LSDPC (Ilesanmi, 2005; Jiboye, 2010), the organization is still largely unfamiliar with POE approach in performance assessment of its housing units.

This raises the need for POE after construction and occupancy, to address questions such as: How are the interior spaces in LSDPC's multifamily apartments working? Is this what was intended by the designers? Do occupants' demographic characteristics fit the way designers organized the spaces? These attributes of design are evaluated in this research; in line with the views of Fatoye and Odusami (2009) that performance evaluation of housing facilities should be based on how well the physical structure conforms to design specifications.

The number of persons to a dwelling, the household demographic characteristics, and the physical design of the habitable spaces in the dwelling units are all highly regarded when considering the conditions of residents. Without a clearly articulated understanding of how the spaces in multifamily housing units were designed to be occupied, it is difficult to ascertain whether such spaces did, or did not produce the intended results (Cole, 1999; McLaughlin & Jordan, 1999; Torvatn, 1999). Also most building evaluations described in the literature had been done against physical rather than use criteria. According to Jiboye (2010), the assumption that the physical and structural efficiency of a dwelling is a good measure of its adequacy and habitability is narrow and misleading. These levels of aggregation are not sufficient in providing enough data to support government's continued insistence on addressing the problems of housing deprivation, housing need and housing quality as a primary housing policy objective.

The absence of comprehensive study of dwelling density and crowding in LSDPC's estates is a gap that this research addresses. Since LSDPC is known for repeatedly constructing prototype buildings for its mass-housing schemes, examining different design models of the corporation's multifamily housing will reveal which design types worked and which did not. Therefore, this research falls under the category of basic information post-occupancy evaluation. Basic information post-occupancy evaluation draws scientifically based conclusions about the effectiveness of specific design decisions. The whole idea is to compare the dwelling density that was theoretically programmed by LSDPC at the design stage, with the actual experience of dwelling density by the occupants during the habitation stage. The purpose is not simply to label or classify households as crowded, but to gain an understanding of which households types are more likely to experience crowding and the factors that contribute to crowding.

The critical issue is to gain a better insight into the adequacy of interior spaces supplied, as this will greatly influence how millions of apartments yet to be built by LSDPC will be designed and arranged. This will ensure that multifamily housing units of the future are occupied by households whose characteristics and space needs were adequately programmed in the design. The intention of the present post-occupancy study is to guide LSDPC in making informed judgements regarding the design models being executed, by confirming how far the dwelling spaces are creating the desired occupancy.

1.2 AIM AND OBJECTIVES

The aim of this study is to evaluate how the actual dwelling density during habitation phase, correlates with the programmed dwelling density during design phase in LSDPC's multifamily apartments in Lagos, Nigeria.

The specific objectives are:

1. To determine how the existing LSDPC's multifamily apartments were designed to be occupied.
2. To determine the levels of occupancy of LSDPC's multifamily apartments in Lagos during usage.

3. To examine variations in dwelling densities of LSDPC's multifamily apartments in Lagos.
4. To investigate the effect of occupants' household characteristics on dwelling density in LSDPC's multifamily apartments in the study area.

1.3 RESEARCH QUESTIONS

1. How were the existing LSDPC's multifamily apartments designed to be occupied?
2. Are LSDPC's multifamily apartments in the study area under-occupied, over-occupied or occupied as programmed in the design?
3. To what extent does dwelling density vary across various design models of LSDPC's multifamily apartments in the study area?
4. To what extent do occupants' household characteristics affect dwelling densities in LSDPC's multifamily apartments within the study area?

1.4 THEORETICAL FRAMEWORK

While a comprehensive theory that is based on clear definitions of post-occupancy evaluation does not yet exist, different theoretical points of view have been canvassed by a number of scholars (Preiser & Pugh, 1986; Preiser & Nasar, 2008). Smith (2010) explains that the term "theory" has varied interpretations, depending on the perspective from which it is viewed. Evaluation theories are generally regarded as models. Smith described models as conceptual frameworks that articulate viewpoints on several underlying theories regarding fundamental issues.

Evaluation theories are expected to furnish evaluators with the platform for making multiple decisions about how a programme is supposed to work, ascertain whether it did work, and why it did or did not work as intended (Cole, 1999). Also, Zimrin and Wener (1985) asserted that there is no formula for a "best" evaluation. Instead evaluations must be assessed in terms of their own goals. This view justifies the argument for a consideration of setting and culture in looking at evaluation theories appropriate to Nigerian public housing domain research. Although the key aim of theory-driven post-occupancy evaluation remains the same, the focus and form can vary in different contexts and for different stakeholders responsible for public housing delivery in Nigeria.

The theoretical framework adopted in this research attempts to integrate the major theoretical and disciplinary approaches. Three major theoretical approaches are considered relevant to this study. These are: (1) programme evaluation and accountability theory (2) Environment-behaviour theory and (3) building performance evaluation (BPE) theoretical approaches. Though the three approaches are interdisciplinary in nature, they are not mutually exclusive and should be seen as complementary.

1.4.1 Programme evaluation and accountability theory

In this approach, programme evaluation is seen as occasioned by the need and desire for accountability. The importance of this is advocated more particularly for programmes supported by government agencies. Evaluation models are primarily derived from social inquiry. Generally public housing is regarded as a social programme in the same way as education, health, and crime (Stake, 1995; Rossi, Lipsey & Freeman, 2004). One distinct characteristic of social programmes is that they are usually associated with programme evaluation theory, which explains how the programme activities and actions will lead to intended outcomes (Weiss, 1997; Patton, 2002; Stame, 2004; Rossi, Lipsey, & Freeman, 2004). The problem of dwelling density addressed in the current research poses a social concern to policy makers and the urban community. Therefore theories that will improve the effectiveness of housing as a social intervention programme are considered appropriate for this research. In its broadest sense, accountability can be seen from three dimensions: goal accountability, process accountability and outcome accountability (Christie, 2003a; 2003b; Alkin &

Christie, 2004; Alkin & Christie, 2008). Goal accountability examines if reasonable and appropriate goals have been established. Process accountability states whether reasonable and appropriate procedures for achieving those goals have been established and implemented. Outcome accountability evaluates how established goals have been achieved. Many evaluation writings are replete with these three accountability types.

Some authors identify two methods that can be applied in the evaluation of social programmes. The first is formative evaluation, which is also referred to as process or progress evaluation. The second method is summative evaluation. Some scholars also call it outcome or impact evaluation (Purdon, Lessof, Woodfield and Bryson (2001); Patton, 2002; Bennett, 2003; Davies, 2003). Table 1.1 illustrates that formative evaluation helps improve a programme, while summative evaluation helps to prove whether the programme worked in the way it was planned.

The formative evaluation focuses on how programme implementation relates to specific objectives established at the programme development or initiation phase, including issues regarding stakeholders' satisfaction with the services provided. Most studies on public housing dealing with satisfaction adopt this approach because they seek to answer questions on how, why and under what conditions housing projects work or fail to work.

The summative evaluation, on the other hand, evaluates the effectiveness of a programme after it has been executed or implemented. It focuses on the relationship between the goals of a programme and its outcomes. This approach provides a way to measure how a programme works (that is, its effectiveness), and proffer suggestions on ways to improve it. The application of this method was evident in a number of studies that evaluated outcomes of public housing in Nigeria (Awotona, 1987; Bana, 1991; Mustapha, 2002; Obeng-Odom, 2009).

Table 1.1: Differences between Formative and summative Evaluations

Formative Evaluation - Improve	**Summative Evaluation - Prove**
Provides information that helps improve programmes. Generates periodic reports. Information can be shared quickly.	Generates information that can be used to demonstrate the results of the programme to funders and the community.
Focuses on programme activities, outputs and short-term outcomes for monitoring progress and making mid-course corrections when needed.	Focuses most on intermediate-term outcomes and impact. Although data is collected throughout the programme, the purpose is to determine the value and worth of a programme based on results.
Helpful in bringing suggestions for improvements.	Helpful in describing the quality and effectiveness of the programme by documenting its impact on participants and the community.

Both formative and summative evaluation options are thus applicable to public housing programmes or projects. In both cases, a major issue of concern is how far the programme has succeeded or failed to meet the goals and objectives enunciated at the beginning. They also examine the factors that account for whichever outcome and identify ways through which the process and outcomes can be improved.

In the current study, the LSDPC's multifamily housing projects under investigation have been completed and put into use for more than five years. This means that the housing units can best be evaluated by examining the outcomes in relation to the goals of the multifamily housing programmes. The specific problem of dwelling density introduces the user dimension into the research. Therefore this study is based on outcome accountability cum summative evaluation theoretical approach. The adoption of these approaches in such an in-depth investigation helps to evaluate the extent to which the housing units had achieved or failed to achieve their intended occupancy outcomes. Most of the previous evaluative researches on public housing in Nigeria were done without reference to this type of underlying programme theories which examine how far the objectives of the programme have been met. This omission places some limitations on the validity of findings and conclusions from such studies as Olatubara & Fatoye (2007), and Jiboye (2010).

The results of accountability and summative evaluations are often used in the improvement of institutional performance and other governmental policy making. Their main focus is on the specification of objectives and measurement of outcomes. Further studies have identified five types of social programme evaluation models that can be adopted in different types of research. These are: goal-based evaluation, goal-free, transaction, connoisseurship, and utilization-focused evaluation models (Patton, 2002).

The goals-based evaluation is concerned about measuring the specific objectives of a programme and comparing them with the outcomes of a social programme. Some researchers have highlighted the importance of goal-based evaluation (Weiss, 1997; Rossi, Lipsey, & Freeman, 2004). According to them, an evaluator needs to be acquainted with clearly stated measurable objectives of a programme before commencing any evaluation research. A study of public housing in Egypt by Taher (2001) and another study in Ghana by Obeng-Odom (2009) are cited as examples of goal-based evaluations.

In a goals-free situation, the evaluator does not possess any means of having a prior idea of programme goals ahead of the evaluation. Instead he is only confronted with outcomes and effects that are observable and documentable. These are then compared with the actual needs of the participants or beneficiaries (Patton, 2002; Scriven, 2001). This type of evaluative model is more useful on inductive research design and is generally not very common in public housing because evaluation of public housing often requires the evaluator to be conversant with the goals of the schemes prior to the study.

1.4.2 Environment-Behaviour Theory

Researchers such as Rapoport (1991) and Day (2000) explained environment-behaviour theory in terms of the relationship between people and place and the mechanisms that link them. It relies on empirical inductive studies that make inquires regarding what planning and design professionals ought to know about people they are designing for and how designed environments affect people. This theoretical perspective relies on a conceptualization of a building that emphasizes the capacity of its physical design to afford opportunities for human liveability and behaviour. The spatial configuration is primarily regarded as providing the physical context for liveability. However, exploiting the opportunities offered by the spatial configuration of buildings are largely a function of the biological nature of people, values, norms and lifestyle (Moustafa, 2009).

Like any other species, human beings are constantly adjusting to the dynamics of the environment. The interactive nature of the relationships between people and their surroundings is usefully represented by environment-behaviour theoretical approach. Specifically, this approach deals with the impact of the built environment on human actions and vice versa.

1.4.3 Building performance Evaluation (BPE)

This framework focuses mainly on evaluating the environmental aspects of building performance. Less emphasis is placed on the social aspects. Lancaster (2008) remarks that it does not require that the building should be occupied before it can be evaluated. Some other authors, however, contend that the Building performance Evaluation (BPE) framework emphasizes an evaluation stance throughout a building’s life-cycle (Preiser and Vischer 2005; Preiser & Nasar, 2008). In the BPE framework, the delivery of a building and its life-cycle are defined from the perspectives of all parties who are involved with the building. This framework draws on a model that adopts a comprehensive approach to building performance evaluation, applicable to all facility types. At the centre of the model are quantitative and qualitative building performance criteria that indicate the expected outcome or performance.

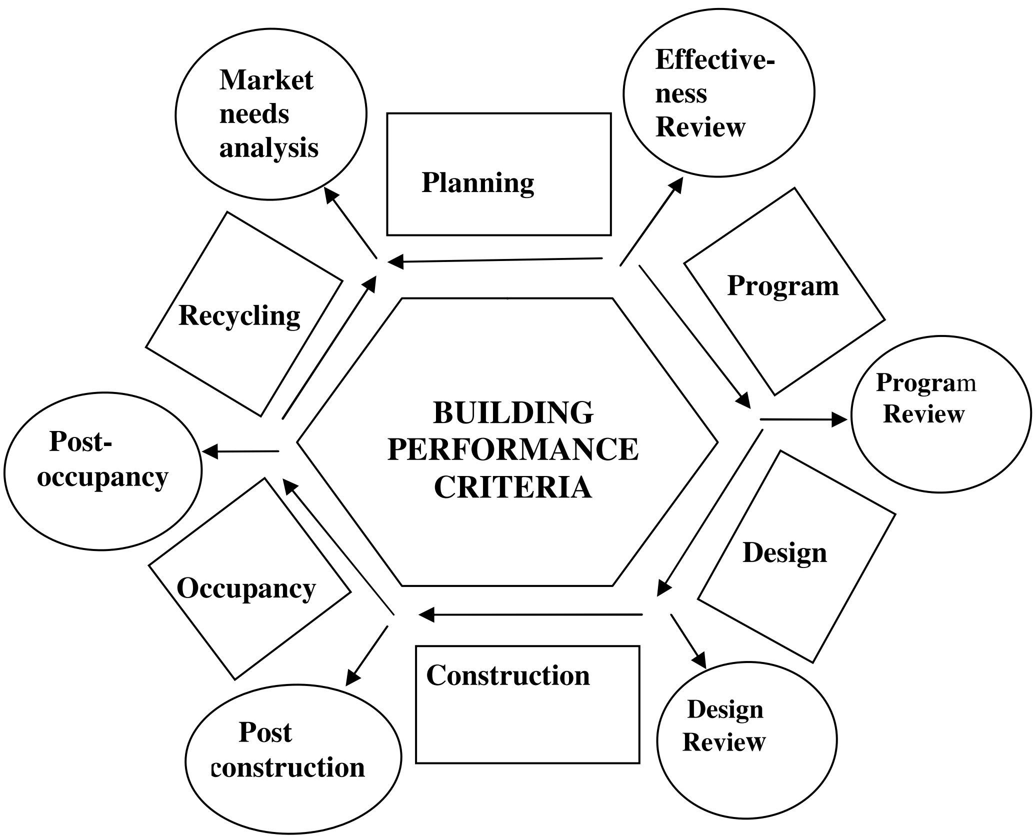


Figure 1.3: Building Performance Evaluation Process Model. **Source:** Preiser & Nasar 2008, P.90

It shows the six sub-phases involved in the life cycle of a building: (a) visioning, strategic planning (b) programming (c) design (d) construction (e) occupancy, and (f) re-cycling or adaptive re-use, (see figure 1.3 and Table 1.1). Each of the six sub-phases has internal review and feedback loop that contributes in validating performance standards that may already exist or that have to be developed for a given building type. Figure 1.3 and Table 1.1 provide justification for the application of POE instrument to the present research since the focus is on programming, design, and occupancy phases of LSDPC's multifamily housing projects.

In the case of building design, goals and performance criteria are usually documented in the functional programme or brief (Preiser 2005). The evaluation of a design has to be according to how it is used rather than how it appears to the designer. BPE at design phase is a way of systematically ensuring that the building quality is protected later during occupancy and operation. The concept of building performance is the major philosophical and theoretical foundation of POE.

Post Occupancy Evaluation (POE) = Statement of Building Performance

A POE is based on the assumption that a building is designed and built to support and enhance the performance of the activities and goals of its occupants. In the act of evaluation, performance measures are compared with appropriate performance criteria. A conclusion is reached on how successful the performance of the specific aspect of a building under consideration has been. The performance concept provides a basis for comparing explicitly stated performance criteria for buildings with the actual performance as measured or perceived by building occupants and evaluators. Among the very early works on building performance was an evaluation of the school construction systems development project in California (Preiser, 2005).

The most important elements of performance that are measured, evaluated and used in POEs to improve buildings are in the domains of technical, functional and behavioural. Holland (2006) identifies a number of qualities of a building that a POE can assess and contends that the importance attached to each is context dependent:

1. Space – the physical capacity and how it fulfils the user's demands.
2. Operations – the usability, manageability and flexibility of the building.

3. Environment – indoor conditions (thermal, lighting, etc) and their impacts.
4. Users – opinions of the occupants, usually gathered by questionnaire.
5. Image – both the building's styling and the signage for route finding
6. Cost – perceived value for money is often the number one priority

The framework for performance evaluation research is based on establishing a connection between the evaluation of buildings and three aspects: measurement technology, data bases and information systems, and the development of performance criteria for buildings (Preiser, 2005).

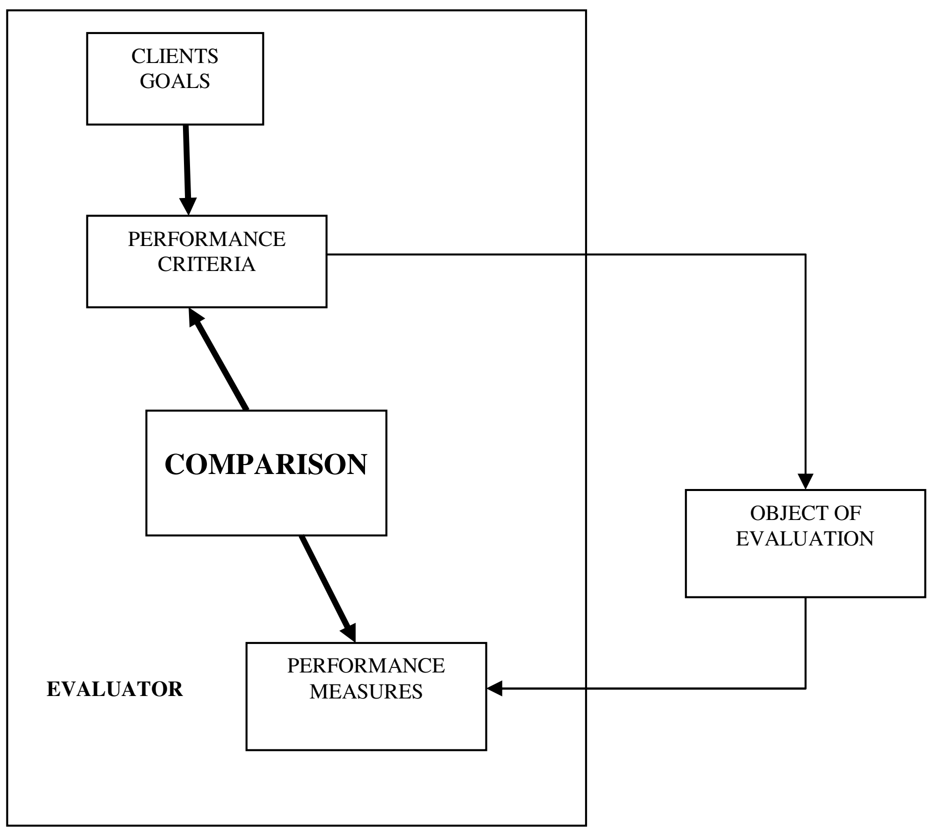


Figure 1.4: Performance Evaluation Feedback System
Source: Assessing Building Performance: Preiser Vischer, 2005:
Performance Based Building: Conceptual Framework, Final Report, 2005.

Table 1.2: Purposes and Methodology of Building Evaluation Instruments
Source: Mastor & Ibrahim (2010) pp.3-4

Instruments	Purposes	Methodology
Post Occupancy Evaluation (POE)	• Fine tuning new buildings • Improving design for future building • Renovating existing building • Identify opportunities to save time and money without reducing quality •Produce data that will aid in recommendation for proper maintenance & operations. • Reduce repetition of problems by providing lesson learned	• Identify purposes of POE • Identify building to be evaluated • Indicate focus of performance measurement • Select tools as appropriate to intensity of evaluation • Select team • Carry out building inspection • Report findings • Identify issues for action
Situational Analysis	• To clarify the situation in order to describe and suggest responses to complex problems. • The documentation and presentation of findings to stakeholders, especially policy makers • To identify strategic opportunities to improve current states of living.	• Gathering the data • Analyzing and interpreting the data • Identifying community needs and assets • Selecting critical community need and concerns • Communicating the results.
Operation & Maintenance Evaluation	• Pin-pointing areas where there are short-falls in the service • Highlighting the practices to be introduced or requiring change • Gaining involvement in setting and monitoring operation and maintenance targets • Developing an environment for continuous improvement in quality of the operation and maintenance service	• Formulate strategy for the operation and maintenance. • Operationalize the strategy • Develop actions plans • Implement plans • Periodic review of performance and strategies
Complaint Management System	• Increase customer satisfaction • Learn from mistake in order to improve the service • Highlight service gaps that need to be bridged and procedures and policies that need to be changed • Reduce operation and maintenance costs.	• Receive complaint • Verify ownership or jurisdiction • Determine follow up needed • Initiate investigation • Develop or renew resolution • Resolve complaint with occupants • Determine if corrective action is required • Verification process
Value Management Analysis	• To gain maximum value for money for any work on the maintenance or rehabilitation of buildings • To achieve time savings when procuring the work in order to allow the buildings to continue to function efficiently and maintain maximum benefits for the users • To ensure high quality workmanship is achieved at all times • To ascertain how financial benefits-in the case of property particularly-may be gained through possible restructuring.	• Identification and testing of a project rationale from the perspective of stakeholders' positions • Identification and ranking of primary and secondary functions and their associated cost and worth relationship • Generation of value improvement options through innovation and alternate means of achieving the required function • Sorting and prioritizing value improvement options to identify viable alternatives. • Identification of actions/ strategy required to achieve value analysis outcomes to provide ongoing management framework for project progression • Analysis and reporting.

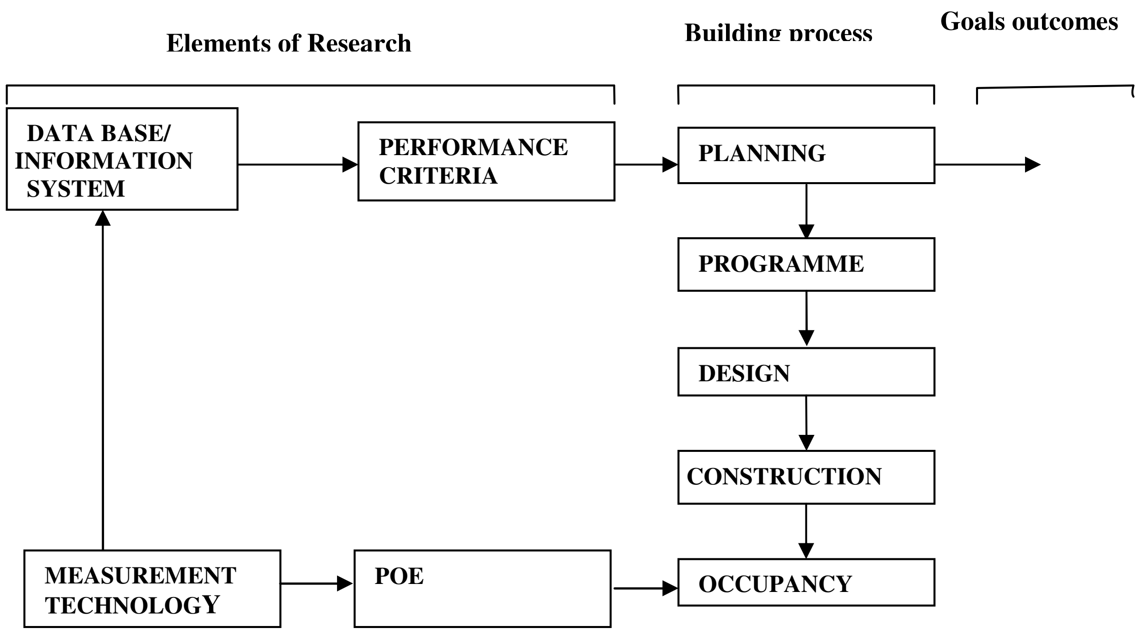


Figure 1.5: The Performance Evaluation Research Framework
Source: Assessing Building Performance: Preiser Vischer, 2005

Measurement technology refers to techniques and technological tools that are employed to support data collection and analysis of POEs. Among such tools are interviews, questionnaire surveys, direct observation, mechanical recording of human behaviour, measurement of light and acoustic levels, video recording, mapping of behaviour and still photography.

Data bases and information systems for a given agency and/or building type can be of a general nature describing the design intent in the form of programmatic statements. Specific performance criteria contained in such programmes for a given facility provide an indication of how the design was expected to meet these criteria. Performance measures collected from POEs are generally compared with specific performance criteria derived from data bases, which are usually in the form of technical manuals and design guides.

The performance concept and framework for systematic evaluation of built facilities is a methodological approach towards achieving higher quality in buildings, accountability in the building process and ultimately, enhanced building utilization and user satisfaction. The performance concept advocated for use in POEs hinges on explicitly stating the performance requirements that are expected from a building, designing the building accordingly, and eventually comparing the actual performance of the building with that which was initially stated in the building programme. In addition to POE, researchers have established four other instruments for building evaluation and feedback. Mastor and Ibrahim (2010) identifies them as: 1) situational analysis, 2) operation and maintenance evaluation, 3) value management analysis, and 4) complaint management system.

The purposes and methodology of these instruments are summarized and compared in Table 1.2 (Mastor and Ibrahim, 2010). Each of these instruments covers various aspects of six indicators that can be used in assessing building performance. As shown in Table 1.3, these include functional, technical, economic, environmental, social, and process performance indicators.

The performance indicators for each of the five instruments necessary for building evaluation and feedback have also been established by researchers. A further description of the six performance indicators was provided by (Le Roux, Kato, & Tsunekawa 2005: p. 44).

Table 1.3: Performance assessment indicators

Instruments	Functional	Technical	Economic	Environmental	Social	Process
Post-Occupancy Evaluation	X	X	X	X	X	X
Situational Analysis					X	X
Operation & Maintenance Evaluation		X				X
Complaint Management System	X	X				X
Value Management analysis			X			X

Source: Mastor and Ibrahim, (2010) p.7

Functional Performance: *Functional performance of a building describes and assesses how well use-specific activities and processes can be performed in the building. Criteria include suitability of the surface and space program for planned use, accessibility and barrier-free design, adaptability to changing user requirements and uses, etc. Functional performance is closely related to the needs of the building users and others such as visitors, and the public community.*

Technical Performance: *Technical performance describes structural, physical and other technical features and characteristics. Criteria included suitability for the planned service life, load capacity, maintenance and revitalization capability, structural resistance to fire, control of noise transmission, heat insulation of building shell, etc.*

Economic Performance

a) Real Estate Performance: Real estate performance is the earnings trend and value of a real estate property. It is especially useful for the decision-making processes of investors and property owners. A performance requirement is likely to be increased revenue and value.

b) Cost Performance: Cost and financial performance describes financial expenditures involved in planning, construction, operation, maintenance, demolition or waste disposal at a particular time or within the life cycle of a facility. The current criteria have moved towards LCC (Life Cycle Costing) methods. Cost performance is used by managers, planers, building users and facility managers to monitor and control costs. Investors and property owners especially consider non- allocatable costs

.

Environmental Performance: *Environmental performance describes and assesses the building's features and characteristics relevant to its impact on the environment. The effects on both the local and global environment are considered. Energy and material flows and resulting effects on the environment are recorded. The use and conversion of areas are also considered in part. Low resource utilization and/or reducing effects on the environment contribute to improving environmental performance.*

Social Performance: *The description and assessment of social performance is based on criteria that indicate the health, comfort and safety of users, visitors, residents and neighbours of the building. In addition, the building's cultural value is also usually assessed. Codes, regulations and standards provide a base for these performance requirements, but clients often choose to demand more.*

Process Performance in Strategic Planning, Design, Construction, Operation, Maintenance, Management and Use*: The overall building performance is influenced by the quality of processes involving planning, construction, use and facility management. It is thus suggested that quality of planning, construction on site* *management and building related services be described and assessed separately as process performance.. The overall building performance is influenced by the quality of processes involving planning, construction, use and facility management. It is thus suggested that quality of planning, construction on site management and building related services be described and assessed separately as process performance.*

Table 1.3 further explains the relationship among the six indicators. Thus it can be observed that all the performance indicators are useful for a POE study. However, the present POE study will utilize only the functional and social indicators.

In conclusion, this section revealed that several approaches can be adopted to establish the theoretical framework, depending on context. The present study is essentially a social programme evaluation, since it focuses on dwelling density and crowding in LSDPC's multifamily apartments. Formative and goal-free techniques are not considered relevant to this study, since they are more related to user satisfaction issues. On the other hand, goal-based, outcome, and summative approaches are relevant to this study. Building Performance Evaluation Process Model and Performance Evaluation Feedback System are therefore adopted. Both of them provide the theoretical framework for assessing the dwelling density and crowding outcomes in terms of their own goals.

1.5 CONCEPTUAL FRAMEWORK

The present empirical study is based on the concepts enunciated in various domains of the literature on post-occupancy evaluation, dwelling density and crowding. The definition of crowding employed in this study conforms to the format used in statistical reporting and for administrative purposes, based on density measures. Crowding is hence measured by using an objective normative rather than a subjective perceptual approach. This definition of crowding expresses a judgment about density levels by setting standards by which crowding level corresponding to a particular density can be declared acceptable or unacceptable. Dwelling density is also used as an objective, quantitative, and, neutral term that is closely related to crowding. Dwelling density refers to the number of people in any given space in an apartment's interior. The term has no positive or negative connotations, unlike crowding. The issue in focus here is sleeping arrangements, reflecting the number of persons who may sleep in a unit of space, based on widely accepted norms and standards. The exclusion of people's perceptions of crowding from this study suggests the existence of a point of convergence in the definitions and meanings ascribed to crowding and dwelling density. This justifies why the two terms are used interchangeably in the conceptual model and other parts of this work.

While the study recognizes the relevance of the six sub-phases in the life-cycle of a building, its focus is on design phase and occupancy phase. Emphasis is on validating the goals and performance criteria relating to density, occupancy, crowding and overcrowding in LSDPC's multifamily prototype units, using established internationally accepted measurement standards such as the American Crowding Index (ACI), Canadian National Occupancy Standard (CNOS), the Equivalized Crowding Index (ECI), Parker Morris Space Standards and Statistics New Zealand. The need for a standard of comparison is perhaps the most fundamental requirement in conducting any evaluation (Cole, 1999).

Although these norms are largely based on western concepts, the original basis for reaching the conclusions is applicable to a developing nation like Nigeria, in a number of ways. First, the density of persons within a building is a rough measure of adequacy of accommodation available. Expressing this measure in terms of persons per habitable rooms gives an indication of overcrowding or underutilization. These figures indicate whether living conditions are comfortable or not, depending on local benchmarks. Second, the western norms considered the number of persons in a house and the sleeping arrangements. Third, it provides a guide for protection of privacy of residents. Fourth, it provides data for the provision of amenities like shops, schools, open spaces, etc. which depend directly on the number of people living in the area.

In all of these standards, the usual method for measuring dwelling density and crowding at household level is to determine the number of persons per room and the space availability in terms of floor space per person. Two factors used to calculate persons per room are: a) the number of household members and b) the size of housing unit (Burstrom, Diderichson, & Smedman, 1999; Kumie, & Berhane, 2002; Obateru, 2005). For the purpose of estimating housing space needs, social factors such as the types of household as well as other household characteristics were considered. These were conceptualized through demographic data, representing the objective facts of household situation. Household characteristics and demographic data employed as social factors in this research include: age, gender, income level, marital status, education, occupation, tenure and ethnicity. Apart from person-per-habitable-room measure, this study measured the average number of persons per bedroom, after controlling for what qualifies as bedroom. A recommendation by the United Nations that a room should be at least 4.0 square metres, to contain an adult's bed was not followed in this study. Also the fact that a space is used for sleeping purpose does not qualify it to be classified as a bedroom. Instead, information on bedroom identity was obtained from designations in the designs of housing unit prototypes selected for this research.

The conceptual model adopted in the present study was based on both The Gap Analysis model developed by Parasuraman, Zeithaml & Berry (1985) and the discrepancy evaluation paradigm enunciated by Preiser & Vischer, (2005.

1.5.1 The GAP Model.

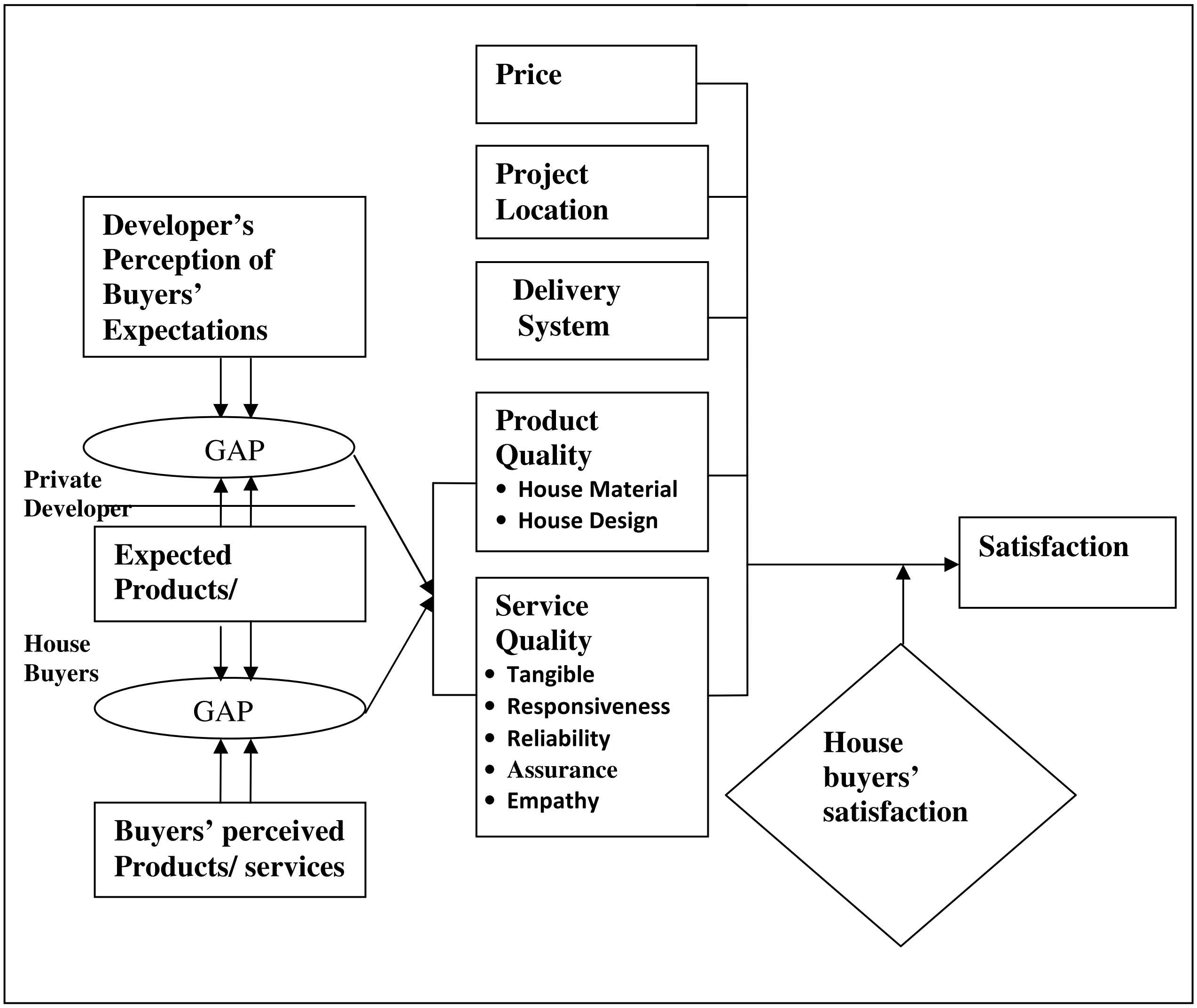


Figure 1.6: **Conceptual Framework on House buyers' satisfaction in Housing Projects**
Source: Mustafa (2009) p.4

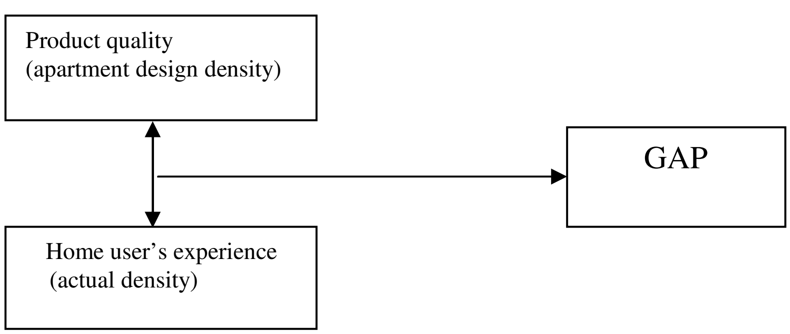


Figure 1.7: Modified GAP model, applied to the present study
Source: Mustafa (2009) p.4

The GAP analysis is used as a tool to minimize the gap between what is produced and the reality of how it is used – see figure 1.6 (Parasuraman, Zeithaml and Berry 1985). Firms that produce tangible goods find this conceptual approach important because it addresses gaps that exist between what the firm offers and customers' experiences. Consequently measurement of such a gap is the first step in attempting to deliver products that users will like. The model is considered useful in this study since a completed residential building is regarded as a product. The argument is that buildings as products should be able to fit the purpose for which they were designed. The GAP model was modified (figure 1.7), since an apartment has a lot of unique characteristics that are different from consumer goods. POE is about the determination of whether or not design decisions made by the architect are delivering the performance needed by those who use the building.

1.5.2: Discrepancy Evaluation Paradigm

In this study, the variables were extracted and modified from the American Crowding Index (ACI), Canadian National Occupancy Standard (CNOS), the Equivalized Crowding Index (ECI), Parker Morris Space Standards and Statistics New Zealand. The threshold values for design density at programmatic stage were derived from the architectural drawings of the prototype housing units, by applying these normative standards described in the literature. Thus the design density is an estimate of the number of persons expected to reside in the apartment.

The floor area of the habitable rooms in the prototype designs were physically measured and computed, to provide the available amount of floor space (in square metres) per person. The inverse of this measure provided the number of occupants per square metre. Similarly, this same principle was applied to obtain the number of people per room. These two computations provided a basis for quantitative assessment of the level of space deficit and room deficit. Based on the modifications to the American Crowding Index (ACI), Canadian National Occupancy Standard (CNOS), the

Equivalized Crowding Index (ECI), Parker Morris Space Standards and Statistics New Zealand, the following guidelines were adopted in this research: no account is taken of a child that is under the age of one year; a child that is aged one year and above, but less than eighteen years is reckoned as one-half of an adult; every adult in a couple relationship is treated as one-half, (that is, both husband and wife are taken as one unit); every other occupant whose age is eighteen years, or above constitutes one unit.

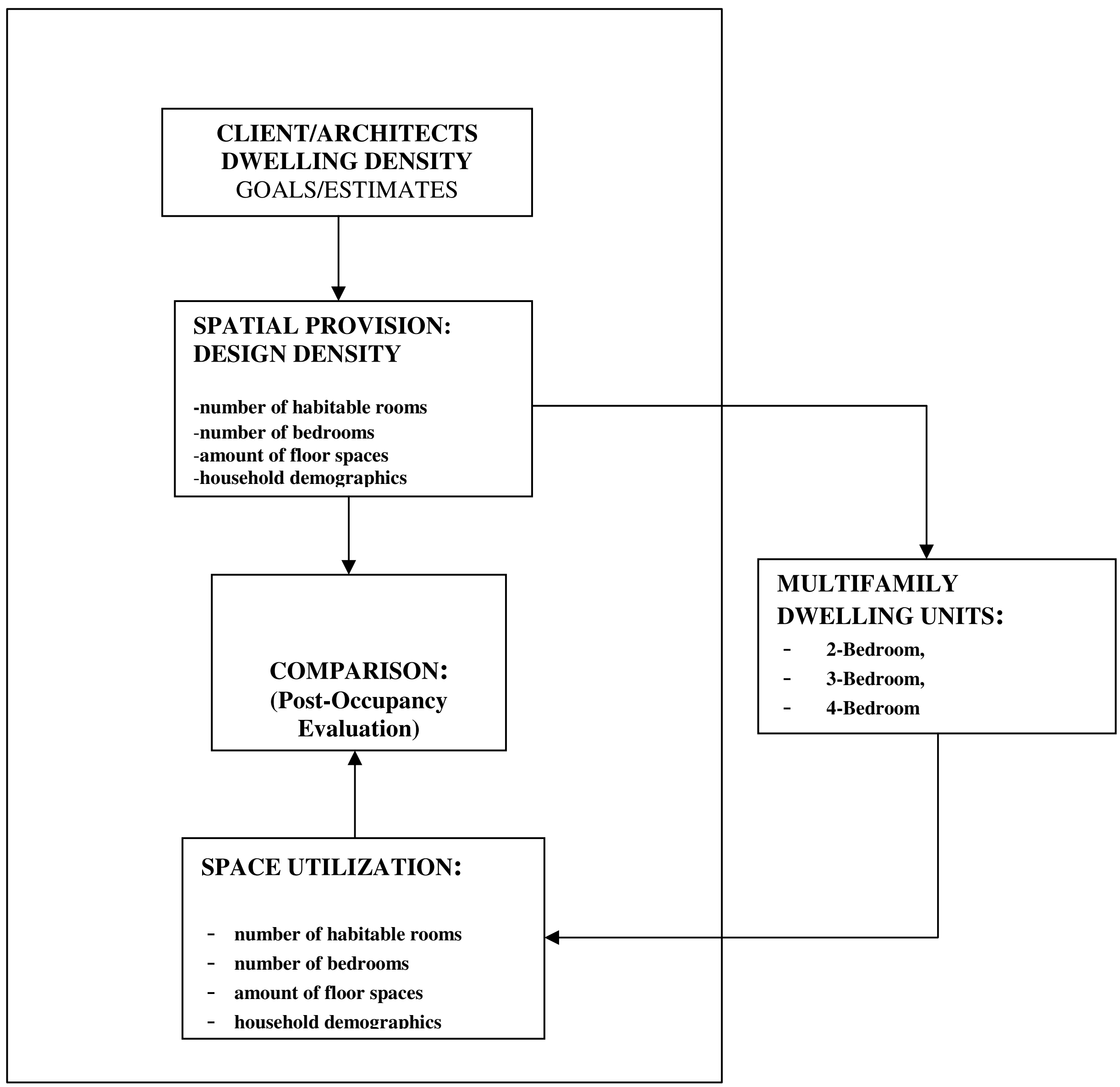


Figure 1.8: Conceptual Model for the Present Study
Source: Preiser Vischer, 2005

The rated capacity concept has been extensively used in determining usability of designed spaces in other sectors like prisons, educational institutions, places of worship, theatres, and so on. The United States Department of Justice (1997) defines rated capacity as an institution's design or operating capacity. In other words, it represents the actual number of occupants for whom each occupied space, floor or building is designed. The United States Department of Justice (1997) specifically explained this concept as it applies to the Federal Bureau of Prisons' facilities. Gaes, (1994), in an earlier research on prison crowding in the United States applied rated capacity as the baseline for the statistical measurement of prison crowding for comparison of results across zones.

Seversky (2009), in an assessment of school building capacity for Central School District, Valatie, New York capital construction projects undertaken by public schools used the term original capacity in place of rated capacity. According to Seversky (2009), original capacity represents the total number of pupils the original building, or total complex in the case of additions, was designed to accommodate. This number is the operational capacity of the building or complex when it was constructed.

Based on these postulations, design capacity is taken in this study as the maximum output/rate of LSDPC's multifamily apartments under ideal conditions. A measure of the adequacy of accommodation available in these multifamily apartments is gained by comparing the rated capacity with density of persons within the dwelling unit. The density of persons is usually expressed in terms of the number of persons per bedroom or number of persons per habitable room. This measure is important because it is interpreted as an indication of over-crowding or under utilization.

The rated capacity concept was articulated to fit into the discrepancy paradigm, which serves as a conceptual model this study and provide a basis for comparison as follows:

$$\left\{\begin{array}{c}\textit{Post-occupancy}\\ \textit{Dwelling density}\end{array}\right\} = \left\{\begin{array}{c}\textit{Total number of adult equivalent}\\ \textit{occupants of an apartment}\end{array}\right\} \div \left\{\begin{array}{c}\textit{maximum design}\\ \textit{or rated capacity}\end{array}\right\} \quad \textit{.... (1}$$

Or:

$$\left\{\begin{array}{c}\textit{Post-occupancy}\\ \textit{Dwelling density}\end{array}\right\} = \left\{\begin{array}{c}\textit{Total number of adult equivalent}\\ \textit{occupants of an apartment}\end{array}\right\} - \left\{\begin{array}{c}\textit{maximum design}\\ \textit{or rated capacity}\end{array}\right\} \quad \textit{....(2)}$$

For equation (1): A value of 1.0 implies that the apartment is occupied as designed. Similarly a value of less than 1.0 means that the apartment is under-occupied, while more than 1.0 suggests that the apartment is over-occupied or over-crowded.

For equation (2): A value of zero implies that the apartment is occupied as designed. Similarly a value of less than zero means that the apartment is under-occupied, while higher than zero suggests that the apartment is over-occupied.

These comparisons show the difference between what is desired and what actually happens in terms of dwelling density of LSDPC's multifamily apartments. Cole (1999) calls this difference discrepancy.

In this study, the conceptual model was operationalized as the comparison between how LSDPC's multifamily dwelling units are expected to be occupied, and how they were actually occupied, based on observations carried out through the evaluation process – see figure 1.8. That is to say: the comparison between the dwelling density that the designer intended for LSDPC's multifamily apartments and that which the apartment users were experiencing in it.

1.6 SIGNIFICANCE OF STUDY

Raising the quality of new and older housing stock in Lagos is important for the government. Assuming that public housing services are still needed in Lagos, the question is whether they can be planned differently in order to improve their effectiveness and efficiency as public investment. This study will bring to the fore, how the actual use of space in LSDPC's multifamily apartments during occupancy meets (or does not meet) the objectives of the original brief or program (either implicitly or explicitly stated). The study represents an opportunity to concisely supply necessary information needed to occupy LSDPC's multifamily apartments satisfactorily. This implies an improvement of design databases, standards, criteria, and guidance literature.

Post-occupancy evaluations carried out on completed public residential buildings are of interest primarily in some aspects of design morphology and process. Lancaster (2008) describes POEs as the quality control in the building and design process. He adds that POE studies are often designed to assess both what is not working well, and also what is working well for the occupants. The present study examines dwelling density, not from a single perspective but, several perspectives.

This study also examines many of the known measures of dwelling density, the traditional measures and recently introduced models. Applying all these measures to investigate the research issues is a crucial step in understanding occupancy and crowding problems among residents of LSDPC's multifamily apartments in Lagos, Nigeria. The study therefore affords government the opportunity to assess the implications of its decisions and actions on occupancy standards in apartments designed to serve as prototypes of public housing in Lagos. The results of the present POE study will identify the extent to which the design intent for occupancy of

LSDPC's multifamily housing units has been met. It will lead to informed decision-making and better understanding of consequences of design, and thus will significantly contribute to better quality buildings. By extension this will also create awareness for accountability for dwelling density performance of buildings by design professionals and owners.

The study advances a greater understanding of the concepts of dwelling density and crowding in terms of design output and occupancy of public housing multifamily apartments. Providing basic empirical data for dwelling density and crowding in Lagos can make an important contribution to the overall planning process and the management of the municipal affairs and urban growth. POEs of LSDPC's multifamily residential facilities will contribute to raising an awareness regarding the importance of POEs in public housing estates. This will help government in the proper monitoring, evaluation and control of overcrowding and its deleterious consequences. Through this study, architects, engineers, facility managers and other stakeholders in the built-environment will gain a greater understanding of the spatial arrangements and design of multifamily apartments. Studying contemporary living patterns in LSDPC estates can help the agency to better its understanding of on-going socio-demographic changes. This study sensitizes LSDPC on the need to keep itself informed about the demographic data of the occupants of its houses. This information is valuable in providing a check against possible over-crowding or under-crowding. By understanding the interactions that take place in LSDPC'S multifamily apartments, professionals in the design industry can also be better positioned to deliver housing units that match users' spatial needs. This will ultimately have a positive influence on the creation of humane and appropriate interior environments for occupants of LSDPC's multifamily apartments.

Evaluating housing projects is an essential part of the design process in the built environment. It is a way of evaluating the success of particular housing projects, using the experience of those who dwell in such buildings. When houses are constructed the developer's intention is to meet the need of sheltering the occupants. The structuring of houses may, however, become limited and lack the ability to meet the spatial needs of the occupants, thus creating imbalances in the way the house is used. Understanding household dwelling density is thus important as it expands knowledge on how the house functions, and the relationship between household members and the home spaces. A body of knowledge relating to house types and use of space provides a basis for comprehending spatial qualities. By analyzing housing types and uses of space, an opportunity is provided for linking research knowledge, design, and occupancy which are considered fundamental in Architecture and Built Environment Analysis. The present research which focuses in this area is essential because it provides knowledge useful for the improvement of living conditions.

The data from this study will be useful at the preliminary design stage of fact finding, information gathering, briefing and programming. A principal purpose and benefit of POE is improving the quality of building briefs and design decisions, thereby promoting understanding of all interest groups. Lessons learned can influence design criteria for future buildings, as well as provide information about buildings in use to the industry. This is especially relevant to the public sector which designs buildings that are constructed on a repetitive basis. The concept of learning from successes and failures is fundamental to the practice and advancement of architecture and engineering professions. Communications among designers about lessons learnt from past projects has always led to a corresponding improvement in design. In the case of LSDPC projects, the feed-back and feed-forward regarding the effects multifamily apartments have on users and occupants can assist the corporation's future designers in addressing users' needs.

Though a standard approach to POE is yet to be developed for housing in Nigeria, this study shows that POE can become the preferred means of assessment of multifamily apartment buildings executed by public housing agencies in Nigeria like LSDPC. In this thesis, the connection is made that POE stands out as the most appropriate tool to investigate how dwelling density can be quantified so that both the government and prospective home owners can be motivated to collectively include it as a key performance index for improving future designs. Therefore this thesis provides substantial information that can assist house designers (particularly interior layout designers) to arrange spaces more effectively. In addition, it can be used to infer the efficiency of the building design and building usage type. It is a good measure of how the building floor spaces are utilized

The study demonstrates that a portfolio of household characteristics could be beneficial as a tool for designing efficient interior spaces in the future.

For researchers and scholars, this study is significant in regard to answering questions about whether or not, and to what extent, meaningful successes have resulted from existing multifamily housing prototypes in Lagos, and elsewhere. More practically, the study will be able to provide a basis for a bench mark that will be useful in evaluating housing unit designs that aim to improve spatial qualities. It will provide the much needed explicit data on dwelling density, as an aspect of housing consumption, to the housing research community.

This research will be of long term benefit to the entire building and construction industry in that it will provide data that could improve project briefings, thus promoting the functionality and cost effectiveness of multifamily buildings. This study falls within the subject of Built Environment Analysis, its discipline being derived from the specific aspect known as Building Function and Quality Analysis. The academic field of Built Environment Analysis deals with relations between people, society and the built environment with the aim of knowledge acquisition to aid physical planning and design of the built environment (Nguluma, 2003)

1.7 OPERATIONAL DEFINITION OF TERMS

Crowding: There is no one international standard definition of crowding. This study defines household crowding as a measure of deficit or surplus arising from the capacity of a dwelling's internal spaces to meet the sleeping needs of the household. In addition to comparing the number of usual residents with the number of rooms or bedrooms, this definition takes into account age, sex and household composition. The issue in focus here is sleeping arrangements, reflecting the number of persons who may sleep in a unit of space, based on widely accepted norms and standards. Crowding as used in this study is based on objective statistical measures of density and does not incorporate people's perceptions of crowding. This definition of crowding expresses a judgment about density levels. That is, it sets a standard by which crowding level corresponding to a particular density can be declared acceptable or unacceptable.

Overcrowding is used as a normative standard to quantify the prevalence of crowding. Over-crowding occurs when the size of a household is larger than the capacity of the dwelling to provide adequate accommodation. That is, over-crowding exists when the number of people using a given facility exceeds the number for which it was designed (Akinmoladun and Oluwoye 2007). Apartments in this category are described as over-occupied. This is distinguishable from congestion, which reflects the simultaneous demands for the use of available space. On the other hand, under-crowding or under-occupancy occurs when the size of a household is less than the rated capacity of the dwelling. This study follows three commonly employed indices: the American Crowding Index (ACI), Canadian National Occupancy Standard (CNOS), and Equivalized Crowding Index (ECI).

Dwelling density: There is no consistency in the definition of density across or within countries, even between municipalities. In this study, dwelling density is interpreted to mean “living density” or “density in the home” (Churchman, 1999). It is used as an objective, quantitative, and, neutral term that represents the relationship between the physical internal space of an apartment and the number of people who occupy that apartment. It is neutral in the sense that a dwelling density result does not immediately indicate whether such a density level is positive or negative, except reference is made to crowding measures. Clearly, this is distinguishable from “residential density”, also referred to as “density outside the home” whether at the building, street, or city level. Dwelling density is therefore closely related to, and discussed together with crowding in this study. Dwelling density is operationalized as an objective measure and refers to the number of people in any given space, e.g. the number of occupants per room, per bedroom, or square metre in a given apartment. This indicator of housing quality depends on the space characteristic of the apartment and on the size characteristic of the household occupying the apartment. High density may not necessarily connote over-crowding.

Dwelling/Housing units: The concept of a dwelling is used to determine household spaces. In this study, it means that self-contained apartments or flats are counted as separate dwellings. Such apartments are stacked vertically or horizontally and are principally built to serve single households or families for residential purpose. All spaces are private and belong to a household. The essential features of housing units are separateness and independence. Different households can be accommodated on each floor with a shared staircase, but with each household having its own front door off the landing. The concept of a dwelling is therefore interpreted to mean a ‘household space’ or 'dwelling space'. In this study, the terms dwelling, dwelling unit, dwelling house, residential dwelling unit, and family dwelling are used indiscriminately to refer to housing units of any model. Dwelling unit model or typology refers to kind, class or category of LSDPC's designs that have common characteristics with respect to the number of bedrooms available. For the purpose of this study, dwelling units are classified according to whether they are two-bedroom, three-bedroom or four-bedroom. These express nothing other than the identification of the different types according to the design. This classification is not correlated with sizes , as some two bedroom apartments are actually bigger than some three bedroom units.

Habitable room: means a room used for normal domestic accommodation and activities that includes a bedroom, living room, lounge room, music room, sitting room, television room, kitchen, dining room, sewing room, study, play room, sun room, gymnasium, fully-enclosed patio. It does not include bathroom, laundry, water closet, food storage, pantry, walk-in wardrobe, corridor, hallway, lobby, photographic darkroom, cloths drying room, veranda, or patio, other spaces of a specialized nature occupied neither frequently nor for extended periods. For the purpose of assessment, habitable rooms do not include small kitchens that are less than 2.0 metres wide, but includes larger kitchens that are over 2.0 metres wide. The minimum width for other habitable rooms is 2.1 metres. Very large rooms of over 19.0 square metres which are capable of subdivision count as two habitable rooms. This particular requirement was applied in the 1976 census in the United States, in order to deal with the problems of housing units that have open-plan layout and the growing practise of removing part or all of the walls joining two or more rooms (Morrison, 1994). Such strict reading of room equivalents improves the accuracy of the estimates for number of rooms. The minimum area for every habitable room is 6.5 square metres. Rooms that are considered as habitable rooms should be at least 2.3 metres in height. It is however acceptable to have a portion of the room with less than

1.5 metres ceiling height, but this part of the room shall not be considered in computing the habitable room area.

Home-spaces: Home-spaces are the spatial provisions that constitute the physical interior in a dwelling unit, for the exclusive use of a particular household. The interior spaces of multifamily apartments and their relationship with occupants are the primary focus of this study (Figure 1.9). Public and semi-public areas such as shared hallways and parking areas are not regarded as home spaces in this study.

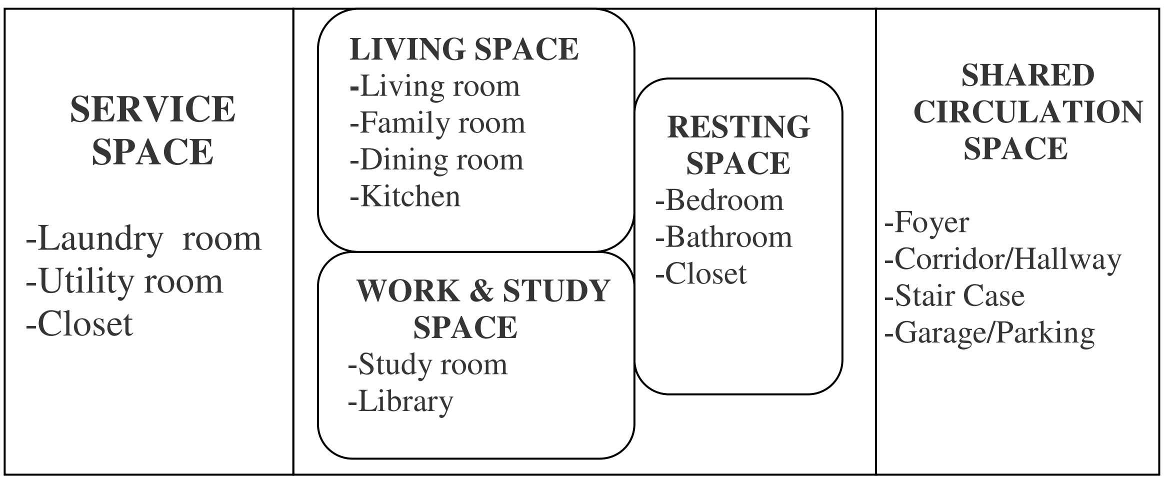


Figure 1.9: Relationships of All Five Home Spaces

Household: Rapoport, (1999) defines a household as a group of people who co-reside in a dwelling or residential compound and who, to some degree, share house holding activities and decision-making. Some other researchers based their conception of the household as living arrangements where members live in the same dwelling and share basic domestic activities such as cooking and eating (Asiyanbola, 2010). These views are in conformity with what operates in the United States and India. In these two countries a household consists of persons who eat food cooked in one kitchen and who live under one roof. Households are seen as natural units that are constituted around relationships where members of the unit pool and share economic resources. Within the household the household head, as the breadwinner is primarily involved in productive work outside the home. This study follows a similar definition. A household is defined as all individuals residing in the same housing unit and have common arrangements for eating food. A household could consist of a husband, his wife, children, relatives, etc. The persons in the household may also be unrelated individuals, or a combination of both. The members share domestic functions and activities. They also share the same source of sustenance and think of themselves as a unit. A household differs from family in that it may be composed of both family and non-family members. Some cases abound in Nigeria where different families living in rooming apartments share the same kitchen space. This is also noticeable in one-bedroom flats built by the Federal Housing Authority in Festac Town, Lagos. This kind of arrangement is not obtainable in LSDPC's multifamily apartments, hence is not applicable to the definition of household used for this research. All households referred to in this study are regarded as stationary households. Stationary households are those which have reached their maximum size and are likely to remain at this size for some time.

Household head: is a person who has primary authority and responsibility for household affairs and who is a chief economic supporter. He is generally regarded as the person who manages the household. Often times, for reasons of age or respect, the household head declares himself/herself as such, or by other members of the household through recognition. The head of the household could be male or female.

Multifamily housing: Can also be referred to as town-homes, duplexes, triplexes, apartment complexes, clustered, row, or terrace housing. Multi-family dwelling means it contains five or more apartments stacked vertically or horizontally on a single parcel of land.

Post-occupancy evaluation (POE): POE deals with procedures for ascertaining the extent to which design decisions made by the architect at inception are delivering the performance needed by those who use the building. In this research, POE is discussed from an end-user perspective, as a tool in understanding the spatial performance of apartments in multi-unit housing types.

Public housing: Public sector's motive in producing houses is not for profit alone, but to help in solving problems of housing inadequacy. Public housing is therefore regarded as housing provided by the state for households who do not have the required resources to obtain such for themselves. Government-sponsored housing involves different kinds of independent landlords, such as housing associations, and cooperatives. They build, allocate and manage the housing units. In this study all housing developed and operated by the Lagos State Development and Property Corporation (LSDPC) belong to this category of government-sponsored housing. This is the context in which public housing is discussed in this research. The study focuses only on multifamily housing units that are located in mass housing estates which have been inhabited for some time.

1.8 RESEARCH ASSUMPTIONS

1. Design configuration of interior home-spaces was not substantially altered during the construction stage. Therefore the spaces supplied during design were the same spaces encountered by households during occupancy. In other words, the initial units provided have not changed over time.
2. Every household is in a *stable state.* A *state* describes the household's current status. For example, states might be single mother household, single father household, and so forth. Movement from one state to another may occur, but the impact of such transitions is considered negligible, since households are classified on the basis of their current state, which this study

regards as the bona fide demographic status. This study was based on a snapshot of household composition at a given period. That is to say, the distribution and composition of the household was hypothetically stationary at the time of the research survey. The difference between growing households (those which may expect further children), stationary households (those which have reached their maximum size and are likely to remain at this size for some time), and declining households (those which are likely to decrease) was assumed to be negligible in this research.

3. Households have relatively stable norms and values that are used to evaluate spatial behaviour.
4. All married persons were treated as adults, whether or not they had attained the chronological age of 18 years. On the other hand, all persons below the chronological age of 18 years who were not in a marital relationship were regarded as children, irrespective of whether they have attained puberty. That is to say that an unmarried girl or boy who gave birth to a child at the age of 13 years, or who could have given birth to as many as four children by the age of 18 years was still a child.
5. The housing units being investigated were not specifically designed for people with disabilities or special needs. The current stock of housing units is known as general needs housing. Hence all disabled persons in the housing units selected for this study were capable of exhibiting significant improvement in adaptive behaviour, and therefore do not experience discrimination that affects their dwelling space needs. Therefore they do not require a high degree of support and segregated services that result in extreme dependence. The disabled population is defined as those persons who suffer from a physical or mental impairment that interferes with their daily activities. It also includes those who may have a substance abuse addiction. The frail elderly persons with special needs belong to this category. The housing needs of all these groups are not simply met by LSDPC's standard apartments. They need special kinds of housing which was outside the scope covered by this study.

1.9 SCOPE, LIMITATIONS AND DELIMITATION OF THE STUDY

Carthey (2006) describes two different ways through which researchers can delineate the scope of a POE: (1) the focus can be on broadly based issues (e.g. overall design quality or efficiency of the procurement process) or (2) the focus could be targeted more specifically on a key or narrow interest (e.g. a single element such as floor finishes; or the acoustical performance of the building). The present study is closely associated with the second option, as it focused specifically on dwelling density in LSDPC's multifamily apartments.

This research did not evaluate the entire LSDPC initiative. Rather, the focus was on evaluating how the multifamily housing program achieved its dwelling density objective by examining the direct experience of people who live there. Within the concept of density, a distinction was made between outside density and dwelling density. Dwelling density was also regarded as "inside density or in-dwelling density", described as the number of people per unit of living space; or "internal density", described as the mean number of persons per room within a dwelling unit. These were the focus of this study, and are therefore used interchangeably. Some other forms of density were outside the scope of this research. These are: "outside density or areal density", regarded as the number of people in a larger community such as a census tract, measured as the amount of square metres per person; "building density", regarded as the number of people or dwelling units within the same building; and "neighbourhood density" described as the number of people or dwelling units within a particular area such as a hectare or square kilometre.

The study covered all housing estates in Lagos built by LSDPC, which contain multifamily prototype housing units, and which had been inhabited for five years or more. The study classified multifamily residential buildings into two categories that captured the essential difference between them: the walk-ups and the high rises. Walk-ups are generally between two and four floors, while high rise are elevator buildings that can go up to thirty floors. The high rise type of buildings was excluded from this study. The multifamily housing units investigated in this research were those designed and built for low-income and medium-income households. Housing units designed and targeted at high-income households were excluded.

Table 1.4: Salary Grade Levels of Federal Civil Servants

CONPSS	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1.	204,878	205,347	213,515	218,265	222,754	227,222	241,092	235,161	240,633	245,099	243,586	254,037	255,506	262,915	257,444
2.	205,206	214,049	219,892	225,735	231,678	237,958	243,264	249,167	254,950	260,793	266,635	272,479	278,322	284,165	290,063
3.	211,048	218,230	225,412	232,594	233,776	246,958	254,145	281,322	268,504	275,686	282,868	290,050	237,232	304,414	311,596
4.	221,072	229,701	238,330	246,959	255,588	264,217	272,646	281,475	290,104	298,733	307,362	315,991	324,620	333,249	341,878
5.	250,498	260,522	270,548	280,570	290,594	300,616	310,642	320,668	330,690	240,714	350,738	360,762	370,786	380,810	390,834
6.	305,429	317,648	329,857	342,086	354,305	366,524	378,743	390,962	403,181	415,400	427,619	439,838	452,057	464,276	476,495
7.	597,185	525,918	544,671	563,424	562,177	600,930	619,683	638,435	657,189	675,942	694,695	713,448	732,201	750,954	269,787
8.	655,384	877,704	700,024	722,344	744,664	786,984	789,334	811,624	833,944	858,264	878,584	900,904	923,224	945,544	987,854
9.	769,855	796,430	823,004	849,578	876,152	902,726	929,300	955,874	982,448	1,009,022	1,035,596	1,052,170	1,089,744	1,115,318	1,141,892
10.	903,711	932,934	962,157	991,350	1,020,603	1,049,826	1,078,049	1,108,272	1,137,49	1,166,718	1,195,941	1,225,164	1,254,387	1,223,610	1,312,833
12	1,042,403	1,087,737	1,133,056	1,178,395	1,223,724	1,259,053	1,314,382	1,259,711	1,405,04	1,450,369	1,495,598				
13	1,163,433	1,211,355	1,259,277	1,307,199	1,355,121	1,403,043	1,450,965	1,498,887	1,546,80	1,594,731	1,642,653				
14	1,235,018	1,338,609	1,388,203	1,539,791	1,691,392	1,842,973	1,394,564	2,148,155	2,297,74	2,449,337	2,500,928				
15	1,757,816	1,640,882	1,913,948	1,987,014	2,060,080	2,133,145	2,205,212	2,279,278	2,352,34						
16	2,156,877	2,274,689	2,362,501	2,450,313	2,538,125	2,625,937	2,213,749	2,801,581	2,889,37						
17	4,173,500	4,331,367	4,489,934	4,648,501	4,897,058	4,965,635	5,124,202	5,282,769	5,441,33						

Developing a reliable and valid socio-economic group classification was of utmost importance in this study, particularly with respect to interpretation of findings. This study did not adopt the definition of low income group used in the formulation of the National Housing Policy, as it has become stale and unrealistic. The policy defines the low income group as all wage earners and self-employed people whose annual income was Five Thousand Naira or below as of 1988, or whose annual income is twenty percent below the maximum annual income of the highest salary grade level within the Civil Service Structure at any given time, whichever is higher.

Table 1.4 shows the current wage structure of workers in the Federal Service of Nigeria. From table 1.4, the maximum annual income of the highest salary grade level is ₦5,441,336.00**.** Twenty percent below this income level amounts to ₦4,353,068.80. Also from table 1.4, it can be seen that the next highest paid civil servant earns ₦2,889,373.00**,** which implies that all persons on grade level 16 and below are low-income. This is not a true representation of the actuality.

Fadare and Alade (2009) provided another classification of persons in three income groups. In a study of determinants of households' trip generation in Lagos Metropolis, they classified low-income group as those who earn less than ₦50,000.00 per month. Those earning ₦50,000.00 and above, but below ₦100,000.00 were grouped as middle income, while people who earn ₦100,000.00 and above are classified as high income.

Ndubueze (2009) in a study of urban housing affordability and housing dilemmas in Nigeria, adopted the methodology used in the Nigerian Living Standards Survey to compute the monthly cash income of households. Two cash income variables were used – the regular household monthly income variable and the incidental household income variable. The regular monthly income variable includes total basic monthly income, rent received (property owners), income from subsidiary group, dividend on shares, and pension. On the other hand, the incidental household monthly income variable relates to pools/lottery winnings, sales of property, cash gift received, remittances from within Nigeria received, remittances from outside Nigeria received, and miscellaneous.

Ndubueze (2009) further adopted the criteria used in developing non-housing consumption poverty line in Nigeria to identify and classify the income group of households. Following this criterion, the national per capita household income was computed to be ₦60,271.00. Two-thirds below this figure (₦40,180.00) was taken as the maximum cut-off point for low income group. On the other hand, two-thirds above ₦60,271.00 was used to determine the minimum cut-off point for high income (₦100,451.00). Thus, there is general agreement that high income groups are those who earn ₦100,000.00 and above. There is also an agreement in the classification of the bulk of the middle-income group. However, while Ndubueze's study fixes the maximum income for low income at ₦40,180.00, Fadare and Alade's study stipulates ₦50,000.00.

These categorizations were contextually relevant to the present research. However, the present study adopted ₦45,000.00 for the maximum low income monthly earning of head of household. Therefore the figures adopted for measurement of socio-economic status of residents of LSDPC's multifamily apartments in Lagos were as follows: low income (below ₦45,000.00); medium income (above ₦45,000.00 but below ₦100,000.00); and high income (above ₦100,000.00).

The low and medium income groups were the target of this research. Statistics shows that in the 1990s, about 70% of Nigerians fall within this category. The situation has not changed substantially up till now.

The justification for limiting the study to walk-up apartments is that they are the dominant apartment type in LSDPC's staple. High-rise public housing supply by LSDPC is skeletal and not widely acknowledged as a success story. This is a sharp contrast with the situation in Singapore, where 84% of its resident population is found in high-rise apartments (Yuen, Yeh, Appold, Earl, Ting & Kwee, 2006). Also, the applicability of the results from the current study to high-rise dwelling units may be in contention, in view of claims that beyond the fourth floor, it is no longer easy to perceive details of objects on the ground below (Okunsanya, 1986).

This study focused on specific large LSDPC's housing estates located in Lagos State. However, there were potential limitations with this kind of study, because the estates were not closed and people were migrating to and away from the study areas. If in-migrants were systematically different from out-migrants, residential turnover could confound research findings.

To address this situation the present study was based on a snapshot of household composition at a given period. The household was not placed in historical context to reflect the changes that have occurred over time. Therefore, it would not be able to adequately represent the dynamic nature of household composition that may be expected from longitudinal changes in household composition. Since household composition is an important factor governing household behaviour, this study did not provide enough bases to understand the challenges facing households at different stages in their life-cycle.

Including a longitudinal component would require researchers to document the path a household took to arrive at its current state, particularly information as to when each member enters and leaves the household. This pursuit fell outside the scope of this study. Again, the study did not delve into proxemics, which deals with interpersonal distances maintained among individuals for purposes of communications. This implies that highly subjective variables involving human use of space within the context of culture were excluded.

Thus, details of personal space, informal space, and territoriality were discountenanced. In this context, this study ignored aspects concerning individual resident's perception of crowding. Individual-level measures of crowding involve resident's perception of their environment and are subjective by nature, making it difficult to derive policy implications based on their analysis (Steiner, & Wooldredge, 2009). Objective measures of dwelling density appear to be more policy relevant hence this study focused on those measures. In the domain of real estate, usually, habitable rooms are the only ones counted when documenting the number of rooms in a house. However, a major limitation arises in situations where rooms in excess of 20.0 square metres are required to be counted as two rooms. While this is understandable and culturally permissible in circumstances where the dining, living and/or kitchen are integrated, it becomes objectionable in large stand-alone bedrooms.

This study was further restricted to only the mass public housing provided by LSDPC for the general public. Under this type of housing provision, completed apartments were rented or sold to the general public at subsidized prices. The other major type of houses which LSDPC provides for government employees and public officers at small fixed rent deducted from salaries was excluded from this research. These are essentially found in the Government Reservation Areas (GRAs), and the lower/middle cadre staff housing for workers in government parastatals.

The focus on apartment form of multifamily housing was in response to pressures for higher densities in Lagos Megacity. Facts derived from this study could be useful in understanding and explaining the incidences of dwelling density and crowding, in relation to housing unit design type. The discussions centred on whether the dwelling units were efficient in terms of spatial qualities and density. The broader issue that bothers on consequences and deleterious effects of under-crowding or overcrowding were not substantially addressed.

For the purpose of this study, only apartments that have not undergone substantial spatial transformation were used. Substantial transformation is said to have occurred if a dwelling unit had been modified or adjusted to alter the total number of habitable rooms from what it was at inception. Also, apartments that have been modified or adjusted to increase or decrease the total area occupied by the dwelling unit from what it was at inception were not studied. Households living in dwelling units where minor modifications have occurred were assessed based on the original spatial context of their housing typology, and not on the basis of the modified spaces.

Like in many other POE researches, this study may be affected by cultural relativity. The same building and its physical attributes that could be objectively measured and described may be perceived by the same people differently at different times, or differently by different people at the same time. There are therefore no absolutes in environmental evaluation because of cultural bias, subjectivity, and varied backgrounds of both evaluator and building user.

CHAPTER TWO

2.0 LITERATURE REVIEW

This study addressed five research questions which focus on post-occupancy evaluation of dwelling density in different multifamily housing models in LSDPC's estates in Lagos. To support these objectives, the review of the literature was structured as follows: Evolution, problems, and trends of public sector housing in Nigeria; The legacy of LSDPC in housing provision in Lagos; Housing space adequacy, density and crowding; Norms and standards for contextualizing households' dwelling space standards; Multifamily Housing, and Post-occupancy evaluation.

Sources of literature review for this research are: peer-reviewed journal articles; books; doctoral dissertations; and non-peer-reviewed articles and reports. The sources were identified through several means such as Internet searches using the Google Search Engine, and references cited in other literature. For the historical part of this study, the principal source was published books. Information on current issues were collected mainly from non-profit organisations and governmental agencies.

2.1 PUBLIC SECTOR HOUSING IN NIGERIA

2.1.1 Public Sector Housing Evolution in Nigeria

Most governments around the world have recognised the gravity of housing problems in their countries, and have responded to the ensuing housing crises in different ways. The responses to the shelter crises varied over time, and from one country to another. One of the major interventions by governments in many countries has been the outright provision of subsidized housing or what is commonly regarded as public housing. The World Bank (2002) identifies public health and safety, as well as overall quality of local neighbourhood as the main concern why governments embark on public housing. The World Bank further outlined approaches that were adopted by different countries as follows: violent destruction of slum communities, tacit support of organised invasions, construction of highly subsidized flats, introduction of basic services in squatter settlements, direct housing provision, and housing enablement.

In Nigeria, the arrival of the British during the latter part of the 19th century led to the evolution of extensive urban development programmes. Developments in commerce, port functions and industrialization led to phenomenal increase in population of major towns along the critical nodes of transportation during the pre-colonial era. Examples of such towns are Port Harcourt, Enugu, Jos, Ibadan, Lagos and Kaduna. These towns and cities grew in population through migration. Consequently housing shortage began to manifest, leading to over-crowding.

Due to the social, economic and political position of Lagos, coupled with the high population, public housing development in colonial Nigeria was highly skewed in favour of Lagos. Government activities and policies in housing started from Lagos area in 1863, with the enactment of Town Improvement Ordinance to control development and urban sanitation in the city. This was followed by the Township Ordinance of 1917 to cover the whole country. Again, there was the Town Planning Ordinance for Lagos and Town and Country Planning Ordinance for the whole country in 1946 (Lawal, 2000).

The attention of government at that time was limited to the provision of quarters for Europeans (expatriate staff) and selected indigenous staff in specialized occupations like railways, police, army, posts and telecommunication. This era started the establishment of Government Residential Areas (GRAs) as well as a few African Quarters. The Government Residential Areas were regarded as high grade residential districts. The oldest of the high grade residential district was that of East Marina. The reservations were set up with the main purpose of providing accommodation for the Europeans. For example, the reservations in Agodi Hill (Ibadan), and Ikoyi (Lagos) were developed in the 1920s to provide for the increasing number of expatriate civil servants.

In Enugu, the area formerly known as European Quarters (now Government Reserved Area) was established. About the same time, due to population growth, a settlement for indigenous workers was established at Ogbete, Enugu. A permanent quarter known as “China Town” was built in 1923 by the railway for its growing workforce (Okonkwo, 2004). No attempt was made by government to embark on mass housing or housing estate that could be sold to the public. The genesis of government housing estates can be linked largely to some major events during the colonial period. The first is the post First World War influenza epidemic or bubonic plague which ravaged Lagos in 1928 due to poor sanitary conditions and unplanned native residential areas, where rooms occupied were small. The rooms were also overcrowded and not properly ventilated (Kogbodoku, 1986; Fadahunsi, 1987; Lawal, 2000).

The recent event was the workers strike of 1945, partly precipitated by the occurrence of the Second World War. One of the issues negotiated during the resolution of the industrial dispute was the building of workers’ housing estates (Fadahunsi 1987).

There was also the issue of the Lagos Central Planning Scheme Law enacted in 1955 which provides for slum clearance in central Lagos, and resettlement of displaced people in Surulere, Lagos. This was necessitated by the impending independence of the country.

Direct government intervention came with the establishment of Lagos Executive Development Board (LEDB) in 1928. Its primary objective was the re-planning, improvement and development of

Lagos. It was also required to clear swamps and slums, resettle people displaced by slum clearance, vet and approve building plans, and plan new residential and industrial estates.

Other intervention agencies were the Ikeja Area Planning Authority (IAPA), established in 1956 and the Western Nigeria Housing Corporation (WNHC) established in 1958. The Nigeria Building Society (NBS) was established in 1956 to provide mortgage loans. However, this did not achieve much due to limited resources and what was regarded as poor response of the public to the saving scheme operated by the NBS.

Public sector contribution to housing development prior to 1960 was therefore limited to the activities of LEDB in Lagos. No housing scheme was executed by Ikeja Area Planning Authority before Independence in1960, while the first and only project embarked upon by the Western Nigeria Housing Corporation was at rudimentary stage in 1960.

Shortly after the attainment of independence, the Eastern Nigeria Housing Corporation was set up in 1962. The Northern Nigeria Housing Corporation was established in 1963, while the Mid-western Nigeria Housing Corporation came into being in 1964. These agencies later came together in May, 1964, to form the Association of Housing Corporations of Nigeria (AHCN). Almost every action of government in the housing sector and its impact on the citizenry can be attributed to these agencies and others that emerged afterwards.

At present, nearly every state of the Federation has a housing corporation. There are also related organizations established by the Federal Government such as the Federal Housing Authority (FHA). All the agencies that existed prior to independence were creations of the colonial government. Hence, Post Colonial housing policies remained a continuation of the processes set in motion during the colonial period.

The Federal Government's interest in housing development was popularized through the establishment of National Council on Housing and Federal Housing Authority in 1971 and 1972 respectively, to intervene in the provision of housing for all income groups. These agencies have a number of developments to their credit. This marked the first significant and direct attempt by the Federal Government (with Headquarters then in Lagos) to intervene positively in the area of housing. A decree was enacted, supporting a proposal to construct 59,000 houses nationwide through the National Council on Housing. Of this number, 15,000 units were to be located in Lagos while the eleven states in existence at that time will have 4000 units each.

The contribution of Federal Government to housing development in post-colonial Nigeria did not reveal any enthusiasm during the First and Second National Development Plans. This situation was reviewed in the third National Development Plan. Government housing policy objective as enunciated in the Third National Development Plan 1975 – 80 (paragraph 38 – 39) stated that the Government had accepted it as part of its social responsibility to participate actively in the provision of housing for all income groups and will therefore intervene on a large scale in this sector during this period. The Federal Housing Authority was empowered to act as an implementing agency for housing programmes of the government. The main thrust of the Federal Government Programme was the direct construction of 202,000 units of housing throughout the Federation. Lagos, being the capital city of Nigeria was allocated 50,000 units. The 1981 – 1985 Development Plan had an ambitious agenda to provide 40,000 units of housing per year at the Federal Government level. Total out put at the end of these two Development Plans were put at less than 15% of the total projected number for the entire nation.

It is noteworthy, however, that some visible impacts were recorded in Lagos State through the action of the Federal Government. Some apartments owned by the Federal Government include Eric Moore

Towers and Bar Beach Towers. These were high-rise residential buildings constructed by the Federal Government for high-income officers of its establishments. The 1004 housing estate, Victoria Island was developed in the 1970s. It first served as accommodation for members of parliament during the second republic. When the legislators moved out following the Military Coup of December 1983, the estate was allocated in 1984 to Senior Civil Servants from Grade level eight and above.

The first overwhelming contribution to mass housing was the development of the Festival Town (FESTAC) in Lagos. It was targeted at low and medium income families. It was a total concept estate consisting of seven communities and covering a total land area of 2,230 hectares (Williams, 2002). Only three of the communities were developed initially to form what existed as FESTAC until some years later when site and services scheme was introduced.

At initiation stage, FESTAC was conceived to accommodate visitors and participants for 1977 Festival of Black Arts and Culture, which was hosted by Nigeria. The various types of houses and apartments were allocated to Nigerians after the Festival. By the records of the Federal Housing Authority, there were 15,000 units of various types and categories of dwellings as at 1992 (Iyagba and Asunmo, 1997). This is a far cry from the 24,000 units of accommodation originally programmed for the international festival (Williams, 2002).

Another Housing Estate that was developed in Lagos State by the Federal Government is located at Ipaja New Town. It was facilitated by the Federal Housing Authority (FHA).

The 1992 account states that 3,044 units of various types and categories of dwellings were realized. A Federal Low-cost Housing Estate also located at Ipaja was started during the Second Republic. It was intended to reduce the problem of increasing housing deficit. The Estate covers an area of about

200 hectares. As at 1996, a total of 1,146 units of various types had been built. This estate was facilitated by the Federal Ministry of Works and Housing during that era.

However, the quantum of housing units produced through direct government involvement has remained negligible in contrast to the housing supplied by the private sector. Some state-sponsored estates suffered location deficiencies, and also impacted negatively on urban master plan. Also, the adoption of Eurocentric models of prototype dwellings and complex technologies suggests that users input were not a major consideration at the critical stage of initiation of most of these projects. The consequences of these deficiencies manifested in overcrowding and unwholesome environmental conditions.

2.1.2 Housing Problems and Trends of Housing Production in Nigeria

Studies by the United Nations (Cited in Onukwugha, 1991; Adebamowo and Oduwaye, 2010) indicate a parameter of eight to ten dwelling units per one thousand population annually to solve the magnitude of current and future housing needs globally. It was observed that this figure is yet to be met in many developing nations, including Nigeria. UNCHS (2001), cited in Ndubueze (2009) gave a projection that globally 1.1 Billion people live in inadequate housing. It recommended that for the problem of housing supply to be ameliorated, about 21.0 million housing units are required annually in developing nations between 2000 and 2010. In addition to this, it is projected that about 14.0 million extra housing units must be built each year for the next twenty years to offset the current deficit by the year 2020. Focusing on Africa, another United Nations report in 1976 concluded that the continent's housing problems was not only technical and economic but also a problem of social development in its widest sense, encompassing legal, educational and community-building aspects (Van-Wyk and Van-Wyk, 2001; Oladapo, 2005; 2006). Onukwugha (1991) equally raised the issue of obsolete management practices. The dimensions of housing problems in most African nations are both quantitative and qualitative (Awotona, 1982; Olotua, 2002).

According to Onukwugha, 50% of the housing stock in the developing world can be labelled as shelter only, and they grossly fall below basic health and sanitation standards. Other authors also describe public housing in developing countries as ill-conceived, inefficient and ineffective in meeting the needs of the target population (Rondinelli, 1990).

In Nigeria, a number of authors have addressed housing problems from varied perspectives such as low income financing (Onajide, 1988); subsides as finance mechanism (Agbola, 1986); affordability, cost recovery and replicability, (Agbola, 1990); and sub-standard housing (Onibokun, 1990). All these are centred on the supply side of housing delivery, based on the age-long philosophy of building as many units as possible at the cheapest rate.

The enormity of housing problems in Nigeria is most apparent in the low and medium income segments of the society, particularly those living in urban areas. The increasing rate of urbanization is aggravating the situation. Although several authors agree to the existence of quantitative problems, they tend to differ in their estimation of the magnitude. Using the data from some Nigerian National Rolling Plans, Ajanlekoko (2001) estimated the national housing requirement at between 500,000 and 600,000 units, based on an occupancy ratio of three to four persons per room. Okolie (2001) and Oladapo (2006), on the other hand found that by the year 2000, Nigeria's housing deficit had accumulated to about 5.0 million. Oladapo's estimate excludes the backlog of maintenance needed to upgrade existing housing units to acceptable standards (See National Rolling Plan 1993-1995). Similarly, Iyagba and Asunmo (1997) established that with a population of eighty million people in 1990s, Nigeria would require 720,000 housing units per annum. Recent studies, however, put Nigeria's current housing deficit at 15.0 million housing units and the existing stock at 23 per 1000 inhabitants (Kabir & Bustani, 2009)

The National Rolling Plan (1990-1992) projected Nigeria's housing deficit to be 4.8 million units. Olotua (2002) also computed that Nigeria with an average household size of seven in 1975 needed 10.0 million dwelling units to adequately house its 70.0 million citizens, whereas the existing stock at that time was only 3.0 million.

Further estimates of housing deficit by various authors and successive governments can be obtained by inference based on policy thrust and extent of intervention in housing delivery. This approach was witnessed in May, 1973, when the Federal Government of Nigeria announced a programme to build 59,000 dwelling units in different parts of Nigeria. An estimated 4,000 units were to be constructed in each of the eleven states then in existence apart from Lagos, which was allocated 15,000 units (Abiodun, 1985).

Also, the enormity of housing deficit in 1980 could be interpreted from the government's elaborate national housing programme to build a total of 40,000 units nationwide, with 2000 units located in each of the then nineteen states, and Abuja (Aribigbola, 2008). Again, some authors provide an indication of the acute shortage of accommodation in Nigeria by reporting that the country planned to deliver 121,000 housing units. Unfortunately, only 1,014 units were realised by the end of 1995 (Iyagba & Asunmo, 1997; Ajanlekoko, 2001). Following the population projections in 2006, the Association of Housing Corporations of Nigeria advised the Federal Government to embark on annual production of at least 10,000 housing units (Adebamowo and Oduwaye, 2010).

Some researchers used the way government responded to the housing sector in the National Development Plans (NDP) to illustrate the magnitude of the nations housing problem. According to

Igwe (1997), it was during the Third National Development Plan (NDP, 1975-80) that the government explicitly accepted the provision of housing to the general public as a social responsibility. This policy inclination was extended to the Fourth National Development Plan (1981-85). During these periods, the Federal Government seriously participated in mass production of housing as evidenced in FESTAC Town, Ipaja Residential Estates and many others in several states.

The Federal government's projection between 1975 and 1980 was to engage in direct construction of 202,000 housing units for letting or outright sale. This represents an increase of 142,200 units from the 60,000 originally planned. Of these 202,000 units, 50,000 were to be built in Lagos, while 8,000 units were for each of the nineteen state capitals then in existence. However, at the end of the period, the Federal Government was only able to deliver 8,500 units (19%) in Lagos out of the targeted 50,000 units. Similar output was experienced for the rest of the country with the production of only 20,000 units (13%) out of the targeted 162,000 units. The overall performance was put at 28,500 units, representing 14.1% achievement (Igwe, 1997; Aluko, 2004; Olayiwola, Adeleye & Ogunshakin, 2005; Kabir & Bustani, 2009).

Although this dismal performance was replicated during the NDP (1981-85), the accounts by various authors were different. While Igwe (1997) and Enuenwosu (1986) claimed that the Federal Government planned to build 160,000 units and realized only 32,000 units; Kabir & Bustani (2009) estimated that the planned quantity was 200,000 and only 47,200 units (23.6%) were constructed.

It is clear from the foregoing that the problem of inadequate supply of housing units in Nigeria stem from government's inability to build the required number of dwelling units for the population. Housing shortage has been identified as the fundamental reason why national governments formulate housing policies (Aribigbola, 2008). In Nigeria, the shortage of desperately needed housing units facilitated the development of the first explicitly formulated National Housing Policy in 1991. The ultimate goal was to ensure that every Nigerian owned or had access to a decent dwelling accommodation at affordable cost by the year 2000 (National Housing Policy, 1991).

Under the National Housing Policy, the Military Government unveiled a national housing programme to increase the housing stock in the country; provide easy access to home ownership; and translate the national policy objectives into reality.

The public sector organizations and agencies that have actively participated in implementation of government housing programmes over the years are the Federal Ministry of Works and Housing (FMW&H), the Federal Housing Authority (FHA), the various State governments and their respective housing corporations. The FHA was set up under Decree Number 40 of 1973, and amended by CAP 136 LFN of 1990, as an agent of the Federal Government. Its mandate was to execute the housing policies of the Federal Government through direct provision of housing units throughout the federation (Iyagba & Asunmo, 1997; Olayiwola, Adeleye & Ogunshakin, 2005 Mayaki, 2009; Kabir and Bustani, 2009;). Since its formation, FHA has a record of having successfully completed a number of housing estates throughout Nigeria. Shortly after the inauguration of the National Housing Policy in 1991, FHA in 1992 released a document indicating that it had delivered a total of 21,756 housing units in all the states and Abuja, from inception in 1973.

This performance gave an average of 0.15% of the annual housing requirements of the Federal Republic of Nigeria during the period (Iyagba & Asunmo, 1997). FESTAC is the largest estate executed by FHA, providing approximately 15,000 housing units, while Ipaja New Town contains about 3,044 units.

With the reinvigoration of FHA in 1990 shortly before the advent of the National Housing Policy 1991, the agency was empowered to develop and manage real estates on commercial and profitable basis in all the states of Nigeria, as well as provide site and services schemes. Consequent upon this new mandate and drive, a national housing programme was designed (1994-1995), to build 121,000 housing units in the 30 states and Abuja, for all income groups. This amounted to 8.4% of the estimated housing needs of that same period amounting to 720,000 per annum (Iyagba & Asunmo, 1997; Kabir & Bustani 2009).

This apparent poor performance prompted the government to reinvigorate the 1991 housing policy in 2002. The aim was to provide solution to the seeming intractable housing crises in Nigeria (Okewole and Aribogbola, 2006). Under the 2002 National Housing Policy, the Federal Government is expected to ensure that every citizen of Nigeria owns or have access to a decent, safe and sanitary housing accommodation at affordable cost with secure tenure through private sector initiative with government encouragement and involvement. A recent review of FHA activities claims that the agency has more than 53,000 housing units distributed in 77 estates nationwide.

Past attempt at provision of housing by successive governments in Nigeria have also been assessed on the basis of distribution pattern amongst various socio-economic groups (Awotona, 1982). Thus the segregation according to income categories of beneficiaries requires that quantity of housing units supplied must match the proportion of the reference group in the larger population. The three distinct groups used by physical planners particularly in the housing sector are low-income, medium-income and high-income. In tandem with planning norms, households within the low-income bracket are expected to reside in high density zones; the middle-income should reside in medium density layouts; while the high-income group should be accommodated in low-density areas or Government Reservation Areas (GRAs).

Since the level and type of housing needs are not uniform across these groups, the government agencies in charge of housing should use an objective means to determine the scale of need for each group. There was no indication that the National Housing Programme (1981-1982) took such measures in its decision to provide 350 medium income housing units in each of the then 19 states, to complement the low-income housing programme embarked upon by the Shagari's government through the Federal Ministry of Housing and Environment (Kabir & Bustani, 2009).

Conversely, the 54,000 housing units programmed for immediate construction between 1972 and 1973 by the FHA was distributed as 60% for low-income, 25% for medium-income, and 15% for the high-income. However, this approach was not emphasized in the National Housing Policy 1991. Under the policy, FHA was merely mandated to provide housing for all income groups, with special emphasis on the low-income strata in the large urban centres across the country. This ambiguity was obvious in the National Housing Programme 1994-1995. The 121,000 housing units designed to be constructed at that time were designated for all income groups (that is, low, medium and high), without any indication of the quantity of housing units for each group.

Igwe, (2001) claims that a major reason why emphasis is placed on the low-income group is because 70% of the entire population of urban residents in Nigeria falls within this bracket. Studies by Onukwugha (1991) and Wahab (1978) were more detailed in their recommendation that for Nigeria to meet her estimated housing needs, 80% share of the housing units should be low cost, 17% medium and 3% high income. These statistics seemed to have provided justification why the civilian administration in Lagos State in 1979 gave a high priority to housing provision for low-income groups. By September 1981, the administration had succeeded in building about 3,000 units within Lagos State. However, this achievement turned out to be a far cry from the estimated 30,000 units needed per annum.

Still focusing on low-income group, the Master Plan for Metropolitan Lagos (1981-1985) estimated that 47,440 new housing units would be needed. This is part of the overall projected requirements for all income groups estimated at 78,360 new dwelling units per annum for the same period.

Ilesanmi, (2005) adduced a reason, for this low quantitative out put. According to him, low-income housing is regarded as resource-absorbing, rather than productive, hence does not favour investment in industrial infrastructure.

Despite the multiplicity of government efforts towards housing delivery in Nigeria, there is no doubt that a gap exists between housing supply and demand (Kabir & Bustani, 2009).

2.1.3 Early Research Efforts on Housing Delivery in Lagos

Efforts at carrying out an empirical study of housing delivery in Lagos have been meagre. Issues such as housing quality, slum clearance, slum and squatter upgrading, social change, urban land use and land management dominate the focus of researchers. Early scholars like Marries (1961), and Aribiah (1972) are prominent among this group. While Marries investigated the social consequences and performance of slum clearance and re-housing schemes, Aribiah dwelt on factors responsible for housing shortage in Lagos, and the policies put in place to address the problem. Aribiah identified high costs of building materials and the shift from rooming type to flats as the problem that considerably reduced the quantity of housing accessible to the inhabitants of Lagos.

Another early study by Ogunpola and Oladeji (1975) focused on comparing housing stock, quality, occupancy rate, rental prices and communal facilities to globally recommended standards of decent housing. Okpala (1977) also carried out an appraisal of the benefits and problems of urban land ownership and management in Lagos during the colonial era and the early years of post-independent Nigeria. According to him, bureaucratic corruption and goals-displacement rank high among the problems of public management of urban land in Lagos. Ilesanmi (2005), however, notes that although the problems identified by Okpala still plague housing and land policies in Lagos, the study's recommendations cannot be applied holistically to the present, as it suffers temporal delimitation.

Olotuah (2000), examined the social responsibility of government in housing provision. He also examined the risks associated with situations where governments fail in their social responsibility to provide housing for their citizens. A closely related study by Arayela and Falaye (2000) focused on the magnitude of the problems associated with inadequate housing supply, from the view point of sustainable development. Arayela and Falaye recommended the use of stabilized laterite bricks.

It is obvious that these earlier researchers focused on increasing the housing supply in Lagos to the apparent neglect of housing utilization factor, which the present study examines. Overcrowding is a symptom of pressure on housing supply. Increasing housing supply, while at the same time reducing overcrowding, should be the priority of housing developers in Lagos.

2.2 THE LEGACY OF LSDPC IN HOUSING PROVISION IN LAGOS

Pursuant to the Town Planning Ordinance (Cap. 95), the Lagos Executive Development Board, (LEDB) was established in 1928 and mandated to take charge of effective planning and development of Lagos. The creation of LEDB (now known as LSDPC) became a landmark event in the sense that it represents the commencement of Public intervention in housing in Nigeria. Until that time, the Government Reservation Areas (GRAs) were the only planned parts in few Nigerian cities. The GRAs provided accommodation for expatriate colonial administrators and executives of foreign firms. In Lagos Island, the planned areas before 1928 were around Race Course, Broad Street, and

Marina, to quarter Government Offices, Missionary Establishments and Foreign Firms. In other locations were Ikoyi, which quartered the foreign expatriates, parts of Apapa, Ebute-Metta, and Yaba (Abiodun, 1985; Aluko, 2004; Ilesanmi, 2005; UNCHS-Habitat, 2006; Immerwahr, 2007; Heap, 2009).

The decision of the colonial government at that time to be deeply involved in housing problem by setting up the LEDB was occasioned by public health problems. The slum neighbourhoods around Idumagbo and Isale-Gangan Lagoons in Lagos consisted of unsanitary dwellings and flimsy shacks, constructed with bamboo, mud and corrugated iron sheets. These areas were founded below sea level and severely flooded during the rainy season (Heap, 2009). The prevalence of filths within the Lagos environment in the early 1920s resulted in incidences of communicable diseases, unhealthy living condition, and the outbreak of a terrible bubonic plague that ravaged the entire city (Ilesanmi, 2005).

According to Heap (2009), the LEDB began its slum-clearing and town planning activities with the clearing of unsanitary dwellings and also reclamation of swamps by raising the level of the fringe areas through sand-filling around Idumagbo, Oko-Awo and Isale-Gangan. The programme suffered major setbacks due to the outbreak of World War II. Not withstanding the constraints occasioned by the war, LEDB was able to declare Lagos as a Planning Area. Slum clearing activities resumed after the World War II, with stiff opposition, particularly from the affected slum settlers. Heap also noted that it was not until the 1950s that LEDB became aggressive in its operations. The agency set in motion an agenda to rid Central Lagos of slums and create a Federal Capital to be proud of as the nation prepared for independence. The legal backing for the slum clearance was contained in a notice published in the official Gazette of 1951. The first massive slum clearance by LEDB was in 1954 with the African Housing Scheme in Yaba, which was conceived as a low-cost housing estate sold to workers.

At about the same time, LEDB also found it necessary to set up a scheme that will accommodate persons displaced by the slum clearance in Central Lagos. This led to the establishment of the Lagos Housing Scheme (LHS), targeted at low-income workers. This estate was cited in a location at the northern axis of the mainland area and named Surulere, after the Yoruba phrase meaning "patience is rewarded". This area later came to be known as "New Lagos". Surulere was chosen because it was considered to have large tracts of virgin land which could be acquired and which also, was in close proximity to the Central Business District (CBD) of Lagos Island, just like Yaba and Ebute Metta (Ilesanmi,2005; Immerwahr, 2007; Heap, 2009).

The New Town in Surulere consists of Housing Schemes I and II, scheduled to accommodate people displaced from areas of Central Lagos namely Ofin area, Idi-Ita, Johnson area, Apongbon Elegbata, and parts of Olowogbowo area. It also includes workers' housing schemes at Eric Moore, and Freehold housing Scheme. Provisions were made for public amenities like churches, markets, clinics, sites for posts and telegraphs, libraries and a host of other facilities. No special sites were allocated for mosques and this accounts for the use of private dwellings and open spaces by those who felt the need for them. Other housing schemes initiated by LEDB in the 1950s and 1960s were located at Apapa, South-West Ikoyi, South-East Ikoyi, Illupeju and Isolo (Aluko 2004, Fadahunsi, 1985).

The decade following Nigeria's independence in 1960 witnessed minimal intervention in housing by LEDB in Lagos. The creation of Lagos State in 1967 necessitated the need to review the strategies and institutions for housing provision. Thus in 1972, the LSDPC emerged, following the reorganization of LEDB, the Western Nigeria Housing Corporation (WNHC) and two other district planning authorities at Ikeja and Epe (Fadahunsi, 1985; Ilesanmi, 2005).

According to Ilesanmi (2005), LEDB produced only 7,000 housing units during the period 1951 to 1972. However, since its establishment in 1972, LSDPC has been deeply involved in the execution of many large low-cost housing projects.

In 1979, the housing programme of LSDPC took a dramatic turn when the civilian administration in Lagos decided to construct 50,000 low-cost housing units between 1979 and 1983. This policy initiative yielded only 10,428 units (20.8%), in contrast to 70% achievement in respect of housing units meant for high-come groups located at Alaka, Opebi and Alapere (Olayiwola, Adeleye and Ogunshakin, 2005; UNCHS –Habitat, 2006).

This relatively higher quantitative contribution from LSDPC was largely attributed to the political commitment of the administration, at the time. It was also reasoned that the restructuring of LSDPC in 1978 could be partly responsible for the result. The restructuring divested most functions from LSDPC, except that of producing houses, either for sale or for rentals. Though the 1979-83 housing programme yielded far below the targeted quantity, it remains the most dynamic in the history of public housing in Lagos State till date. In comparative terms, it made more contribution to the provision of housing in Lagos than all its predecessors put together.

With the emergence of the Military in 1984, LSDPC's housing programmes underwent a major reform. New design models were adopted for the housing units while the target output was drastically reduced to 8,000 housing units for the period 1983-1986 (Olayiwole, Adeleye & Ogunshakin, 2005). Despite the spate of achievement earned by government through LSDPC between 1979 and 1983, it was still widely rated poor against the 1981 projected annual housing needs for Lagos which was put at 78,000 housing units.

In 1987, LSDPC's focus shifted towards becoming a self-financing agency, committed to a policy of housing only those segments of the population who can afford to pay the market price. Thus, government withdrew from granting subventions on low-income houses, while at the same time encouraging the production of medium-income and upper-medium income housing schemes as well as commercial complexes, based on profit motive (Ilesanmi, 2005; Immerwahr, 2007). Rasaki (1988) argues that this approach leaves government to provide subsides through the funding of infrastructure. Prior to the withdrawal of subsidies for low-income housing production, LSDPC had, between 1974 and 1988, provided 12,000 housing units for the low-income group (Rasaki, 1988). These include the schemes at Amuwo Odofin, Iba, Iponri, Abule-Nla, Ojokoro, Ipaja, Dolphin I and Dolphin II, Oko-Awo, etc. On the other hand, the thrust on commercially-inclined projects saw the emergence of high rental accommodation for medium-income and upper medium-income groups in Victoria Island, Ikoyi, Surulere, Ebute-Metta, Ogba and Alapere. According to Mayaki (2009), the over-all number of housing units produced by LSDPC to the year 1992, had grown to about 17,000 in several locations. These included the low-cost units at Abesan (4,272 units), Amuwo Odofin (2068), Iba (1674) Ijaiye (796), Ijeh (450), Isolo (3664) and Ojokoro (534). The agency also built 1200 medium income flats in Ijaiye (492), Omole (100) and Alapere (140). Some 1,184 units of upper medium income flats and duplexes as well as luxury apartments were constructed at Dolphin (656 units), Herbert Macaulay (528).

2.3 HOUSING SPACE ADEQUACY, DENSITY AND CROWDING

This section examines the literature appertaining to concepts of space adequacy, density and crowding, as they relate to the present study.

2.3.1 Space Adequacy

The understanding that adequate shelter contributes to improvement in the quality of life is universal. Many countries, including Nigeria have adopted the United Nation's definition of adequate shelter contained in paragraph 60 of the Habitat Agenda:

> *Adequate shelter means more than a roof over one's head. It also means adequate privacy; adequate space; physical accessibility; adequate security, including security of tenure; structural stability and durability; adequate lighting, heating and ventilation; adequate basic infrastructure, such as water-supply, sanitation and waste management facilities* (UNCHS, 1966).

The focus of this study is on adequate space. Sufficient indoor space and provision for privacy are regarded as important considerations in healthy housing and personal enjoyment (Snaith, 1998). According to Chen (1998), spatial constraint is one major challenge which modern residents have to face. Under this circumstance, the control mechanism of interpersonal distance and boundary cannot function normally. Thus situation is created where individuals are unable to manage interactions with others in the same setting, which may result in excessive unwanted interactions and the feeling of "too many people with too little space".

The reality of this situation is explained by United Nations Human Settlement Programme (2006), which claims that approximately 20% of the world's urban population lived in inadequate dwellings in terms of sufficient living area in 2003, with two-thirds of the total in Asia. The United Nations General Assembly in 1988 adopted floor area per person as one of the ten key housing indicators approved by the Commission on Human Settlements (UNCHS) to measure progress towards meeting the objectives of the Global Strategy for Shelter by the year 2000. This same indicator was also adopted by the UNCHS in 1995. The UN Habitat (ICH, 2008).

The World Health Organization (WHO) recognizes that one of the definite criteria a house must fulfil to be deemed “fit for human habitation” is the provision of sufficient space for all normal household activities for all members of the family. It states that overcrowding and exposure to limited personal space in homes increase the potential for unhygienic conditions and stress. The WHO thus advocates that a human habitation should provide sufficient space for all normal household activities for all members of the family (Snaith, 1998).

A slightly more definitive classification of housing problem is obtained from Mohit, Ibrahim & Rashid (2010). According to the authors, housing problems are seen either from the perspective of inability to provide the number of housing to meet the demands or from the perspective of inability of available housing to satisfy family needs, comfort, social, cultural and religious needs. The second perspective of the problem is considered important as it influences the quality of life of the inhabitants directly.

Moreno and Warah (2008) express concern for adequate space in residential dwellings. They found that in 2003, about one-fifth of the urban population in developing nations lived in houses that lacked sufficient area. In these houses more than three persons shared a bedroom. Smith (1988) however contends that determination of what constitutes sufficient space for all normal household activities may be interpreted in many ways by different people, thereby making the measurement of housing quality difficult to standardize.

Other authors have equally drawn attention to this lack of consensus concerning space requirements or the way in which space is appropriated within a dwelling unit. According to Rapoport (1975) and Nguluma (2003), interpretation given to the quality of space depends on the perspective from which such a space is being judged. They further linked the varied meanings given to use of spaces with cultural differences. Findings by scholars like Sibley-Behloul (2002), Zeynep, (2004) and Modit, Ibrahim, & Rashid (2010) emphasize this cultural dimension. In a study of selected mass-housing estates in Algiers and Cairo, Sibley-Behloul (2002) pointed out that the design and spatial organization of the dwelling units were far from adequate in meeting the needs of the occupants, in terms of family size and life styles. He therefore concluded that lack of space within the dwelling units was largely responsible for various adaptive modifications executed by the occupants, to make their dwellings more habitable. He identified some of such initiatives taken by occupants to cope with lack of space. Some occupants closed-off the balconies and verandas of their apartments to gain additional floor area. Others converted their kitchen into an additional bedroom. Yet some residents fashioned out a small kitchen by closing-off the loggia. The study further found that most households of seven people who occupy three room apartments used the sitting room as a bedroom at night, due to the need to separate grown-up sons and daughters. While the parents occupy the master bedroom, the daughters and sons occupy the second bedroom and the sitting rooms respectively.

In a study of Sungai Bonus Public Low-Cost Housing, Mohit, Ibrahim and Rashid (2010) recommended the upgrading of spaces in the dwelling units on the grounds that their sizes were not appropriate. About 30% of the residents of the Estate were affected. The study examined the Policy implication and suggests that future designs of low-cost housing should be responsive to the indoor space needs of inhabitants, particularly large families. Such indoor spaces were identified as the bedrooms, the dinning and the dry area. Consistent with this assertion, the World Health Organization divided indoors spaces into two components: (a) dwelling space areas comprising living rooms, bed rooms, and Kitchen, (b) ancillary spaces comprising corridors, stairs and storage (WHO, 1988). In addition to cultural factors identified by other authors, the WHO (1988) contends that social and economic status of the households could also account for their indoors space requirements.

The emergence of Millennium Development Goals (MDGs) draws attention to lack of sufficient living space as a key determinant of housing deprivation. The United Nations uses this element as one of the major indicators for identifying Slum households (Tibaijuka, 2003). The United Nations Expert Group Meeting (2002) gives what can be regarded as the most concise illustration that provides quantitative measures of sufficient living space. The report notes that apartments can be considered as not providing sufficient living space for household members when a single room of not less than four square metres accommodates three or more people.

2.3.2. Density

The issue of sufficient living space is closely tied to the concept of dwelling density. Density is an objective measure and refers to the number of people in any given space, e.g. per square metre, per room, per dwelling or per hectare. Density itself is a neutral term that has no positive or negative connotations. The distinction is important because the same objective density may or may not be uncomfortable depending on the situation. It can take on a good form or a bad form depending on the circumstance. A system of measurements that provides indicators and control for evaluating many physical attributes of density is expressed as residential density.

2.3.2.1 *Residential density*

Churchman (1999) referred to residential density as the number of dwellings in an area divided by the total area of that place. Similarly, Chuang (2001) described residential density as a measure of the intensity of dwelling units and/or people within a defined land area. Mathematically, it is expressed as a ratio between the number of dwelling units and the area of land it occupies. According to him, residential density is categorized into gross, net, molar, molecular or and micro-level and macro-level densities. Gross residential density is also referred to as gross population density. It describes the number of people living in an entire residential neighbourhood or district parcel of land. No deduction is made for open spaces and community facilities serving the neighbourhood.

Net residential density refers to the number of housing units per unit area on neighbourhood land that is specifically serving for dwelling houses, excluding spaces firmly reserved for roads, shops, schools, places of worship, recreational and other community facilities serving those housing units. Net population density is another way of expressing net residential density. Population density gives a better idea regarding the number of people likely to make use of a given area whereas residential density provides an indication of the number of dwelling units in that area. Churchman (1999) indicated that population density can be translated into residential density by imputing information about household size in a particular context. By so doing, a distinction is drawn between residential density and living density. According to Churchman, living density signifies density inside the home, and this is clearly different from residential density, which represents density outside the home, whether at the building, street, or city level.

The terms molar density, and macro-level density have also been used to describe density of an entire neighbourhood in terms of number of persons per hectare. On the other hand, the terms molecular density, micro-level density, household density, internal density, inside density, in-dwelling density and dwelling density are used to reflect density within the dwelling unit. These are measured in terms of persons per room, square metre per person, or persons per dwelling. According to Chuang (2001) sociologists particularly employ these measures of density when using density as a measure of crowding.

It is obvious that an understanding of the overall concept of residential density is complex, and necessarily requires an investigation into the number and characteristics of households as well as the density of rooms within dwellings.

2.3.2.2 *Household density*

Most of the literature focussing on household density discuss the term alongside crowding (Newman & Hogan, 1981; Walden, Nelson & Smith, 1981; Churchman, 1999; Kaya & Erkip, 2001; Pader, 2002). However, there appears to be no agreement among researchers that there is a single point of density at which everyone will be affected in terms of health or at which everyone will feel crowded. High density doe not always lead to crowding (Jazwinski 1998).

Kaya and Erkip (2001) specifically pointed out that density and crowding can be considered as conceptually independent concepts. An earlier study by Newman and Hogan (1981) had identified two approaches employed by environmental psychologists to justify this assertion. Firstly, crowding is described as a perceived phenomenon, while density is physical and spatial. Secondly, crowding results at a point where density level dictates information overload. That is, an excessive quantity of information that requires to be processed in a particular situation. Newman and Hogan restricted their interpretation of density to urban density. Accordingly, they defined urban density as the population of a city divided by the total area of the city, excluding all non-urban land uses. They noted that density studies within rooms or buildings are relevant to urban density, and bear linkage to the concepts of territoriality and personal space. They also claimed that the link between territoriality and high density is not necessarily negative. Thus, even though high rise buildings have high physical density levels, the architectural design of the internal spaces can provide mechanisms that cater for individual human territoriality. This assertion was corroborated by Yuen, et al. (2006), in a review of high-rise public buildings in Singapore. According to them, the new town of Toa Payoh was developed with a high density of ninety-nine buildings to a hectare, yet the flats were relatively large, yielding twenty-four square metres per person for mean household size of 3.7 persons. Also, history shows that many cities that are dotted with buildings that are low in height are high in density.

Personal space was described as perceptive and bounded by a cultural adaptation to territoriality theory on a micro scale. It describes an area with invisible boundaries around a person, into which intruders may not be allowed.

Although these authors delved into micro-level issues regarding territoriality and personal space inside buildings and macro-level issues of high rise buildings within towns, the restriction of the definition of density to urban density is a major short coming.

2.3.2.3 *Other types of density classification*

Churchman (1999) and Chuang (2001) gave a wider interpretation to the issue of density, by disaggregating it into: measured density, physical density, perceived density, and crowding. They adopted the definition of density given by Newman and Hogan as the relationship between a given physical area and the number of people who inhabit or use that area. Churchman contended that density is an objective quantitative and neutral term which can be categorized into two aspects: spatial density and social density. While spatial density relates to the number of persons contained in different sizes of spaces, social density is used to describe situations where different numbers of people inhabit the same space.

Churchman (1999) identified perceived density as an individual's estimate of the number of people present in a given area, the space available, and the organization of that space. Chuang (2001) also noted that perceived density is the result of physical density, a function of social interaction, and even spatial arrangement of the built forms. Thus perceived density is distinct from population density or residential density. By definition, perception is subjective because it is based on an individual and grounded in a contextual approach to the study of person-environment unit. Perceived density is based on the principle that the same density can be perceived and evaluated in very different ways by different people, under different circumstances, in different cultures and countries. It therefore varies widely from one country to another or from one socio-economic group to another.

The views of Churchman and Chuang are closely applicable in the present study. In general, density measures vary in several ways within and between countries. The description of density as a neutral term is relevant to this study because a given density level does not include an evaluative component to immediately know whether it is positive or negative. The focus of the current research is on density inside the home which is interpreted to mean dwelling density.

2.3.3 Crowding

There is no one single definition of crowding. However, many scholars agree that crowding occurs when the size of a household is larger than the capacity of the dwelling to provide adequate accommodation. Some countries such as Canada define crowding as a situation where one or more additional bedrooms are needed to meet the sleeping requirements of household residents. A good number of researchers on crowding use World Health Organization (WHO) standard of persons per room or square metre per person. A United Nations (UN) definition regards crowding as three or more persons per room, but noted that two persons per room may be considered more appropriate in many countries. The United States Census Bureau defines a dwelling with more than one person per room as crowded. In Australia, Canada, and United Kingdom, crowding indicators that are sensitive to household size are used. These indicators measure bedroom unde-utilization as well as crowding.

Many years ago, Newman & Hogan (1981) associated crowding with density. According to them, crowding can be experienced at the level of density where residents begin to exhibit abnormal behaviour that can be observed and measured. They, however, noted that such a level of density varies across cultures, the number of interacting individuals, their tasks and roles, their relationship to each other, and their psychological states. These views support some previous studies in the area of proxemics which affirm the existence of personal space. There is, therefore, an optimal range or distance beyond which violation of personal space occurs and discomfort results. In another earlier study, (Raporport, 1975) interpreted this violation of personal space as crowding, pointing out that it addresses the negative subjective aspects of density. Thus, crowding is seen as a subjective qualitative and affective experience. This is contrary to the views expressed by WHO (2000) which describes crowding as an objective measure of space and overcrowding as more subjective measure that indicates how people perceived density and its effects. Similarly, Warah (2003) described crowding an indicator that measures the physical expression of shelter deprivation. This indicator focuses attention on circumstances depicting spatial deficiencies as indicators of housing need. Technically, crowding is only an indicator (or, an objective measure) of the number of persons per room in a housing unit. Overcrowding on the other hand gives an expression of a normative judgement concerning the degree of crowding that manifests on the scale. Warah concluded that the crowding indicator is objective but the adoption of a particular number of persons per room as an overcrowding standard is a subjective evaluation. The literature reveals evidence of confusion in the sense that many researchers interpret density and crowding to mean an objective measure. There seems to be consistency, however, in interpreting overcrowding as a subjective measure of crowding or density.

Churchman (1999) associated crowding with the negative psychological and social significance of density. He also contended that a feeling of being crowded can be triggered by interpersonal, intrapersonal, or physical conditions, or by the interaction among these conditions in a given circumstance. A clearer understanding of the difference between crowding and density can be implied from Churchman's interpretation. Hence crowding is the subjective evaluation that a given density is too high or negative. In other words, when the outcome that results from a subjective and experiential evaluation of density is negative, crowding can be said to occur. However, Churchman quickly cautions that the level of density that is regarded as optimal varies between nations, cultures, socio-economic classes, contexts, and at different stages of development.

2.3.3.1 *Relationship between Crowding, Personal Space Privacy and Territoriality*

A number of studies have also added credence to the argument that crowding, as a social issue, is conceptually similar to personal space, privacy, and territoriality (Walden, Nelson & Smith, 1981; Kaya, & Erkip, 2001). A feeling of crowding occurs when an individual experiences more social contact than is desired. This effect of social density was supported by a study where it was observed that residents felt crowded when three students had to share a bedroom designed for two (Kaya, & Erkip, 2001). Conversely, crowding occurs when an individual gets less privacy than is wanted or expected.

Privacy is the ability to determine the information about oneself that is communicated to others. Privacy can be classified into four basic types: solitude, intimacy, anonymity, and reserve. Solitude reflects the desire to be alone and free from observation by others. Intimacy refers to a need for privacy as a member of a group seeking to form close personal relationships among its members. Anonymity is the desire to be free from identification and surveillance in a public setting. Reserve describes the desire to withhold personal information that one considers shameful, personal, or profane (Kaya, & Erkip, 2001).

2.3.3.2 *Crowding Ratings and Overcrowding in Household Settings*

Pader (2002) noted that the range of reactions to spatial relations discussed above can largely be ascribed to socialization, and cultural practices. The argument of Pader regarding the number of people per room at the residential level is considered most relevant for this study. At the core of the argument is the anthropology of proper and acceptable sleeping arrangements, particularly as it applies to household social and spatial relations. These considerations may not necessarily be essential in terms of psychological factors associated with privacy and violation of personal space.

The computation of number of persons per room applied in this study is used to establish a measure of overcrowding, based on the physical parameter, density. However, measures of crowding as a subjective experience that does not necessarily follow from the physical parameter, density, have been recorded by previous researchers. Kaya, & Erkip, (2001), for example, examined the feelings of crowding in dormitory rooms that were of the same size and had the same number of individuals living in them (were of equal density). The study found that: (i) residents of higher floors perceived their rooms as larger, felt less crowded and were more satisfied with their rooms than residents of the lower floors, (ii) perception of crowding varied inversely with the brightness of a room, hence rooms that received more sunlight were perceived as less crowded. The finding that there is a significant difference in crowdedness ratings with no variation in either physical or social density indicates that density is neither a necessary nor a sufficient condition for the perception of crowding to occur. The distinction between objective density conditions and the subjective experience of crowding makes it difficult to assume that an increase in density will necessarily produce a corresponding increase in the subjective feeling of crowding.

The detrimental effects of over-crowding were brought to the fore since the days of Malthus, when social scientists showed periodic apprehension. During the 1960s, interest in crowding was stimulated by a study of laboratory rats, which linked high population density with aggressive behaviour, mating pattern disruption and higher rates of illness (Conley, 2001). This study led researchers to search for detrimental effects of higher population density in the human species. Another study that linked human dwelling space with stress considered the number of square metres in the home, and found that when each person has less than 8 - 10 square metres, instances of physical illness and behaviour were double than those in less crowded homes (Ahianba, Dimuna & Okogun, 2008)

In the United States of America, crowding is on the rise; nearly 2.0 million households live in overcrowded units (Joint Centre for Housing Studies of Harvard University, 2004). This figure is unduly high in a number of developing countries. In 2000, the National Statistical Office of Korea reports that 23.1% of households lived in accommodation that did not meet the minimum housing standards, in terms of floor space. In Ghana, roughly 44.5% of all households live in overcrowded housing condition of 2.5 or more persons per room (Fiadzo, 2004). According to Okoko (2001), the average room occupancy in Akure, Ondo State of Nigeria is 4.42, as against the United Nations standard for Nigeria for room occupancy of 2.10; the World Health Organization (WHO) range of 1.8 to 3.1persons per room, and the Nigerian Government's prescribed standard of 2.0 persons per room. A more recent average household size declared for Nigeria in the result of the National Population Commission 1995/96 household survey is 4.48 (Asiyanbola, 2010).

The problem in interpreting these indexes and working with them is that it is not clear whether the reference is to number of bedrooms or number of habitable rooms. The situation in Algeria is not different. Sibley-Behloul (2002; 2005) reported that the national average occupancy rate per dwelling was 7.55 in 1988. According to him, overcrowded condition within the dwelling unit is cited as a main reason why children and male adults tend to spend most of their time outdoors. Overcrowding is thus a visible feature in many countries, particularly in urban areas. It is associated with irritation, unproductiveness, fatigue and deleterious behaviour. Unlike other physical measures of housing quality, crowding measures examine housing quality from the perspective of households' need in relation to the space available in the dwelling.

Crowding and space are critical factors taken into consideration in determining the risk faced by occupants. In recent times, the UN-Habitat introduced the notion of shelter deprivation as a key measure to identify residential dwellings which suffer any of four different housing deficiencies: (1) lack of water,(2) lack of sanitation, (3) overcrowding and (4) non-durable structures.

In the US, housing problems as defined by the Department of Housing and Urban Development indicates that the household either has a housing cost burden, or is living in overcrowded conditions, or is lacking a complete kitchen or plumbing facilities. (Tarrant County Consolidated Plan, 2005-2009).

The role of gender was also evident in Kuma, New Guinea, where separate houses are erected for men and women (Zeynep, 2004). It was further asserted that women's houses were designed and built to accommodate their daily activities which are clearly defined in their culture.

According to some authors, became prominent in 1940s, when the United States Census introduced it as an indicator of housing need (Dowel, William, & Seong-Yong, 1996). This claim is however, disputed by Burnett (1986). According to Burnett, overcrowding as a crude measure of people per house received statutory recognition in the 1850s when it was inserted into the "Nuisances Removal Acts", though without regards to the number and sizes of rooms, or the ages of the occupants.

Burnett further argues that during the same period, local medical officers found that death rates were directly correlated with occupancy rates. He linked a situation where twenty, thirty, or even forty individuals were permitted to reside in houses originally built for the accommodation of a single family or at most two families as smacking of ignorance, indecency, immorality, intemperance, prostitution and crime. Burnett also remarks that overcrowding first received a technical definition in 1891, as a room containing more than two adults, children under ten counting as half and those under one year not counting at all. In the present study, dwelling density is interpreted as an objective measure of spaces, available for each person (WHO, 2000). The number of persons per room in a housing unit has long been used as a measure of crowding. However, there is considerable confusion and inconsistencies in regard to the measurement of crowding.

Fiadzo, (2004) claims that crowding has been operationalized most frequently as spatial density or a ratio of a facility's total population to the maximum design or rated capacity. Similarly, Gaes (1994) highlighted rated capacity as a model for predicting thresholds of number of persons that can be accommodated in institutional buildings like prisons, hospitals, schools, and places of assembly. Gaes used this model to interpret crowding as the ratio of the number of inmates in a prison to its rated capacity. According to him, an increase in the number of prisoners confined leads to decrease in the amount of space per person. On the other hand, office of the Deputy Prime Minister in the United Kingdom (ODPM, 2004) states clearly that some studies measure the number of people per dwelling whereas several others lay emphasis on the number of people per room or persons per bedroom.

Models arising from studies by Fiadzo, (2004) and Gaes (1994) were used in the present research as a primary criterion in drawing conclusions about the relationship between rated capacity and dwelling density in LSDPC's multifamily apartments.

OPDM (2004) agrees that the threshold whereby a household is deemed to be overcrowded varies among researchers. It is seen as a complex housing problem that involves household structure, racial and ethnic diversity, housing availability, gender and age factors. These issues have attracted research attention over the years. Baskerville (2001), in a study of relationship between home ownership and spacious homes in Twentieth Century Canada found that owning one's home did not lead to an appreciable increase in household space. This means that there is no significant effect of home ownership on crowding level. This finding is similar to other international studies such as that carried out by Myers et. al (1996), which identified rented households in the US as much more likely to experience crowded living conditions. Baskerville's study also found that in terms of gender of household head, (whether owned or rented), female-headed households were more likely to live in a less crowded apartments than male-headed households. In New Zealand, socio-economic considerations came to the fore when the 2001 census report indicated that overcrowding is a mark of poverty (Statistics New Zealand, n.d.). However, the census report was for households in private occupied dwellings. Also, the physical location of such dwellings was an issue. Further research in New Zealand shows a strong relationship between crowding and ethnicity of residents (Gray, 2001). Some ethnic groups accept higher levels of crowding, as a way of life more than others. The research suggests that many people of same ethnic origin may choose to stay together to provide mutual support to one another. However, the research could not explain the extent to which affordability issues, obligations towards family members, personal preferences or a combination of these factors were responsible for levels of crowding experienced.

2.4 NORMS AND STANDARDS FOR CONTEXTUALIZING HOUSEHOLDS' DWELLING SPACE NEEDS

The quality, size and other attributes of existing housing stock are measured in terms of value which occupants derive from them. An important concern for the present study is an explicit recognition of the spatial characteristics of multifamily housing units which have significant impact on household density during occupancy. In a doctoral dissertation, An (1994) indicated that if adequate housing is to be provided for every household, then the concept of dwelling space must be addressed from two broad perspectives. These are: a) dwelling space design concerns, and b) dwelling space design elements. The study classified dwelling space design concerns into functional, physical and socio-cultural aspects. According to An, the functional components are not limited by space and time. These are the most basic needs of any human being or household, and include sleeping, eating, cooking and sitting. The basic functional spaces required to meet these essential activities in a home include bedroom, dining, kitchen, living room and bathrooms. The physical component, on the other hand, pertains to critical dimensions relating to sizes and shapes of dwelling spaces. An, (1994) further indicated that the needs for activities such as sleeping, cooking and eating vary across cultures. In terms of dwelling space design elements, An also identified room units, room dimensions and space organizations as the issues of focus. Thus the amount of area or room needed can be quantitatively established. The basic activities for sleeping and resting in a housing unit require special consideration. The spaces reserved for such activities are regarded as the most basic place in the house. Crook (2008) traces the evolution of modern sleeping space to the 18^{th} century, when ideas about privacy and civility came to the fore. During this period, the bedroom as a space mapped out for sleeping became distinct from other activities of the home, such as cooking and dining. Crook (2008) claims that prior to this time, typical households faced high exposure to risks associated with brothers and sisters, mothers and sons, fathers and daughters having to compulsorily share the same bed spaces. Working-class homes in particular, were faced with all manner of moral and physical challenges such as bad habits and social ills (e.g. crime, alcoholism, laziness and violence). Crook provides justification for this claim by citing the report of an investigation conducted in 1839 by Leeds Council.

> *Let the fact be marked that in some instances there are from five to six persons to a bed; there are generally two or three; and frequently without separation of the sexes, or consideration as to age. It is to be feared that crime to an incalculable extent takes its rise from this custom and spreads thence its influence abroad* (Statistical Committee of the Town Council, 1840:406).

Crook interprets this as the ultimate inversion of familial normality, a situation that promotes the taboo of incest. A decisive architectural intervention occurred during the Victorian era, aimed at enhancing the integrity of the home. The physical manifestation of this philosophy was the working-class apartments erected in 1851, as part of the Great Exhibition in Hyde Park. The apartments had three sleeping spaces which provided for separations that were essential for morality and decency in a family life (Crook, 2008). In such homes where three bedrooms were available, mothers and fathers would be able to sleep separately from their children; brothers separately from their sisters.

This situation presents architectural design as one sure means of normalizing imbalances and bringing a new prestige to the domestic spaces of households. Kaitilla (1993) in a study of residents' satisfaction with the housing unit as a distinct physical object in Papua New Guinea emphasized the issue of size, adequacy and privacy. The study found that, on the average, 6.5 persons lived in each house at a density of 2.4 persons per room.

This has serious implications for privacy, in the context of the referent society's socio-cultural norms. Kaitilla (1993) claims that in Papua New Guinea, the norms of traditional living patterns were based on segregation by sex and seniority. Kaitilla's study clearly demonstrates that architectural design solutions in Papua New Guinea generally followed a standard format which presupposes that all Papua New Guineans were homogeneous, with a fixed family size of six members. The study concludes that this situation was totally misleading and unrealistic in the context of Papua New Guinean socio-Cultural practices.

In the United States, the index of overcrowding of 2.0 persons per room was adopted as a norm in 1940. This figure was later lowered to 1.5 persons per room by 1950 and by 1960, it was 1.0 person per room (Myers, Baer & Choi, 1996). This standard of person-per-room was obtained by dividing the number of persons in the household by the number of habitable rooms in the dwelling space.

The regulation of maximum person-per-room ratio has, however, suffered inconsistencies in the way it was applied, as there is no scientific literature for choosing one measure of crowding over another. While, Johnson and Meckstroth, (1998), claim that most researchers regard a housing unit with more than one person-per-room as overcrowded, Morris and Winter, (1978) observe that the American Public health Association in its 1971 model housing code recommends 2.0 as maximum person-per-room ratio. Morris and Winter, (1978) further points out other ways that housing spatial needs have been measured and interpreted. These take into consideration the number of adults in the household, the ages of children in the household, and gender separation. Morris and Gladhart, cited by Morris and Winter, (1978: 98) interprets the situation as follows:

> *...no more than two people may share a bedroom and a bedroom is needed for the parental couple (or single parent); each child aged 18 or over; each pair of same sex children, at least between the ages of 9 and 17, whose ages differ by 4 years or less; each pair of children*

of any sex, both under age 9, whose ages do not differ by more than 4 years; each additional adult or couple.

The significance of room sizes was applied in the policies governing occupancy of dwellings in some municipalities in the United States, thus making it difficult for practitioners to adopt one particular approach. Nevertheless, some later studies have attempted to reduce the ambiguities associated with the indiscriminate setting of standards. Morris and Winter (1975), for example, introduced the idea of normative measures and room deficit in determining the adequacy of the number of people per room. Their study establishes that a household with fewer than the normative number of bedrooms is theorized to have a deficit and will make a housing adjustment, unless constrained by lack of resources. According to them, a housing deficit is a deviation above or below the family or cultural norm in housing situation. It is formally defined as:

$$\mathbf{a = b - c}$$

where **a** is the value of the housing deficit;

b is the actual housing conditions; and

c is the housing norm.

So far, it is obvious that there is neither a consensus nor a basis in the scientific literature for choosing one standard of sufficient living space over another. For many years, researchers have used indicators that counted all rooms in a household regardless of type and all persons in a household regardless of their relationship. In 1961, a report on "Homes for Today and Tomorrow" was published by the Parker Morris Committee of the Ministry of Housing and Local Government (MHLG). The standards in the report, which later became globally known as Parker Morris Floor Space Standards have served as a benchmark for regulation of space usage. The standards were obtained by adding up the spaces required for a number of activities considered as appropriate in the home, such as eating, sleeping and entertaining. The Standards were made mandatory for all Local Authority Housing in Britain between 1967 and 1981 (Adler, 1999; Madigan & Milner, 1999)

In South Africa, the norms and standards set out in the nation's housing code stipulates that the minimum size of a completed house shall not be less than thirty square metres. It further states that every room or space must have a dimension that ensures that such a space or room is fit for the purpose for which it is intended (Velayutham, 2004). The recommended standard in Tanzania is that every room shall have a minimum clear superficial floor area of nine square metres. An occupancy rate of 2.0 persons per habitable room for urban residential areas was also prescribed as an acceptable standard (Nguluma, 2003). The assumed composition of the average household was, husband and wife, two adults of the same sex, two children below the age of twelve of either sex, the average family size being four to six persons. Arrangements for sleeping were such that persons in a couple relationship usually had their own room; though sometimes they could share a room with children below school age, assumed to be seven years old.

Nguluma's empirical study, however, found that household sizes range from two to eleven before extension of the housing units; and four to seventeen, after transformation had occurred in the housing units (URT, 1978; URT, 2000; Nguluma, 2003). Additional alternative approaches have been suggested by the World Health Organization (WHO), the United Nations (UN), and other researchers in different countries. The goal of a decent apartment that meets the fundamentals of a healthful living formed the nucleus of a World Health Organization (WHO) Expert Committee proposal on public health aspects of housing. The following are some of the recommendations the committee expects each dwelling unit to fulfil, in the context of crowding:

i. A sufficient number of rooms, usable floor area and volume of enclosed space to satisfy human requirements for health and for family life consistent with the prevailing cultural and social pattern of that region, and so utilized that living or sleeping rooms are not overcrowded .

ii. Suitable separation of rooms as used for sleeping by adolescent and adult members of the opposite sex except husband and wife (WHO, 1988; Awotona, 1982a; Awotona, 1982b).

Similarly, the United Nations (UN) report on the use of space in dwellings proposed minimum floor space in square meters, in relation to family (WHO, 1988). Many studies on room sizes and occupancy standards in different countries are based on moral issues whereby adolescents and adult persons of opposite sex are not permitted to share bedrooms except they are husband and wife. The occupancy standard in Britain, which Nigeria largely adopted, was devised to take care of this moral perspective. Household structure and the number of bedrooms are considered, rather than the number of bed spaces (Table 2.1). Following this standard, a husband and wife are allotted one bedroom, just as every single person over 18 years and above.

All persons from 10 years to 17 years old, of the same sex are paired and allotted one bedroom. Any single person left over in this age range is paired with a child under age 10 of the same sex and allotted one bedroom. Those under 10 years old are paired and allotted one bedroom irrespective of sex (Awotona, 1982b). In addition to number and composition of persons in the household, and number of bedrooms, occupancy includes types of rooms and the total area of the dwelling in square meters. The British Housing Act 1985 specifies the minimum space standards for the number of people sleeping in them. These are: 6.50 square meters for one person, and 10.20 square meters for two persons. The Act specifies the number of persons allowed, based on number of rooms (Table 2.1).

Table 2.1: Minimum Space Standard specified by The British Housing Act 1985

Rooms	1	2	3	4	5 or more
Number of persons	2	3	5	7.5	2 for each room

In addition, minimum floor areas for the aggregate of cooking, eating and living areas (CEL) were recommended as shown in Table 2.2.

Table 2.2: Minimum Floor Areas for the Aggregate of Cooking, Eating and Living Areas (CEL)

Number of persons	1	2	3	4	5	6	7
CEL area (m^2)	22.0	23.0	24,0	27.0	30.0	33.0	36.0

Table 2.3: Housing Improvement Regulation's Space Standard, New Zealand

Room area in square metres (M^2)	**Number of persons**
Under 4.5	None
4.5 or more but less than 6.0	0.5
6.0 or more but less than 8.0	1.0
8.0 or more but less than10.0	1.5
10.0 or more but less than 12.0	2.0
12.0 or more but less than 14.0	2.5
14.0 or more but less than 17·0	3.0
17.0 or more but less than 20.0	3.5
20.0 or more	4.0
Every additional $5.0m^2$ above $20.0m^2$	One additional person

The computation of area of CEL in Table 2.2 excludes utility areas, staircases, hallways/corridors (Mayor of London, 2006; Australian Bureau of Statistics Year Book, 2005). In New Zealand, the 1947 Housing Improvement Regulation (HIR, 1947) stipulates the number of persons permitted to sleep in a bedroom as shown in Table 2.3. In all cases, no account shall be taken of a child under 1 year. A child 1-10 years counts as 0.5 units.

In Lagos, Nigeria, the State's Public Health Bye-Law of 1972 recommends room occupancy of two persons per room for a standard room size of 12.0 square meters based on standard dimension of 4.0 metres by 3.0 metres (Igwe, 1987). This conforms to the legal minimum space of two persons per room adopted in London during the 1970s (Dudgeon, 1996). The details of separation based on moral consideration were, however, not specified. Mayor of London (2006) claims that it is difficult to determine whether a dwelling is spacious or inadequate, without first establishing the occupancy to which it was designed and built. According to the author, a sensible assessment of the probable level of occupancy of a dwelling can be interpreted as the designed level of occupancy. The recommended levels of occupancy are given in Table 2.4.

Table 2.4a: Probable Level of Occupancy for Different Spaces in a Dwelling

Function	**2- bedroom**		**3- bedroom**			**4- bedroom**		
Occupants	3	4	4	5	6	6	7	8
Living room (m2)	13	13	14	14	16	16	17	18
Dining	5	5	13	14	16	6	7	8
Kitchen	6	7	7	7	8	8	8	8
Bedroom 1 (parents)	14	14	14	14	14	14	14	14
Bedroom 2	8	12	8	12	12	12	12	12
Bedroom 3	-	-	8	8	12	12	12	12
Bedroom 4	-	-	-	-	-	8	8	12

Some other studies on occupancy standards in Nigeria focused on Southwest geopolitical area. In a research on housing problems in Ibadan City, Onibokun (1981) recommended the following minimum standards:

> *The estimation of housing needs would be based on the standard that each bedroom will accommodate two adults (a couple) or 3 children (young people below marriageable age of same sex). Under this standard, in a single housing unit of four bedrooms and two living rooms, for example, two related married couples and their children can live in the housing units, or three married couples without dependants in the unit, or one married couple, one or two dependants and the old parents of the husband in a unit; or one married couple and one or two dependants in a two bedroom housing unit; or one old couple and the widows of their close relatives in a two to three bedroom housing unit.*

Onibokun's argument is that two people who are adults can live in a single room provided they are in a couple relationship. Also three children under the age of 16 years can share a single room, provided they are of same sex. He further recommended that room sizes should be 3.6 meters x 3.6 meters (that is, 12.96 square metres).

These variables have also been prescribed as far back as 1975 for use in Western Nigeria by the Town Planning Division of the Ministry of Lands and Housing, Ibadan, (Obateru, 2005). While Obateru agrees that no account should be taken of children under one year of age, he uses primary school as the bases for establishing the individuals that could be counted as one-half. The assumption is that the upper age limit for primary school is eleven years. Thus post-primary school pupils are regarded as adults, who are assumed to be more than eleven years old. Obateru recommended 1.0 occupancy rates for low-density areas, 1.5 for medium density and 1.75 for high density areas. These norms later became applicable in present day states of Ogun, Oyo, Ondo and Ekiti. Izomoh (1997) cited a 1980 situation in several Nigerian urban towns as illustrated in Table 2.5.

Table 2.4b: Room Occupancy Rate in Selected Nigerian Urban Towns
Source: Izomoh (1997), P.8.

Towns	Average number of persons per room
Lagos	4.2
Port Harcourt	2.4
Benin City	2.3
Warri	3.6
Kaduna	3.8
Kano	2.4
Ilorin	2.2
Ibadan	2.3
Enugu	3.8
Owo	1.6
Oshogbo	2.1
Sokoto	2.2
Jos	3.7

In the literature, three globally recognized indexes are most commonly used within housing and urban policy circles to discuss occupancy and crowing. These are the American Crowding Index (ACI) as developed by the United States Census Bureau; the Canadian National Occupancy Standard (CNOS), developed by the Canadian Mortgage and Housing Corporation; and the Equivalized Crowding Index (ECI), developed by Australian Bureau of statistics.

2.4.1 The American crowding index

This index was developed by the U.S. Census Bureau to measure crowding. It is operationalized as the number of usual residents in a dwelling divided by the number of rooms in the dwelling. Dwellings containing more than one person per room are classified as crowded while those with more than 1.5 persons per room are severely crowded. This measure of occupancy or crowding does not give consideration for the type of rooms in the dwelling. Also it does not make adjustments for the age and sex of the usual residents. Hence, it is criticized as being less detailed than both the CNOS and the ECI (Basavara, 1996).

2.4.2 The Canadian National Occupancy Standard (CNOS)

The CNOS takes into account, the short-comings of the ACI and is based on the number, sex, age, and inter-relationships of household members. According to Maani, Vaithianathan and Wolfe (2006), the CNOS identifies the number of bedrooms that are required but lacking, based on the number of occupants, their age and the gender of siblings. The CNOS is regarded as a standard measure for housing utilization. This measure assesses the bedroom requirements of a household by specifying that:

a. There should be no more than two persons per bedroom.

b. A household of one unattached individual may reasonably occupy a bed-sit (i.e. have no bedroom).

c. Couples and parents should have a separate bedroom.

d. Children under 5 years either of the same sex or opposite sex may share a bedroom

e. Children five years of age or over of opposite sexes should not share a bedroom.

f. Children less than 18 years of age and of the same sex may reasonably share a bedroom.

g. Single household members aged 18 years or over, and any unpaired children require a separate bedroom. (Basavarappa, 1996; Schuluter, Carter and Kokaua, 2007; Australian Bureau of Statistics year book 2008; Seeling, Milligan, Phibbs and Thompson, 2008).

Households living in dwellings where this standard cannot be met are considered to be overcrowded. The CNOS is widely used internationally as an indicator of housing utilization. CNOS shows how many people live in houses that require additional bedrooms. This standard was used as a basis to document that in 1971, one-in-twelve Canadian homes were overcrowded, or contained more than one person per room. This figure dropped to one-in-forty in 2001.

In Australia, the National Housing Strategy (NHS) of the early 1990s relied strongly on the CNOS in formulating its own standard. However while the Canadian standard emphasizes suitability, the Australian standard focuses on appropriateness (Batten 1999). According to Batten, suitability refers to a sense of the dwelling fitting the household whereas appropriateness contains an added moral dimension of housing that is proper for the household. NHS (1991a, 1991b) argues that housing may be quite affordable but inadequate and inappropriate with regard to size, quality and condition. In operationalizing these concepts, the Canadian occupancy standard follows the argument that household size defines only a minimum dwelling size (that is, a threshold of need) that if exceeded will no longer be considered important in a household's choice of dwelling. The Australian standard is seen as resulting from examining the logical converse of overcrowding. Hence the Australian standard highlights the possibility that people might be under utilizing their homes.

King (1994) remarks that it makes sense to define under-occupancy using the same measure used to define overcrowding. The Australian perspective is supported by arguments regarding the dual situation where some households live in overcrowded dwellings and others appear to have surplus space (Batten 1999). The Australian interpretation of CNOS has triggered researchers' interest in calculating the occupancy rates and applying it to identify households that are under-occupying their dwelling. In both Canada and Australia, the critical issue is the relationship between households and dwellings. The application of these standards sees under-occupancy and overcrowding as the converse of each other, thereby supporting the claim that the occupancy rate is a sufficient measure of space utilization. It also supports the argument that policies on housing standard should logically include the need for less space, where applicable. The Australian censuses show that a good proportion of one person households and two person households live in smaller dwellings and have done so since 1947. Smaller dwellings are defined as dwellings with one or two bedrooms. According to Troy (2002), this fall in average size of household is remarkable, yet about 50% of the housing stock consists of three bedrooms, while 25% are of the two bedroom type.

The demonstration of the existence of significant under-crowding at one end of the housing scale and over-crowding at the other end has been the focus of some studies in Australia since the 1970s and 1980s (King, 1973; Berry, 1977). Milne (1977) specifically applied this idea in a conference paper about public housing under-occupancy. Although all these scholars admit the veracity of popularizing under-occupancy, they tend to disagree with the standard of under-occupancy recommended by King (1973; 1994). King's standards of under-occupancy (as cited in Batten, 1999) are: (a) one person occupying five rooms is over-supplied, (b) two persons occupying six rooms are over-supplied, (c) thereafter a supply of one extra room for each person is an over-supply.

This Australian version of estimating under-crowding incidences does not command universal acceptability as the Canadian National Occupancy Standard. The reference of CNOS to minimum people per bedroom clearly represents a measure of under utilization.

2.4.3 Equivalized Crowding Index

The Equivalized Occupancy or Crowding Index applies the concept of the adult equivalent. The consideration is that adults require separate bedrooms. In applying this formula, each individual who is in a marital relationship is rated as one-half, as well as children aged less than 10 years (Morrison, 1994). The following formula is applied:

$$\left\{\begin{array}{l}\textit{Equivalized}\\ \textit{Crowding Index}\end{array}\right\} = \left\{\begin{array}{l}\tfrac{1}{2}\textit{ (children under age 10}\\ +\textit{ (Number of couples)}\\ +\textit{ (All other people age 10}\\ \quad\textit{and over)}\end{array}\right\} \div \left\{\textit{Number of bedrooms}\right\}$$

Any value greater than 1.0 represents overcrowding. The above equation gives an equivalized number of people per bedroom (Iweka, Adebayo & Igwe 2009). A closely related approach was established by "The Statistics New Zealand" to compute an equivalized crowding index. The following formula was applied:

$$\left\{\text{Crowding Index}\right\} = \left\{\begin{array}{l} \tfrac{1}{2}\text{ (children under age 5} \\ +\ \tfrac{1}{2}\text{ (females ages 5 -- 17)} \\ +\ \tfrac{1}{2}\text{ (males ages 5 -- 17} \\ +\ \text{(Number of couples)} \\ +\ \text{(All other single people} \\ \quad \text{age 18 and over)} \end{array}\right\} \div \left\{\begin{array}{l} \text{Average Number of} \\ \text{bedrooms Per} \\ \text{household} \end{array}\right\}$$

Any value greater than 1.0 represents overcrowding.

It is obvious that there is no consensus in defining the point at which a dwelling may be considered crowded, thus raising issues of subjectivity. The present research, however, focuses on the variables contained in these three indexes, because they are consistent with the recommendations of the United Nations, and have also been used in many countries. These measures take into account the ages, sex, and relationship, as well as other household characteristics, relative to size of the rooms.

2.5 MULTIFAMILY HOUSING

2.5.1 Nature and Types of Multifamily Housing

Zietz (2003), Jabareen (2005), and other authors agree that single family housing is by far the preferred type of housing across all income groups in many countries. Zietz (2003) further asserts that the popularity of multifamily housing as a housing choice is growing fast due to improvements in overall quality of the new units of multifamily housing available. Zietz also attributes the popularity of multifamily housing to changing household demographics. According to him, 25% of all households in the United States of America live in multifamily housing. This view about quality or desirable feature is consistent with the notion that many residents are satisfied with multifamily housing if the units provide amenities like privacy, protection, outdoor space, and the option to purchase the unit. Colton and Collignon (2001), on the other hand, argues that the nature and composition of multifamily housing can best be understood if researchers' attention goes beyond the simple distinction between single family and multifamily housing.

Different organisations or agencies define multifamily housing differently, and this tends to create some confusion. However, most of the definitions are purely based on the structure type. The National Association of Home Builders (NAHB) regards a multifamily home as a building that contains two or more dwelling units. Another definition is used by the United States Congress for legislative and regulatory purposes to enforce the requirements for the design and construction of multifamily housing as contained in the Fair Housing Law of 1988. The operational definition by Congress for multifamily housing is any project that contains four or more units that includes condominiums, apartments, and single storey (Zietz, 2003).

This definition by the United States Congress varies slightly with the one adopted by the United States Department of Housing and Urban Development (HUD), and the one used by the Bureau of Census. A document released by HUD defines a multifamily mortgage as a loan secured by a property that has five or more dwelling units including cooperatives as well as rental units (Colton & Collignon, 2001; Zietz, 2003). Closely related to the HUD's definition is that of the Bureau of US Census which regards multifamily housing as five or more units contained within a single building (Van Vliet, 1998; Hyun-Jeong, 2005). Conversely, among earlier researchers, Kain (1980) classifies dwellings as single-family, two-family and multifamily.

A common theme with all the definitions is that there is no upper limit. An obvious ambiguity emerges in an attempt to focus on a particular segment of multifamily housing. It becomes necessary therefore to contextualize such concepts as walk-up buildings and high-rise buildings. Multifamily dwellings can be configured in the form of three to four floor walk-up buildings for the purpose of achieving medium or high density low rise scale of urban housing. A major determining factor for choosing four floors (that is, three storeys) as the limit was the stair (Zietz, 2003). Stairs usually serve a function of providing access to the dwelling units sharing one stair landing. Medical opinion also considers three flight of stairs maximum for healthy adults. Similarly, scholars in the field of behavioural studies agree that occupants of vertically stacked floors become disengaged from the ground level once the building exceeds three to four floor levels. They further maintain that once this limit is exceeded, residents will start experiencing problems such as anonymity, indifference, fear for safety, loneliness, lack of community interest and insecurity towards natural process in general (Zietz, 2003).

In addition, (Larco, 2009) agreed with the definition that a walk-up multifamily dwelling should typically consist of three to four floor levels. He, however, added that such buildings should normally come without elevators, often have an entry for every unit and includes associated parking and open spaces.

Larco (2009) further contended that land costs, rental rates and construction costs are factors why multifamily walk-up dwelling units are rarely less than three floor levels. Again, due to the requirements for fire safety and building codes, the four-floor level is rarely exceeded.

Some other authors have interpreted the use of height for classifying multifamily housing differently. Kelly (2003) grouped multifamily dwellings units into three categories:

i. Low-rise, defined as buildings with one to four floor levels,

ii. Mid-rise defined as buildings with five to nine floor levels, and
iii. High-rise as buildings with ten or more floor levels.

Following a similar approach, Vliet (1998) also identified three groups of multifamily housing. These include:

i. Garden apartments (also called garden density) which refer to buildings that have two or three floor levels,
ii. Mid-rise buildings, which refer to multifamily buildings that have four to eight floor levels,
iii. High-rise buildings defined as buildings with nine or more floor levels.

This appears to clarify his earlier ambiguous definition of high-rise as buildings higher than safety ladders can reach, higher than 50 feet (15.3 metres), higher than four levels, higher than six levels and higher than eight levels (Vliet, 1983). Generally, Vliet's classification bears some correspondence with that of Kelly.

Further indications of the use of specific architectural design parameters for categorizing multifamily buildings types have been recorded in the literature. Lee (2005) used the number of bedrooms and the number of floor levels in a dwelling unit as distinguishing factors. According to the scholar, a multifamily dwelling unit can be referred to as efficiency/studio, one-bedroom apartment, two-bedroom apartment, three-bedroom apartment, four-bedroom apartment or five-bedroom apartment, based on the number of bed rooms in the unit. On the other hand, applying the criteria of number of floor levels in specific dwelling units De Chiara, Panero, and Zelnik (1995) classified multifamily housing as:

i. Simplex apartments/flats, which have all rooms at one level
ii. Duplex apartments which have all rooms on two levels
iii. Triplex apartments which have rooms on three levels.

The duplex or triplex types are normally designed in such a way that the living room, kitchen, and dining area are usually located on the lower level while the upper level accommodates the sleeping area. The two zones are connected by an interior private stair. Lee (2005) provided additional criteria for classifying multifamily buildings. Using an elevator as reference point, Lee indicates that a multifamily housing can either be a walk-up or elevator apartments. The floor plan arrangement can also be used as a basis for classifying multifamily buildings. Such buildings can be:

i. Centre-corridor type indicating that the plan has apartments on both sides of the corridor
ii. Open-corridor type, indicating that the plan consists of an exterior corridor serving as a single line of apartments.
iii. Tower plans, referring to plans that have central cores with staircases or elevator lobbies, and apartments arranged around the core.

According to Lee (2005), centre-corridor and open-corridor plans are favoured by developers for reasons of economy. The two types are considered economical in terms of their space usage, since they permit the maximum number of dwelling units per floor, and because it is possible to extend the length of building. However, Lee (2005), points out that these two plan types have disadvantages from the residents' perspective. According to him, the long corridors in such buildings prevent some units from having good access to the staircase or elevator. In addition, residents' privacy is adversely affected due to movement of people in front of some dwelling units. Short circulation corridors are therefore recommended, as having the same advantage as a tower plan type. Lee (2005), however, asserts that tower plans have a major disadvantage in the sense that only a limited number of dwelling units (four to six) can be attached to a core.

The shape of the building has also been used to classify multifamily buildings such as three-wing plans (Y-plan), cross plans, five-wing plans, circular plans and so forth.

2.5.2 Demographic and Occupancy Issues in Multifamily Housing

Occupants of multifamily dwelling generally comprise people from all ages, life stages and income levels. According to Larco (2009), this contradicts the notion that regards this type of housing as a stigma for low-income households. Larco further contends that multifamily housing is actually a choice selected by individuals based on their lifestyles and stage in the life-cycle. He also recognizes that this multifamily housing is attractive to specific demographics like young singles, couples without children, the elderly, and the divorced because it is affordable and does not require much maintenance.

Similarly, Colton and Collignon (2001) observed that the traditional stereotype which links multifamily housing to low-social class has been challenged by the growing number of professional and empty nester households that inhabit this housing type in different locations.

Other researchers like Nadji (1997) and Zeitz (2003) also agree that an ageing population, lifestyle and income levels tend to facilitate the current desire for multifamily dwelling units in the United States of America. According to them, the inclination of many American households to elect multifamily complexes as their residence is ascribed to their busy lifestyles and the desire for freedom from the responsibility of maintenance costs and repair time, the mobility of the work force and the convenient location of most of the complexes.

A common finding from many studies in the past is that lack of internal spaces in multifamily residences was a disliked feature by occupants (Michelson, 1977; Morris and Winter, 1978; Vliet 1983). However, Colton and Collignon (2001) assert that the potential space constraint may have become less severe in recent years due to improved designs, new technologies, increased amenities and a focus on resident satisfaction.

In Australia, previous perceptions classified multifamily housing as possessing inferior quality and suitable only for the socially disadvantaged. Recent studies by Urban Design Advisory Committee (2000) have shown evidence of increased demand for multifamily housing units. The study estimated that multifamily dwellings constitute over 50% of the total number of dwelling approvals in Sydney for each of the past five years. According to the study, this increase is justified by the changing social structure of the society. This is evident in the preponderance of smaller household sizes, late marriages, women active in workforce, an ageing population, etc. These types of people usually demand high quality, dwelling units in places close to public transport, with good amenity and easy access to work and recreation.

Thus, where there is aversion to multifamily housing, it is more an objection to the lack of amenities rather than an objection to the multifamily aspect of the housing.

2.5.3 Multifamily Dwelling as a Housing Choice in Public Housing Developments

Most previous researchers on housing choice, particularly in the United States point out that home ownership of a single-family detached house is the dominant choice (Joint centre for Housing Studies of Harvard University, 2003; Morris & Winter, 1978; NAHB, 2004). This type of housing choice provides a wide range of benefits for certain segments of the population looking for affordability and flexibility (Joint Centre for Housing Studies of Harvard University, 2003).

Goodman (1999) describes multifamily as the second highest favoured housing choice in America. NAHB (2004) also estimates that 25% of all households in America live in multifamily housing. These households comprise people from different socio-economic groups.

Among occupants who chose multifamily dwellings as their housing type, some have a choice, but others are influenced by their circumstances (Gleason, Bogdon, & Lang 1999; Kelly, 2003). While

40% of multifamily residents choose their housing for reasons other than their financial situation, the rest acknowledge that they choose theirs due to convenient location, freedom from responsibility for maintenance and repair, and affordability (NAHB, 2004).

Goodman (1999) states that residents who choose to live in multifamily housing on personal volition are regarded as life-style renters. On the other hand households can choose their multifamily housing on account of compelling circumstances. Goodman identified some of such circumstances as financial difficulties, households who need to move frequently, due to the demands of their jobs or school. Goodman compared renters by choice with renters by circumstance and concluded that renters by choice tend to have much higher incomes than renters by circumstance. Kelly (2003) further argued from managerial perspective that renters by choice are likely to stay longer, cause fewer problems, and make better residents. In addition, Goodman identified other characteristics associated with households who willingly choose to occupy multifamily housing:

1. They are old enough to be established in the labour force and do not have to move every year or two for reasons of job or school. About 87% of all multifamily dwelling unit renters are aged twenty-five years or above.
2. About 69% of all apartment renters are households of married couples that do not have children under age eighteen.
3. They have enough income to buy a house and may previously have been owners.

Multifamily housing types have also been recognized for the role they play in creating more liveable urban communities. Colton and Colignon (2001) established a number of factors which encourage households to choose multifamily housing. This includes a more efficient use of infrastructure and service delivery arising from location advantage closer to employment centres, public transportation and neighbourhood services. Multifamily housing also creates the required densities that can support public transit and equally lead to less energy consumption per capita. In addition, Haughey (2003) remarks that due to the compact form of multifamily development, consumption of other public infrastructure like roads, sewer and water pipes, as well as electricity are minimized. This in turn creates efficiency in land use, making it possible to preserve open spaces (Haughey, 2003).

2.5.4 **Home Spaces and Habitable Rooms in Multifamily Apartments**

Home space in the context of this study represents all interior spaces within each housing unit in LSDPC's multifamily residential development. In this research, the interior spaces of the physical structure of LSDPC apartments are the primary focus. Each single interior space is typically referred to as a room. According to Li (2003), rooms can be classified into five categories of spaces, based on the functions and activities that take place in them. These are: (a) living, (b) work and study, (c) resting, (d) service and (e) circulation. Li further grouped living, work and study, and resting spaces as primary spaces while service and circulation spaces are regarded as support spaces. He also identified the features associated with these spaces as follows:

1) The primary spaces – this space usually include living room, family room, kitchen and dining room. These are the spaces where the family spends most of its time. Living activities usually consist of household gathering, entertainment, cooking and eating. Also activities such as sleeping, relaxing which can take a long time utilize primary space. The space for work and study may be utilized for activities like reading, writing, and using computer. Some housing units may have a separate room for work and study activities such as a library, a study room, or a home office. Resting activities include sleeping, bathing, and other activities that are private.

2) The support spaces – these are made up of service space and circulation space. The service space consists of storage spaces such as closets, pantry, laundry room, garage and utility room,

which provide the necessary support to all other home spaces. The circulation space, on the other hand provides a means of linking other spaces within the home. The principal function associated with circulation space is movement among and between other spaces. Such spaces ordinarily include corridors, foyers, and stairs. All support spaces are outside the scope of the current study.

Li's description of primary spaces agrees with the definition of habitable rooms given by Obateru (2005). Obateru described habitable rooms as spaces that normally serve the functions for sitting, sleeping, eating, studying or recreation. However, while Li (2003) included kitchens as part of primary spaces for work, Obateru, (2005) defined kitchens as habitable rooms. Again Li integrated bathrooms and closets into the primary spaces reserved for resting, whereas Obateru excluded the same spaces from being classified as habitable rooms.

The present study accepts Obateru's position on kitchens. Thus kitchens were regarded as habitable rooms. This position was justified by Asquith (2006), who argued that apart from cooking and eating, a kitchen may also be used for many other purposes like working, homework, playing, entertaining, hobbies and talking. The bathrooms and closets were not regarded as habitable rooms in this study.

The Office of the Secretary (2007) cites The Housing Regulation of the District of Columbia's recommendation for determining occupancy, strictly on the basis of combined floor area of all habitable rooms and the number of persons. The report stipulates the following occupancy requirements:

i. A minimum of 12.08 square metres of floor area in habitable rooms for the first occupant of the apartment.

ii. A minimum of 8.36 square metres of additional floor area in habitable rooms for each additional occupant of the apartment up to a total of seven (7) occupants.

iii. A minimum of 6.97 square metres of additional floor area in habitable rooms for each additional occupant of the apartment if the apartment is to be occupied by more than seven (7) persons.

The report further stipulates a specific requirement for a habitable room area that could serve for sleeping purposes only. For a single occupant such a habitable room used for sleeping shall have a minimum of 6.50 square metres, while each habitable room used for sleeping by two (2) or more occupants shall contain a minimum of 4.65 square metres per person. These variables and the relationships recommended in this report were adopted in analyzing the data for the current study.

2.6 POST-OCCUPANCY EVALUATION (POE)

This section examines the key components used by earlier researchers to interpret how constructed facilities perform during occupancy. Also, the terminology, definitions and goals of POE are discussed. In addition, the section chronicles the evolution of formal POE, and highlights the advances in theory, method, strategy, and benefits of POE.

2.6.1 Building Performance Evaluation

A historical approach to identifying indicators and setting priorities on building performance was established many years ago by the Roman architect Vitruvius in the 1960s. He theorized that there are three categories for evaluating building quality, namely firmness, commodity and delight. Other authors operationalized these postulations into 'habitability framework' (Preiser, 1983; Vischer, 1989). The three levels of priority are delineated as follows: a) health, safety and security performance, b) functional, efficiency, adequate spaces and work flow performance, and c) psychological (that is privacy, sensory simulation), social, cultural and aesthetic performance.

The performance-based concept is hinged on the fact that the basis of all building activities should be the performance of the building in use. Performance based requirements should be such that can be objectively verified to ascertain that they have been met. The requirements are concerned with what a building is expected to do. Vischer (2006) claims that in evaluating buildings, it is customary to refer back to the design objectives or programme goals to determine whether or not the building as it is being used has met these goals and objectives.

Ecomart (2007) reports that building performance evaluation assesses a building’s performance from diverse aspects like energy and water consumption, acoustic performance, thermal comfort, lighting and air quality. The exercise usually takes place between one and five years after construction and establishes the extent to which a given building has met its design goals. Ecosmart further distinguishes between building performance evaluation and full building audit. Audits essentially concentrate on one or two elements of a building’s performance; for example, its mechanical and electrical systems; and carrying out an elaborate evaluation of each piece of equipment relating to those elements. Though a building performance evaluation may be combined with full scale audit, it is essentially designed simply to provide an overview of how the building is performing, compared to its design goals.

Evaluating the actual performance of occupied buildings as compared to their design goals can be achieved through quantitative or qualitative approach. Preiser (2002) classified quantitative aspects to include lighting, acoustics, temperature and humidity, durability of materials, as well as amount and distribution of space. He also categorized the qualitative aspects as ambience of space, aesthetic beauty and visual compatibility with a building’s surroundings. He asserted that the qualitative dimension is an elusive domain since it is more difficult, subjective and less reliable than the quantitative dimension.

Addressing these total building performance issues demands an integration of technical and behavioural disciplines. Through this approach, it becomes possible to understand and highlight which of the building features are operating optimally, and which features have the potential to be enhanced. These judgements are usually based on responses from building occupants about each of these aspects.

2.6.2 Types of Evaluation for Building Projects

Evaluations of buildings or other constructed facilities may have its genesis in any phase of the project's life-cycle, ranging from planning, programming, design, construction and occupancy. Such evaluations range from technical to operation management. Preiser (2002) points out that technical tests often respond to questions relating to materials, engineering or construction of a building. He also contends that technical tests are normally employed when evaluating some physical systems against relevant engineering or performance criteria. He nevertheless, maintains that even though technical tests could result in better and safer buildings, they do not evaluate such buildings from the point of view of occupants' needs and goals. In addition to technical evaluations, he also established the existence of other types of evaluation that focus on issues relating to operations management of a facility, such as energy audits, maintenance and operation review. Though these forms of evaluation are not classified as post-occupancy evaluations (POE), the questions they address are similar to the ones POE addresses.

Moro, (1991), on the other hand, examined three evaluation types from the construction project life-cycle in detail:

(1) ***Value Engineering*****:** Value Engineering (VE) has become recognised as a feed back process that aims to intentionally re-examine design proposals during the early phases of a project. The focus of VE is on life-cycle cost, and is generally confined to the design phase.

(2) ***Constructability (or, Buildability):*** Constructability is defined as the application of a disciplined, systematic optimization of the construction-related aspects of a project during the planning, design, procurement, construction, test and start-up phases by knowledgeable, experienced personnel who are part of a project team (Morro, 1991). Constructability provides opportunities to integrate construction knowledge and expertise into early planning and design, hence facilitates the bridging of traditional gap between engineering and construction. The focus of constructability is on all evaluations that emanate from the construction phase of a facility's life cycle.

(3) ***Post-occupancy evaluation (POE):*** POE represents all evaluations in construction that occur during the operational and maintenance phase of a facility's life-cycle. It can however, be applied in almost every phase. POEs are generally employed to determine the effectiveness of a facility's design and construction. A POE, by definition, occurs after a facility's completion. Lessons learned from POEs are usually too late to integrate back into the same facility, but are potentially useful in the planning, design and construction of subsequent facilities and structures.

POE is distinguishable from other technical types of evaluations. POE focuses on questions that relate to the needs, activities and goals of the people using a facility while other technical tests assess the building and its operations regardless of its occupants (Preiser, 2002). The criteria used for POEs are generally derived or inferred from the functional programme or documented design intent. Building performance indicators for POE include acoustic and lighting levels, adequacy of space, and spatial relationships (Preiser, 2002). The focus of the present research was on adequacy of space and spatial relationships in LSDPC's multifamily housing units, from the occupants' perspective.

The study measured the functionality and appropriateness of designed spaces in LSDPC's apartments. In its strictest sense, the study analyzed the performance of the designed spaces in terms of dwelling density and then compared the results against an inferred specification of design density, with a view to ascertaining compliance with required performance

2.6.3. Terminology and Definition of Post-occupancy evaluation (POE)

Over the years, several theorists and practitioners have faced ambiguities in an attempt to interpret the term POE. Zimring (2002b) claims that the literal meaning of the term appears to imply that POE takes place after occupants have eventually evacuated the building. He also argues that POE is executed at one single point in the process. Other researchers have attempted to suggest what they considered to be more appropriate terms. Vischer (1996) suggests the term "environmental audit" or "building-in-use assessment". About the same period, terms like "building evaluation" and "building performance evaluation" have also been recommended (Baird, Gray, Isaacs, Kernohan, McIndoe, 1996).

These views were intended to portray POE as an assessment that occurs after the occupants have inhabited the building for a period of time. The views were equally intended to highlight the contrast between POE and some other types of assessment such as value engineering that reviews designs and plans prior to construction. This diversity of opinions seems to provide justification for the prevalence of various definitions of POE in the last few decades.

Zimring and Reizenstein (1980), cited in Khalil and Husin (2007), defines POE as examination of the effectiveness of occupied design environment for human users. Vischer (2002), on the other hand, vaguely defined POE as any and all activities that originate out of an interest in learning how a building performs after it has been constructed, including if and how well such a building has met expectations and how satisfied the users are with the environment that has been created.

Another perspective to the definition of POE was offered by Presier et al (1988) and Preiser (2002). POE is the process of evaluating buildings in a systematic and rigorous manner after such buildings may have been erected and inhabited for some time. In a more recent exposition, Zimring (2002) recommended that POE be defined in line with the definition of programme evaluation by Weiss (1997). Zimring consequently described POE as the systematic assessment of the process of delivering buildings or other designed settings, or of the performance of those settings as they are actually used, or both, as compared to a set of implicit or explicit standards, with the intention of improving the process or settings. In recommending this definition, Zimring further explained three key aspects:

1. Systematic implies that POE follows a distinct accepted methodology developed for POE or derived from allied disciplines like social science, building science, architecture, planning, etc. The approach can be either quantitative or qualitative.

2. The focus of POEs is on buildings that are actually in use. This makes it possible for performance to be evaluated. Thus POE is seen as being complementary to other activities and practices like programming, building modelling, pre-occupancy evaluation and others.

3. The ultimate aim of POE is to improve the built environment.

The present study adapted the POE definition given by Zubairu (1994). According to her, POE refers to the measurement of the functioning of building in use, with respect to the goals of the designers, and the feelings of the users. There are arguments that statements of expected performance of buildings could be embedded in programmes that serve as decision-making process for architectural designs. For some public-sector housing agencies such as Lagos State Development and Property Corporation (LSDPC), POE is a mechanism for linking, the experiences of users of occupied buildings with the goals of the designers. The occupancy-ratio (or, dwelling density) of a building is seen as one major aspect of public housing that designers have serious responsibility to establish right from the preliminary design. Understanding the occupancy-ratio as a design criterion will help in predicting the effectiveness of emerging designs and reviewing completed designs (Carthey, 2006). The goal is to make improvements in public housing design, construction and delivery. In addition, Preiser (1995) asserts that POE is highly beneficial to organizations with recurring construction programmes, or with a significant volume of facilities that need remodelling. The present study that focused on LSDPC would therefore be of immense benefit to the organization as it provides a mechanism for linking feedback on existing multifamily prototype apartments with pre-design decision-making.

2.6.4. Evolution and Development of Post-occupancy evaluation (POE)

Initial POE efforts were focused on addressing problems related to housing needs of disadvantaged persons and enhancing the quality of public housing (Vischer, 2002). In the 1970s major leaps in POE studies were witnessed. Vischer points out that courthouses, prisons and hospitals were identified for evaluation. Preiser, Rabinowitz and White (1988) equally note that during the same period, offices and schools became the targets by POE researchers in Great Britain. The period of 1960s and 1970s, witnessed the emergence and acceptance of research methods and tools from several fields in POE. During the period also, a wide variety of building types and occupant types were identified for systematic study. A large body of knowledge were generated in the process, resulting in the development of certain design guides and standards (Preiser, 2002). The progress recorded in the 1970s facilitated the growth of POE into a discipline on its own right during the 1980s.

Zimring, Wineman and Carpman (1988) state that POE originated in academically based studies in the 1960s and 1970s. Similarly, some other authors claim that the practice of POE in the 1960s and 1970s were largely restricted to individual case studies of public housing and student housing sector in Britain, France, Canada and US (Vischer, 2002; Khalil & Husin, 2009). These views agree with that of Rabinowitz (1989) who asserts that by the 1970s, POE results were already being applied at a commercial scale by government agencies in the United States (US). In New Zealand, Joiner and Ellis (1989) reports that the New Zealand Ministry of Works and Development (MWD), (Now Works and Development Services Corporation (N.Z Ltd) began developing techniques for POE of government designed buildings in 1979. The action was necessitated by the quest by the New Zealand government to improve the design quality of public buildings by establishing an appropriate data-base that will contribute to policy for future designs.

Zubairu (1994), however, holds the view that POE actually developed into a discipline of its own in the 1980s. At that time, POEs in most advanced countries had gone beyond the traditional concerns of addressing user responses to building; to also include issues of energy usage, thermal performance, ventilation, illumination and other factors (Public Works, Canada, 1983).

This is in contrast to many of the earlier POE endeavours which focused on low power vulnerable groups, in an effort to give them a voice in the design process (Zimring, Wineman & Caprman 1988). In addition such earlier approaches were intended to make the design process self-improving so that systematic feedback about the effectiveness of buildings and designs would contribute in improving subsequent buildings (Zimring, Wineman & Carpman, 1988).

2.6.5. Levels of Post-occupancy evaluation (POE)

Researchers have struggled for many years to categorize the levels of efforts involved in POEs. Currently three levels of POE have been identified. These are (a) indicative POE, (also referred to as Walk through" POE), (b) investigative POE, and (c) diagnostic POE (Preiser, Rabinowitz, & White, 1988; Rabinowitz, 1989; Zubairu, 2000; Preiser, 2002, Zimring, 2002a; 2002b). Each level requires progressively greater resources to complete and subsequently produces more detailed and technical reports. A further elaboration on these classifications is important.

Indicative POE leads to an awareness of issues in building performance. It is generally carried out within a very short range of time, from two or three hours to one or two days. Typical methods of gathering data in an indicative POE include:

(i) Archival records and documents such as "as-built drawings" of the facility to be evaluated are obtained and analyzed. In addition, space utilization schedules, remodelling and repair records, or any other historical/archival data that may be pertinent are also obtained and analyzed.

(ii) Performance issues that deal with technical building, functional appropriateness (adequacy of space, health, safety and security issues) and behavioural or psychological concerns such as the "image" of the facility.

(iii) Walk-through evaluation based on a discussion with management could be conducted covering the entire facility and addressing the issues raised by management. This approach relies mostly on direct observation and still photography to identify issues that may require attention.

(iv) Interviews with selected personnel that are acquainted with the facility may also be used to obtain more information for an indicative POE.

An investigative POE provides a thorough understanding of the causes, and effects of issues in building performance. It is more complex, and consumes more time as well as resources when compared to an indicative POE. An investigative POE is usually carried out after an indicative POE has identified issues requiring additional investigation, either in terms of a facility's physical performance or the occupants' response to it. Although the major ways to conduct investigative and indicative POEs are identical, the level of effort required for an investigative POE is higher than that for an indicative POE. Unlike the indicative POE, the investigative POE uses criteria that are objectively and explicitly stated. Again, the investigative POE covers more details and engages more sophisticated data collection and analyses techniques. It also has higher degree of reliability.

For investigative POE, simple, descriptive, statistical techniques can be employed to analyze the data. The analysis of data is based on fact rather than on the intuition of the evaluator or building occupants. In this type of POE that typically deals with one case, the analysis yields information that is primarily applicable to the project context and is not usually generalizable.

A diagnostic POE is the comprehensive and in-depth type of investigation that requires a higher level of effort than both the indicative and investigative types of POE. It uses many methods for evaluating building performance. This explains why it is usually referred to as a multi-method strategy. This multi-method approach allows for convergence of results, which lend validity to a POE study. An important goal of a diagnostic POE is to provide an understanding of the relationships between variables (physical, environmental and behavioural) so as to predict building performance for a more generalized building type (Preiser, 1988). These investigations rely on more sophisticated data collection and analysis involving questionnaires, surveys, observations and physical measurements. The diagnostic also takes longer time ranging from several months to one year or longer to complete. The results and recommendations are long term oriented, aiming to improve not only a particular facility, but also the state of the art in a given facility. In the diagnostic POE, data collection and analysis techniques are more sophisticated than investigative and indicative POEs.

Diagnostic POE is usually associated with the creation of new knowledge regarding building performance (Preiser, 2002). Zimring, (2002a) stresses other aspects of diagnostic POE. According to Zimring, diagnostic POEs can help determine the sources of problems or controversies surrounding a building and suggest ways such problems can be prioritized. For example, the San Francisco Central Library opened in 1996 was an architectural landmark, but aroused controversies among the users and other stakeholders. There were complaints by the public that it was difficult to locate books and other services. On their part the staff also complained that it was difficult to manage materials. As a result, the mayor set up an audit commission that recommended a POE. The POE team conducted focus group meetings with staff and users. The team further observed the use of the facility and analyzed records. A number of serious problems were discovered. The configuration of the spaces made operations difficult. Related books were scattered among several buildings and much staff time was spent finding and retrieving them and some were damaged in transit. The POE diagnostic report recommended a multi-phase renovation to reorganize the interiors (Zimring, 2002a). In another example, an office building designed by Hugh Stubbins and Associates was discovered to be stuffy and hot. Following a diagnostic POE, it was found that the ductwork had never been connected by the heating contractors. The problem was thus resolved to the clients' satisfaction (Zimring, 2002a).

At the level of diagnostic POEs, cross-comparisons of building types are made, requiring representative samples. Therefore more elaborate statistical analyses are carried out. Several quantitative and statistical analytical techniques are more prevalent in diagnostic POE studies. These include averages and measures of central tendency, percentages, measures of variability and standard deviations. More statistical techniques are also employed in diagnostic POEs in the following areas: comparing two groups, simple analysis of variance, chi-square analysis and correlation analysis.

Following these three levels of categorization, the present study focused on using indicative POE for the pilot study. A combination of investigative and diagnostic POEs was used for the main study. This is because the research aimed primarily to identify whether people were using the spaces in LSDPC's multifamily apartments the way the designers programmed them to.

2.7 SUMMARY OF THE FINDINGS

The review of the literature revealed a number of variables and options for dwelling density computation that were adapted to determine the post-occupancy performance of spatial provisions in LSDPC's apartments. These are described below:

2.7.1 Number of Habitable Rooms

The consideration is that every adult equivalent requires a separate room. This assumes a crowding index of 1.0.; that is:

(Number of rooms) multiplied by (1.0) = Number of adult equivalent occupants.

This means that number of rooms is equal to the number of adult equivalent occupants.

However, other recommendations that could be applied to Nigeria are as follows:

(i) Obateru's recommendation for Western Nigeria, specifying an occupancy index of 1.5 for medium density; 1.75 for high density; and 1.0 for low density. This recommendation implies that the number of adult equivalent occupants can be computed thus:

Medium density, **(Number of rooms) multiplied by (1.5) = (Number of adult equivalent occupants)**

High density, **(Number of rooms) multiplied by (1.75) = (Number of adult equivalent occupants)**

Low density**, (Number of rooms) multiplied by (1.0) = (Number of adult equivalent occupants)**

(ii) Federal Government of Nigeria's accepted standard of 2.0 persons per room. This implies that **(Number of rooms) multiplied by (2.0) = (Number of adult equivalent occupants).**

(iii) The specification by the British Housing Act (1985) also provided a useful guide for this study. It states that a house of one habitable room can accommodate an equivalent of two adults, while two habitable rooms can take three adult equivalents. Similarly, a house of three habitable rooms can accommodate five adult equivalents, while a house of four habitable rooms can take 7.5 persons. Any additional room in excess of four requires two more adult equivalents for each room.

This study adopted Obateru's indexes. The high density group were taken to be equivalent of low income while the medium density group were regarded as medium income. The indexes of 1.5 and 1.75 were considered relevant for government-sponsored housing which is the context in which public housing was discussed in this research. Thus for the low income housing estates at Abesan, Dolphin II and Iba, an index of 1.75 was applied in estimating the dwelling density. Similarly, an index of 1.5 was applied in the medium income estate at Ebute-Metta chosen for this study.

2.7.2 **Combined Area of Habitable Rooms Measured in Square Metres**

The literature identifies two approaches in this aspect, which can be applied to the present study through extrapolation (see Tables 2.5 and 2.6.)

Table 2.5: Relationship between Combined Area of Habitable Rooms and Number of Persons

Combined area of habitable rooms in M^2	Adult equivalent occupants
12.08	1
20.44	2
28.80	3
37.16	4
45.52	5
53.88	6
62.24	7
69.21	8
76.18	9
83.15	10

Table 2.6: Maximum Number of People Permitted to Sleep in Rooms of Various Sizes

Source: adapted from New Zealand's Housing Improvement Regulation Standard, 1947

Area in square metres	Adult equivalent number of occupants
Less than 4.0	0
4.5 - 5.9	0.5
6.0 – 7.9	1.0
8.0 – 9.9	1.5
10.0 – 11.9	2.0
12.0 – 13.9	2.5
14.0 – 16.9	3.0
17.0 – 19.9	3.5
More than 20.0	4.0
Every additional 5.0 m^2 above 20.0 m^2	One additional person

2.7.3 **Aggregate Area of Space for Cooking, Eating and Living (CEL)**

This computation focuses on the combined floor areas for three activity spaces – cooking, eating and living (Mayor of London, 2006). In the current study, these activity spaces were defined as the kitchen, the dining and the living rooms. Table 2.7 was derived from the recommendation of Mayor of London (2006).

Table 2.7: Aggregate Area of Space for Cooking, Eating and Living (CEL):

Aggregate area (CEL) in square metres	**Number of adult equivalent occupants**
22.0 – 22.9	1
23.0 – 23.9	2
24.0 – 26.9	3
27.0 – 29.9	4
30.0 – 32.9	5
33.0 – 35.9	6
For every additional 3 m^2 of space	One additional occupant

2.7.4. **Bedroom Spaces**

The specific requirement for a habitable room area that could serve for sleeping purposes only was approached from two perspectives:

(i) Persons-per-bedroom: this requires isolating the bedrooms from other habitable rooms and computing the occupancy using the relevant indexes of 1.0, 1.5, and 1.75 to determine the number of adult equivalent occupants.

(ii) The literature also indicates that a single occupant requires 6.50 square metres of space for sleeping purpose, while two occupants sleeping in a single room will require a minimum of 4.65 square metres each, amounting to a minimum of 9.30 square metres. It has already been noted that the minimum width for every habitable room should be 2.0 metres. Since the bedroom for sleeping belongs to this class, it means that the minimum dimension for a single occupancy sleeping bedroom is 2.0 metres by 3.25 metres. This serves as a benchmark for determining the adult equivalent number of occupants that can be accommodated in bedrooms. This computation is specific for the bedrooms and provides a check for other methods that merely specify occupancy in terms of the number of rooms and the number of persons. This measure could be extended to determine the combined area of bedrooms against the occupancy. However this measure does not seem to talk about adult-equivalent number of occupants.

2.7.5. **Sizes of Habitable Rooms**

The literature also established the need to compute the size of every habitable room space in each apartment. This will help to establish whether the spaces are higher than 19.0 square metres (so that they can be counted as two), or less than 6.5 square metres (so that they can be disregarded).

2.7.6. **Total Size of Each Dwelling**

The UN-Habitat recommends that an area of 7.0 square metres be allowed per person to ensure sufficient privacy and good health. This was applied to the present research, to estimate the designed level of occupancy, based on adult equivalent.

Thus: **{Total area of apartment} divided by {7.0} = {Number of adult equivalent occupants}**

2.7.7. **Household Demographics**

The literature explained that demographic characteristics are the most frequently used features to discuss housing behaviour of households. In general, changes in household circumstance can trigger changes in space needs. The literature also provided measures for distinguishing different household demographic variables. The normative social traditions which define the existence of specific household types that are applicable in the Nigerian context were determined in this study. Not much has been done at the research level in Nigeria to expand the marital status variable beyond the traditional nuclear family and single (yet to marry) individual. The literature identified the multiplicity of household types in existence and other associated variables. These include:

a. Nuclear household, consisting of 2 parents (spouse/partner), with or without siblings. This category also includes single-parent households; single individuals
b. Extended-family households
c. Multigenerational households
d. Number, ages and gender of household members.
e. Gender, age and other personal attributes of head of household

These classifications were important in deciding how to pair occupants into habitable room spaces. Also important was the question of what constituted an adult equivalent in the computation of dwelling density. The clues from the literature that were relevant in the current study are:

a. Children aged below one year were ranked as zero.
b. Children aged one year and above, but below 18 years were ranked as one-half of an adult.
c. Each person in a marital relationship was ranked as one-half.

d. Each person constituting a single parent was ranked as one full adult.

Also the strong influence of age, gender, and relationship in determining how household members can share room spaces was evident in the literature. The milestones in the age factor derived for use in the present study are:

(i) **Below age 1.00 years –** persons in this category were rated as zero; therefore they do not affect the occupancy in any form whatsoever. Hence they can stay in any room, and in any number.

(ii) **From age 1.00 to 4.99 years –** each person in this group was rated as 50% of an adult. Persons in this category can share a bedroom, irrespective of gender. In other words, children of opposite sexes in this group could share a bedroom. This implies that where the target occupancy, for example, was one adult equivalent, two children below age five may conveniently be accommodated. The possible combinations are: (a) two males (b) two females (c) one male and one female

(iii) **From age 5.00 to 17.99 years –** each person in this group was rated as 50% of an adult. Persons in this category belonging to different gender cannot share a bedroom. This implies that where the target occupancy, for example, is one adult equivalent, two children above age 5.00 years but below age 18.00 years may conveniently be accommodated. The stiff condition is that they must all be of the same sex, two males or two females.

(iv) **From age 18.00 years and above –** household members belonging to this category should have a separate bedroom. Sharing of bedroom among this group was only permitted if they were husband and wife.

CHAPTER THREE

3.0 METHODOLOGY

This chapter discusses the research methods selected to achieve the purpose of this study. A research methodology sets out and justifies the techniques adopted for the collection, analyses, and interpretation of data. The chapter gives an overview of the study area, the research design, the description of specific cases selected for in-depth study, the study population, sampling procedures, sources of data and data collection instrument, validity and reliability of instrument, and procedure for data analyses.

As stated in chapter one, this study provided an in-depth evaluation of dwelling density in large mass housing estates, using Lagos State Development and Property Corporation (LSDPC) housing schemes as case study. The context of the study was housing estates containing large numbers of multifamily dwelling units, for low-income and medium-income urban households. The definition of large estates or large numbers of multifamily apartments in this research was not based on absolute number or benchmark. It is contextual to LSDPC, where such quantitative expressions for one estate were interpreted relative to other estates belonging to the organization. In addition such estates must have been in use for at least five years (Vischer, (2002)).

The study focused on the relationship between people and the interior spaces in their multifamily residential units. It provides insights into the consequences of past design decisions regarding space usage and the resulting building performance. The choice of interior spaces for this research is predicated on the view of earlier researchers that human beings spend 90% of their life time indoors.

Being an evaluation research, the approach involved identifying the estimates of dwelling density at the design phase, and then measuring outcomes during the occupancy phase. The study was based on methods that objectively test the fit between the dwelling density criteria used at the design phase, and performance of the spaces in the multifamily housing units.

The objectives of this study are recapitulated as follows: (i) to determine how the existing LSDPC's multifamily apartments were designed to be occupied; (ii) to determine whether LSDPC's multifamily apartments in Lagos are under-occupied, over occupied or occupied as programmed in the design, during habitation; (iii) to examine variations in the dwelling density across various design models of LSDPC's multifamily apartments in Lagos; and (iv) to investigate the effect of occupants' household characteristics on dwelling density in LSDPC's multifamily apartments within the study area.

From the very early stages of this research, an extensive review of the literature was carried out. A large number of academic journals, industry journals, books, reports, proceedings, theses, regulations, and web pages were reviewed, documented, analyzed, synthesized, and compared.

This is important, as it provided an opportunity to utilize previous works done on different aspects of housing in the areas of space usage and post-occupancy evaluation. The intention of the review and analysis was to understand and decide on terms and concepts relevant to the study. Literature review process remained a concurrent activity throughout this entire research process. The latest findings or information in related areas were continuously monitored to incorporate new ideas or avoid potential overlap.

3.1 THE STUDY AREA

Lagos was established as far back as the 15th century, as a Portuguese trading post exporting ivory, peppers and slaves. The city currently covers an urban agglomeration of 300 square kilometres. It stretches from Ojo and Ijanikin settlements in the west to Lekki Peninsula in the East; and from Ikorodu and Alagbado towns in the North to the Bight of Benin in the South.

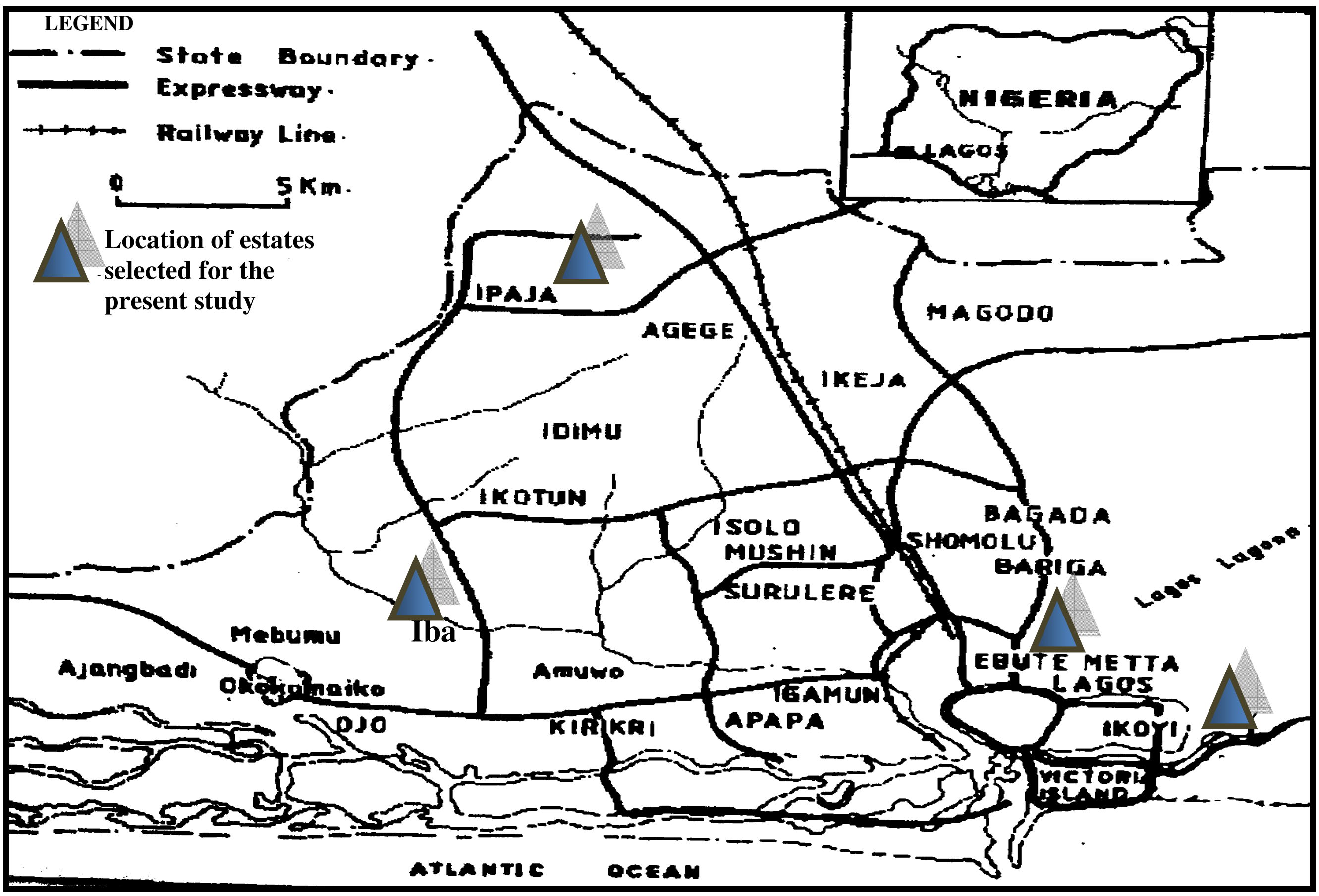


Figure 3.1: Map of Lagos State

Currently, the built-up land area of Lagos metropolis is about 18,533 hectares. Residential coverage is about 9,609 hectares representing 52.1% of the built-up land area. Ninety-four percent of the city's 5.72 million population figures in 1991 were classified as urban dwellers.

Lagos is the most populous urban centre in Nigeria, and compares favourably with other African Cities like Cairo in terms of population. It is also one of the fastest growing large urban agglomerations in Africa.

One of Africa's largest sea ports is located in Lagos. The road network in Lagos covers about 650 km, with a traffic density of 222 motor vehicles per road kilometre, far above Nigeria's average of 11 motor vehicles. Traffic congestion is one of the major transportation issues in the metropolis. It takes an average of two to three hours to cover a distance of 10 to 20 kilometres.

In the fifty-seven year period between 1950 and 2007, the population of Lagos grew from 300,000 to an estimated 17.0 million (Oyeleye, 2001; George, 2008). There are speculations that by 2010, the population of Lagos will approach 18.0 million inhabitants. This substantial population growth has tremendous consequences, particularly in terms of providing adequate housing for immigrants moving into the area to pursue employment opportunities. Mabogunje (2002), reports that the population density of Lagos is about 20,000 persons per square kilometre. This factor of high population density is particularly significant in addressing the problems of urban settlements, housing needs, housing demand and housing supply. Lagos is a rail terminus and has an international airport. The city was the capital of Nigeria from Independence in 1960 until 1991, when the capital was moved to Abuja. It, however, remains the country's economic and cultural centre.

Lagos is a classic example of a developing country mega city in dire need of better living environments for the millions of urban dwellers. The standard of housing accommodation in city varies widely, portraying an overall picture of gross inadequacy. In recent years, the overcrowding in Lagos has spread to the surrounding areas due to urban drift. It is estimated that an average of three people move into Lagos every hour to stay, while 60% of the population are in dire need of accommodation.

3.2 RESEARCH DESIGN

The aim of the present study was to evaluate how the actual dwelling density during habitation phase, correlates with the programmed dwelling density during design phase in LSDPC's multifamily apartments. The investigation was essentially a case study research that incorporated aspects of evaluation analysis. The methodological issues attached to the case study were substantially based on survey research design. The survey research component provided an indication of the prevalence of the phenomenon of dwelling density within the selected cases.

The adoption of case study approach in this study is considered appropriate because the research was interested mainly in information specific to a particular study context, the LSDPC (Illesanmi 2005). This is also in line with the recommendation of Yin (2003) that case studies are the preferred strategy when a research focus is a contemporary phenomenon within some real-life context, especially when the boundaries between the phenomenon and the context are not clearly evident. According to him, an investigator who wants to know "how" and "why" a Programme had worked (or not) would lean towards a case study, a field experiment or histories. Yin further claims that in a case study, the researcher does not (or, cannot), control or manipulate the situation. Similarly, Gerring (2007) interpreted case study as an in-depth, multifaceted exploration of a single case where the purpose of that study is to shed light on a larger class of cases. One of its positive aspects is that a case study permits the researcher to concentrate on a specific issue. It is similarly noted that a case study encourages an in-depth investigation of particular instances within the research subject. The strength of this mixed research design approach is that it frames and specifies the conditions under which LSDPC's multifamily housing programme is achieving its objectives in terms of dwelling density.

The selection of case study methodology for this research provided in-depth details that allowed for objective interpretation of dwelling density in LSDPC's multifamily apartments. In addition, a case study methodology provided an opportunity for this study to apply a multiple method approach such as survey, physical measurements and interpretation of drawings. This multiple method approach is also called triangulation. Well-known case study researchers such as Stake (1995) and Yin (2003) have written about case study research and suggested techniques for organizing and conducting the research successfully. Their works suggest six steps that can be used; which were considered relevant in this study:

a. Determine and define the research questions
b. Select the cases and determine data gathering and analysis techniques
c. Prepare to collect the data
d. Collect data in the field
e. Evaluate and analyze the data
f. Prepare the report

Jensen and Rodgers (2001) identified five classifications of cases studies: i) snapshot case studies; ii) longitudinal case studies, iii) pre-post case studies, iv) patchwork cases studies (combination of preceding case studies methods), and v) comparative case studies. Among all these, comparative case study method examines a set of multiple cases for the purpose of cross-unit comparison.

Case studies are, however, criticized on the ground that they provide little basis for generalization and they take too long (Yin, 1994). This argument is hinged on the supposedly narrow focus of case studies on a few units which tend to limit their representativeness and generalizability. The case study approach is hence regarded as being vulnerable to subjective biases. Some even dismiss case study research as being useful only as an exploratory tool. Yet researchers continue to use the case study research method with success in carefully planned and crafted studies of real-life situations, issues, and problems.

The research object in a case study is often a program, an entity, a person, or a group of people. The single institutional context of LSDPC qualifies it to be classified as a single unit entity, or single case with multiple real-life cases for in-depth examination. Moreover, LSDPC has identifiable boundaries. Although it is customary to research a case like LSDPC as singular, a case study research design generally refers to a study that includes several cases (Gerring, 2007). In this study, LSDPC is treated as a single case, with several embedded units. Even if the situation involved studying more than one case, the focus involved the analysis of individual cases. Stake, (1995) and Tellis, (1997a; 1997b) classify this specific situation where a group of cases is studied as *collective* type of case study.

Kim (2002) in a doctoral study that involved collecting and analyzing data from several cases described the method as a multi-site case. Other distinct types of case studies identified in the literature but are not applicable to the present study include exploratory, explanatory, descriptive, intrinsic and instrumental (Yin, 1993; Stake, 1995; Tellis 1997a, 1997b).

In exploratory case studies, field work and data collection may be undertaken before the research questions and hypotheses are defined. Explanatory case studies are useful for casual investigations; while descriptive cases require a descriptive theory to be developed by the investigator before commencing the project. A case study is described as intrinsic when the researcher has an interest in the case; or instrumental when the research is used to understand more than what is obvious to the observer.

The collective type of case study adopted in this research is also referred to as multiple-case designs. The justification for this is to maximize what can be learned. The difficulty in selecting cases for this research was minimized by applying the recommendations of earlier researchers, (Yin, 1993; Stake, 1995; Tellis 1997a, 1997b). The scholars contend that five components of research design are significant for case studies: (a) a study's question, (b) its propositions, if any, (c) the units of analyses, (d) the logic linking the data to the prepositions, and (e) the criteria for interpreting the findings.

The idea of appropriate number of cases to include in a study of this type has been a subject of controversy over the years. Some scholars argue that dependence on a single case makes it difficult to generalize its conclusions. Yin (1993), for example, cited Giddens's argument that describes case study methodology as "microscopic" because it lacked 'sufficient number" of cases. Conversely, Tellis (1997a) points out that a case study research does not need to have a minimum number of cases, or to randomly select cases. He therefore suggested that the researcher should work with the situation that presents itself in each case. Major researchers, including Yin, Stake, Feagin, and Tellis, however assert that this feature of case studies should not be confused with sampling logic (or randomization). Randomization is a classical procedure that gives every object in the population an equal chance of being selected, for inclusion in the study. The distinction lies in the fact that the design of a multiple or collective type of case study as adopted in this research must follow a replication rather than a sampling logic. Hence each individual case that is selected for this study is seen as being capable of providing facts from which conclusions could be drawn. In this study, the selection of cases is based on purposive non-probability approach.

According to earlier researchers, LSDPC has 40 residential estates comprising a total of 20,572 housing units (Fotoye & Odusanmi, 2009; Jiboye, 2009; 2010). Since the present study was restricted to multifamily housing units, the housing estates where these were available constitute the focus. Again, since the theme of the research was on large housing estates containing multifamily apartments, the first step was to identify such large estates in the low income and medium income categories. In this study, a housing estate was considered to be large if it contains 100 or more numbers of multifamily housing units. There are nine estates in the low income category (Table 3.1). In the medium income category there were three estates that contained more than 100 multifamily dwelling units, and were therefore included as part of the study population (Table 3.2). Tables 3.1 and 3.2 show all housing estates that define the sample frame for this study. Specific housing estates for in-depth case study were purposively selected from this list. Three housing estates containing sixty-five percent of multifamily housing units were purposively selected from the low-income category, while one housing estate containing forty percent of multifamily housing units was purposively selected from the medium-income category for in-depth study.

The three low-income estates selected were: (1) Abesan, (2) Iba, and (3) Dolphin II. The medium-income estate chosen was Ebute-Metta.

This classification technique was employed following Gerring (2007)'s recommendation that the fewer cases there are, and the more intensively they are studied, the more a work merits the appellation "case study". It is primarily the choice of small numbers which are investigated in depth that makes case studies attractive, convincing and useful (Denscombe, 1998). Findings by

Scholars like Patton (1987) and Flyvberg (1999) were employed in selecting the case studies for this study. They contend that the selection should consider cases which are information-rich. Information-rich cases are those which a lot can be learned from about the issues that are in the study focus. Patton emphasizes that cases become significant where some particular problem or situation needs to be understood in great depth, and where one can identify cases rich in information, in the sense that a great deal can be learned from a few examples of the phenomenon in question (Patton, 1987). And because they are intensive, case studies highlight the important variables, processes and interactions that deserve attention.

Table 3.1: LSDPC Low-Income Estates with More Than 100 Multifamily Housing Units that are over 5 Years Old

S/N	Name of Estate	No of Units
1.	Abesan	4,272
2.	Amuwo-Odofin	2,068
3.	Anikantamo	714
4.	Dairy Farm/Ijaiye	708
5.	Dolphin II.	576
6.	Iba	2,388
7.	Iponri	1,026
8.	Isolo	3,664
9.	Ojokoro	534
Total		15,950

Table: 3.2 LSDPC Medium Income Housing Estates with More Than 100 Multifamily Housing Units that are over 5 Years Old

S/N	Name of Estate	No of Units
1.	Ebute-Meta	528
2.	Femi Okunnu	405
3.	Ijaiye	796
Total		**1,729**

They also provide useful anecdotes or examples to support more generalized statistical findings.

Sibley-Behloul (2002) used this strategy in selecting four large mass-housing estates in Algeria that were the focus of a doctoral research. Illesanmi (2005), in another doctoral research work also used this method to choose eight housing estates for a study of equity and satisfaction in LSDPC's estates in Lagos. Again, Nguluma (2003), in a study of how housing transformation occurs in informal settlements in Tanzania, choose one informal settlement called Hanna Nassif in Dar es Salaam, Tanzania, as a single case study.

The major themes considered in this study were housing types, home spaces, occupant households and the interactions among them.

3.3 THE CASE STUDY AREAS

3.3.1 LSDPC Low Income Housing Estate, Abesan

The estate is located along Ipaja road, off Lagos-Abeakuta express way. The houses have been sold to private investors or individuals who are either residing there or have rented their apartments out to other users. The estate consists essentially of three basic building types that make up a total of 4,272 housing units. These basic building types consist of four floors having two apartments on each floor.

- 6 units of 3 bedroom flats in a block with escape stairs
- 6 units of 3 bedroom flats in a block without escape stairs
- An attached 2 bedroom flat of 8 units within a block

The design is quite simple and this is due to the initial purpose of the design being low cost. The kitchen is small (about 6.5 square metres).

3.3.2 Dolphin II Low Income Housing Estate, Ikoyi

Dolphin estate was constructed by HFP Engineering firm, but it is owned by LSDPC. The estate is located off Alfred Rewane Road, formerly Kingsway Road, in Ikoyi area of Lagos metropolis. The estate is divided into two main parts (1) the medium income housing zone, comprising semi-detached duplexes; (2) the low income housing zone.

The present study is restricted to the low income housing scheme. This is a gated community consisting of apartment buildings that are four floors in height. Two apartments are on each floor, giving a total of eight per building.

The apartments were built using two prototype designs: (1) 2-bedroom prototype and (2) 3-bedroom prototype. The 2-bedroom apartments are grouped into 17 blocks amounting to 136 dwelling units. Also, the 3-bedroom apartments are similarly arranged in 63 blocks giving a total of 504 apartments. In all, this estate contains 640 dwelling units.

3.3.3 LSDPC Low Income Housing Estate, Iba

The Iba Low-Income estate was commenced in 1982 and completed in 1991. It is located off Lagos-Badagry expressway along the road that links Iyana-Iba to Iyana-Ipaja. Houses in the estate are block of flats which consist of three-bedroom flats. Each block of flats consists of six apartments, arranged in units of twelve per plot. The layout is grouped into seven zones with a total of 199 blocks. Overall there are 2388 dwelling units within the estate

The floor plan is a prototypical design. Each dwelling unit or apartment has a kitchen, a toilet and a bathroom in addition to other basic functions.

3.3.4 LSDPC Medium-Income Housing Estate, Ebute-Metta

Built with prefabricated components, this medium-income estate is located at the heart of Ebute-Metta, in Lagos Mainland. It is a gated community with perimeter fence walls and only one access with a security post. The buildings are made up of three-storey blocks, with two apartments of four-bedrooms on every floor. There are altogether sixty-six blocks of eight apartments, totalling 528. The floor plans are prototypical units.

3.4 THE SURVEY COMPONENT OF THE STUDY

The survey aspect of this research design addressed methodological issues associated with the selected cases. As already stated, the objectives of this study focus on in-dwelling density in multifamily apartments in LSDPC's low income and medium income estates. The survey design kept the objectives in view to ensure that the data collected ultimately addressed them. The basic survey design questions in this study were the population, sampling, questionnaire and data analysis.

3.4.1 Study Population

The population for this study was all multifamily apartments built by LSDPC in Lagos. Since a post-occupancy evaluation must necessarily take place after a minimum of five years of use, all housing estates that were not completed and possessed by 2005 were excluded from the study. It should also be noted that LSDPC came into existence in 1973. Therefore, this study is limited to all low-income and medium-income mass housing estates built by LSDPC, between 1973 and 2005, which contain multifamily housing units. There were 17,679 of such units, comprising two-bedroom, three-bedroom and four-bedroom (Tables 3.1 and 3.2). All the estates built by LSDPC's predecessor, the Lagos Executive Development Board (LEDB) did not form part of this study.

3.4.2 Sampling

A sample is interpreted as a smaller group of elements drawn through a definite procedure from a specified population, such that the elements making up this population are those chosen for actual study. In this research, the units of study were the original prototype apartments, also referred to as housing units, dwelling units, or flats. Being a collective case study research, the study sample frame is not the same as the 17,679 units that made up the population. Instead the sample frame for this study was made up of all the multifamily dwelling units in the four purposively selected cases namely: Abesan (4,272 - units); Iba (2,388 - units); Dolphin II (576 – units); and Ebute-Metta (528 - units) Purposive non-random sampling as it applies to case-study research, focuses on selecting information-rich cases for in-depth study. In the present circumstance, the four cases picked meet the specific or distinctive criteria outlined by the researcher. The total number of housing units in the four selected estates was 7,764. This is the sample frame. This sample frame was considered proper for this research because it is consistent with the stated aim and objectives.

3.4.3 Sample techniques and size

The sample groups of interest in this research were different classes of multifamily housing units in the four housing estates purposively selected as cases for in-depth study. In order to collect an unbiased sample, a probability sample design was employed to identify housing units that were studied among the 7,764 housing units in the four housing estates (Abesan, Iba, Dolphin II, and Ebute-Metta). This section describes how the sample of housing units studied was selected, so that it reflects the characteristics of the larger population it represented. The four estates purposively chosen for detailed study comprised three low-income and one medium-income.

These estates constituted a good representation of the study population. They also contain a good combination of different bedroom types. The sample frame representing the population of study is 7,764 housing units. In all, a 7.5% sample of the housing units was chosen for this study, amounting to 582 units. This large sample was chosen based on the argument that as the sample size increases, sampling error reduces (MacCallum,Widaman, Zhang & Hong, 1999). This sample size of 582 (7.5%) far exceeds the figure of 376 (2.1%) recommended many years ago as appropriate for a study population of 17,679, based on assumed standard error of 0.5 (Krejcie & Morgan, 1970) – see appendix 3-1. Adequate sample size permits reliability of results so that the investigation can be repeated with consistent results.

3.4.4 Application of two-stage, stratification and systematic techniques

Two categories of housing provision were evident in this study. These are: (1) the low income category located at Abesan, Dolphin II, and Iba estates; (2) the medium income category located at Ebute-Metta. Each estate in these two categories was treated in proportion to the overall size of housing units it contains.

Thus:	Abesan estate, with 4,272 units at 7.5% sample rate	= 320
	Dolphin II with 576 units at 7.5% sample rate	= 43
	Iba estate, with 2,388 units at 7.5% sample rate	= 179
	Ebute-Metta estate, with 528 units at 7.5% sample rate	= 40
	Total	= **582**

The next stage was to apply a two-stage stratified sampling technique to select the housing units. Stage one involved the identification and selection of housing unit design types available in each estate. These housing types were classified according to Number of Bedrooms. The following result was obtained from stage one:

Low-income (Abesan): Two types – (a) 2-bedroom; (b) 3-bedroom

Low-income (Dolphin): Two types – (a) 2-bedroom; (b) 3-bedroom

Low-income (Iba): One type – 3-bedroom

Medium-income (Ebute-Metta): One type – 4-bedroom

Stage two involved the stratification of the housing unit design types according to the proportion in each estate. This stratification technique helped to maximize accuracy in a sample because it ensured that all population proportions were matched in the sample. The result of stage two stratification is shown in Table 3.3.

Table 3.3: Housing Estates Selected for the Study and the Sample Sizes for Various Categories of Housing Units

			2-bedroom		**3-bedroom**		**4-bedroom**		**Total**	
	Name of Estate	**Status**	**No. of Units**	**No. Selected**	**No. of Units**	**No. selected**	**No. of Units**	**No. selected**	**No. of Units**	**No. selected**
1	Abesan	Low income	1,672	125	2,600	195	-	-	4272	**320**
2	Iba	Low income	-	-	2,388	179	-	-	2388	**179**
3	Dolphin II	Low income	136	15	440	28	-	-	576	**43**
4	Ebute Metta	Medium income	-	-	-	-	528	40	528	**40**
			1,808	**135**	**5,956**	**447**	**-**	**-**	**7,764**	**582**

The large size of the sample allows for consideration regarding the possibility of errors that may arise from the use of an inadequate sample frame, or non-response by respondents. Denscombe (1998) suggests that researchers should build an allowance in the sample size for non-responses. Non-response is failure to obtain information from selected households.

The housing units eventually chosen for detailed survey were selected using systematic random sampling technique after the first apartment was chosen at random. Through this procedure, a sample of 582 was obtained. This principle was applied to systematically select 125 housing units to be investigated, from among the 1,672 units of two-bedroom in Abesan estate. The procedure was repeated for the 2,600 units of three-bedroom apartments, to obtain the 195 units for investigation. This action was similarly applied to the estates at Iba, Dolphin II, and Ebute-Metta.

3.4.5 Sources of Data

For this study, data was collected from primary and secondary sources. Two methods were used to collect primary data. The first was to obtain the actual physical measurements of dwelling units that have not undergone any spatial transformations. This gave factual information that was useful in reproducing the floor plans, indicating spatial organization with relevant dimensions. Such measurements were generally compiled by type, because all dwelling units within a type were virtually identical with respect to spatial characteristics and functions. The typical data that was used include length and width. Therefore such measurements and associated drawings revealed the number and internal floor area of rooms, as well as usage. The second method through which primary data was obtained is structured survey questionnaires administered on the occupants of the multifamily housing units. The content of the questionnaire was derived from guidelines issued from the literature review. Through this questionnaire technique, information regarding household demographic and home-space use was obtained. The survey questionnaire was distributed to and collected from household heads.

Secondary Sources of data included information from documents and relevant publications that centre on the activities of LSDPC. Such archival documents and statistics from LSDPC's records and architectural drawings were obtained from the heads of project units in the corporation. Information from architectural drawings, briefs and other details were analysed to discover space standards to which the housing units were designed and built. The architectural drawings obtained from LSDPC served as a check for reliability of physical measurements of floor plans during on-site observation and questionnaire activity. Information from this was used to establish the number of housing units, types, floor plans, space sizes and other provisions.

3.5 DATA COLLECTION INSTRUMENT

Case study research allows the use of multiple methods of data collection such as interviews, questionnaires, documentary reviews, archival records, direct participant observations and measurements. In the current study, two methods were used to collect data for analysis. One was direct measurement, while the other was through a pre-test survey questionnaire. The aim was to determine whether the in-dwelling density of multifamily apartments was properly matched with their design density.

3.5.1 Direct physical measurements

The major variables that were measured physically or from archival drawings/documents were the number and sizes of rooms, including the sizes of apartments in terms of floor area. The number of rooms was obtained by observation and counting, while the area was measured using geometrical properties that conform to the shape of the floor plan of the apartment. Data obtained from direct measurement provided the basis for obtaining the occupancy level to which the particular housing apartment prototype was designed. In order to deal with the problems of precision, care was taken to ensure that the measurements were capable of being interpreted using internationally validated measures like The Canadian National Occupancy Standard (CNOS), the American Crowding Index (ACI), and the Equivalized Crowding Index (ECI). Care was also taken to ensure that errors associated with measurement and recording were minimized through repetitive actions.

The present study addressed housing estates built for two socio-economic groups: the low-income and the medium-income. The low-income apartments constitute 7,236 units, while the medium-income covers 528 units out of the sample frame of 7,764. In the low-income category, the two-bedroom housing typology consists of two design prototypes. These were classified as follows:

1. "Type one", found at Abesan
2. "Type two" found at Dolphin II

In the low-income category, three-bedroom housing typology consists of three design prototypes. These are classified as follows:

1. "Type three", found at Abesan
2. "Type four", found at Iba
3. "Type five", found at Dolphin

Similarly, in the medium-income category, the four-bedroom housing typology consists of only one design prototype, classified as follows: "Type six", found at Ebute-Metta.

Each of the six typologies was physically measured and drawn out in appropriate scale. To ensure reliability, the site measurements were cross-checked with the drawings obtained from LSDPC offices.

3.5.2 The Questionnaire Instrument

Other variables that could not be obtained through direct physical measurements or observations were collected through the use of self-administered questionnaire, adopted for this study. One important aspect to consider in dealing with a survey questionnaire is that the questions should relate directly with the research objectives and questions. As a precursor to questionnaire development in this study, content analysis of evaluation literature was carried out to ensure that appropriate measures of crowding were identified and included in the questionnaire.

In the present study, the research questions were more of quantitative than qualitative. The distinction between quantitative and qualitative in this sense is interpreted from the way data is treated, and not strictly based on the research methods. According to Denscombe (1998), quantitative research measures phenomena so that they can be transformed into numbers, which ultimately facilitates analysis through statistical processes. Numbers therefore serve as the basic unit of analysis.

Quantitative research as applied in the current study was based on transforming what was observed or recorded into data that are numerical. It tends to be associated with analysis. Conversely, qualitative research relies more on written words (not numbers) as the unit of analysis. It is better suited to description. Thus, in analyzing qualitative data, taped interview, for example, get transformed into transcripts, observations get documented in field notes while pictures get described in words. The quantitative data necessitated by the present study required a questionnaire that was designed to obtain overt factual data (for example, age, sex, number of household members, number of rooms, etc.). However, indirect questions were employed in matters that were less straightforward, where direct questions were considered inappropriate. Denscombe(1998) notes that such aspects include occupation, income, and education. The intense use of quantitative techniques in this study was intended to be useful in dealing with the methodological challenge of developing more appropriate measures of dwelling density that were applicable to LSDPC's multifamily housing context. The research was a snapshot survey aimed at determining the dwelling density of households currently occupying LSDPC's existing multifamily housing apartments

In this research, persons-per-room is observed as a measure of household density and potential housing needs. Determining the household composition serves as a measure of additional or reduced pressure on the available housing space. The measure of dwelling density was constructed from responses to questionnaire items pertaining to the number of persons and the number of rooms in the housing unit.

Furthermore, the questionnaire instrument was used to collect information that revealed other demographic data of occupants, such as persons-per-room by age, sex, marital status, ethnicity, income, tenure, household type, level of education of head of household, length of residence, etc. The characteristics of respondents (or, demographics) were used as predictor variables to determine whether such characteristics correlate with, or predict response to, other questions regarding the dwelling units. The evaluations were made from a single perspective – that of the building users. The building users were defined as the household residents of the dwelling units.

The questionnaire was structured to accomplish the occupancy ratio of the dwelling units and the factors associated with it.

3.5.3 Scales of Measurement

Measurement provides researchers with defined processes for assigning standard numbers or labels to units of analysis (or variables) in a scientific research. The success of most scientific research endeavours is generally predicated on how well the key concepts are measured. The scale of measurement is critical in analysis because it relates to the type of analysis that can be used to analyze the research data. Hence there is the need for researchers to adequately consider the scale of measurement to be employed when determining the statistical tools of analysis to be applied. Generally, statistical techniques are determined by the type of data. The present study adopted four well known statistical measurement scales in classifying the data – nominal data, ordinal data, interval data and ratio data. The questionnaire contained 22 items and was divided into two main sections. Section A sought to obtain general personal information concerning the head of household; while Section B focused on dwelling and household characteristics.

3.5.3.1 ***Nominal scales Nominal scales*** were used in this study to classify different groups of variables as a basis for easy identification and distinction. Nominal data are obtained from counting things and placing them into a category. In the survey questionnaire, the responses and respondents were labelled by merely assigning them with non-numeric data values, without any implication of gradation or distance. Nominal data represents a head count of members of a particular category like male or female. The location, classification of apartments, gender of head of household, marital status, and ethnicity, were measured using nominal scales. Detailed descriptions of the variables that were measured using nominal scales are as follows:

(i) Apartment type classification – housing characteristics in the study area includes apartment types. These various apartment types were coded prior to the distribution of the questionnaires.

(ii) Gender – household heads were asked to indicate whether they are male or female. The responses were scored with nominal numerical values of “1” = male, and “2” = female.

(iii) Marital status – household heads were requested to state whether they are married, separated, divorced, widowed, single mother, single father, or just single. The responses were scored with nominal numerical values thus:

Married = 1; Separated = 2; Divorced = 3; Widowed = 4; Single Mother = 5

Single Father = 6; Just single = 7

(iv) Ethnicity – it is claimed that there are more than 250 ethnic nationalities in Nigeria and that all of them are represented in Lagos. However, the dividing lines are not clear, particularly where there are several dialects. In this study, ethnicity was derived from the native language spoken in the respondent’ local government area of origin. The response categories for this study were limited to the nine biggest ethnic groups in Nigeria that constitute 95% of the languages. Among these the Yoruba, Hausa-Fulani and Igbo constitute 68% of the population of the country. At the same time, the Ijaw, Edo, Ibibio, Kanuri, Tiv and Ebira Nupe account for 27%. The other minority groups comprise the rest 5%. Respondents were required to select one language. These are coded as follows, using nominal scale: Yoruba =1, Hausa-Fulani = 2, Igbo = 3, Ijaw = 4, Edo = 5, Ibibio = 6, Kanuri = 7, Tiv = 8 and Ebira Nupe = 9, others =10

(v) Tenure – respondents were asked to indicate whether the apartment is owned by household head, owned by a spouse, owned by a child, owned by a relative, or maintained on rental. The responses were scored with nominal numerical values as follows: owned by household head = 1; Owned by a spouse = 2; Jointly owned by head of household and spouse =3; Owned by a child = 4; Owned by a relative = 5; Rental = 6

(vi) Respondents who owned their apartments were requested to indicate whether they originally purchased it from LSDPC or they purchased it from previous private owner. The responses were scored with nominal numerical values as follows: Originally purchased from LSDPC = 1; Purchased from previous private owners = 2.

Non-parametric statistical techniques are usually recommended for analysis of nominal data. For the variables listed above, data obtained from responses were transformed into numbers to lend them to analyses through statistical procedures. The quantified numbers were particularly well suited to the kind of comparisons and correlations required in this study. The most likely non-parametric statistical tools are the mode and cross tabulation with chi-square. The Chi-Square test is good for finding the correlate between two categorical variables. These descriptive statistical tools involve data grouping, computation of frequencies and percentages, and the presentation of results using tables, charts and cross tabulation. This provided a basis for proper understanding of the characteristics of the respondents and their relationships to both projected and actual dwelling density in LSDPC's multifamily apartments.

3.5.3.2 ***Ordinal scales*** **–** Data values in this case are categorical, hence follow some numerically clear, ordered and ranked relationship. However, the rank order is all that can be inferred from the ordinal scales, as it neither shows the cause of the order or by how much they differ. Ordinal scales were used in this study to classify measurement systems that were indicative of magnitude, without any property of interval. The variables that were measured using ordinal scales in the current study are described below:

(i) Education level of head of household – this variable indicated the education level of the household's head, based on ranked attainment. These were given ranked values as follows: below primary school = 1; primary school = 2; secondary school = 3; college of education = 4; polytechnic =5; university = 6.

(ii) Respondents' socio-economic characteristics, was applied to this study by classifying those whose monthly income were less than ₦45,000.00 as low, those whose monthly income were ₦45,000.00 and above, but less than ₦100,000.00 as medium, while ₦100,000.00 and above were grouped as high income. For the purpose of data analyses, ordinal numerical value of 1 was used to code low-income. The value 2 was used to code medium income and the value 3 was used to code high income.

(iii) Age range – respondents were requested to indicate their ages in ranges of years. They were classified and coded as: Less than 18 years = 1; 18 – 30 years = 2; 31 – 40 years = 3; 41 – 50 years = 4; 51 – 65years = 5; Above 65 years = 6.

(iv) The nature of employment – This was measured by distinguishing among respondents in the following categories: self employed = 1; private firm employee = 2; daily paid casual worker =3; unemployed = 4; retired or pensioner = 5; government employee = 6; unpaid family work = 7.

(v) Length of residency – this variable ascertained the number of years the respondent had been living in the apartment. They were classified and coded as: 0-5 years = 1; 6-10 years = 2; 11-15 years =3; 16-20 years = 4; 21-25 years = 5; 26-30 years = 6; Above 30 years = 7

The ordinal scales applied in the present study made use of non-parametric statistics like the median, mode, rank order correlation and non-parametric analysis of variance. Like in nominal data, ordinal data is based on counts of responses for specific categories or groups of variables, except that in this case, the categories stand in some clear, ordered, ranked relationship. This implies that the quantification of responses in one category can be compared with the quantification of responses in other categories as being higher or lower than, more or less than those in the other categories. This further indicates the level of importance and relative position of the variables.

3.5.3.3 ***Interval scales*** (continuous scale of measurement) **–** the interval scale possesses all the attributes of the nominal and ordinal scales but has an additional advantage in the fact that the distance between the ranked categories of observation is constant. This means that the interval of the rankings conform to a scale, thereby providing opportunities for direct contrasts or comparisons. There is an additional advantage in analyzing data obtained using interval scales. In addition to comparing the data in terms of more than or less than, it can be further analyzed to determine how much more or how much less.

In this study, interval scale was used for measuring the:

(i) Number of different types of habitable rooms

(ii) Floor area of different types of habitable rooms

(iii) Total floor area of each prototype apartment

(iv) Ages of occupants

(v) Number of years respondent has lived in the apartment

(vi) Total number of regular occupants

(vii) Number of male occupants

(viii) Number of female occupants

(ix) Number of adult equivalent occupants (male and female)

Olagunju (2011) used interval scale to measure these variables in a study of maintenance of residential buildings in Niger State, Nigeria. Data collected from respondents in each of these categories differ by known intervals. This allows the researcher to use addition and subtraction (but not multiplication and division) to contrast and compare the data. Variables which are measured on a continuous scale of measurement (interval scale of measurement) are usually recommended to be summarized using means and standard deviations. Parametric statistical techniques such as mean and standard deviation, correlation and regression analysis, were used in analyzing the interval scale data for the present study.

3.5.4 Choosing the Respondents

Rather than make a subjective choice of respondents, this study choosed an objective procedure of designating the head of household as the resident to be interviewed at each dwelling unit, irrespective of gender. Traditionally in an African setting, the patriarch of a family is regarded as the head of household. Also, in a marital or conjugal relationship, the male partner is designated as the head of household. In other circumstances, the household head is the person generally regarded by members of the household as being in charge. Only household heads were interviewed. Interviewing the head of household instead of whoever answers the door, helped to avoid any biases as to which type of people were most likely to be at home.

The choice of the person to interview was predicated on a high probability that such a designated respondent would be at home. If the head of household was not at home when the interviewer visited, the questionnaire was dropped with the instruction that the interviewer will call back. As much as possible, the head of household was not substituted. To mitigate field research difficulties related to the timing of the survey exercise, the distribution of the questionnaire was done outside official working hours, when the head of household was expected to be at home, preferably in the evenings of weekdays or during weekend days. However, where there was no male head, the female head was interviewed. In circumstances where the interviewers did not get into the selected dwellings the first time, they went back at different times and on different days, otherwise the survey would become biased towards the unemployed and the housebound.

The interviewers were be taught general procedures for obtaining good interviews as well as specifics about the current questionnaire. They were shown how to initiate interaction with a potential respondent and how to administer the questionnaire used in this research. They were equally briefed on the objectives of each question. This knowledge assisted them in handling problems that were envisaged during the interviews

One of the strategies adopted in this research to improve the effectiveness and response rate of the questionnaire exercise was to send a brief pre-notice letter to the respondents a week prior to administering the questionnaire. The letter noted that a questionnaire for an important survey would be distributed in a few days and the person's response would be greatly appreciated. This was also a way of addressing ethical considerations that required researchers to obtain informed consent of respondents before involving them in filling out surveys, interviews, etc. This was intended to protect the rights of the participants.

The packaging of the questionnaire itself also included a cover letter explaining the research purpose and why a response was important. The phrasing of the questionnaire's cover letter to the selected households was considered important. The cover letter in the present study was made as vague as possible regarding the purpose of the survey, to avoid skewing responses. It was not explicitly stated that it was intended for a doctoral thesis. Instead the research was packaged as a departmental initiative while the researcher was designated as the coordinator of the project. Best practice was followed to maximize the number of responses by providing a short and attractive questionnaire.

3.6. VALIDITY ISSUES

This case study research focused on an in-depth study of a single social phenomenon (household dwelling density), using a single case (LSDPC). Validity is concerned with how far a test appears to measure what it sets out to measure. In this research, the concerns of construct (internal) validity were addressed by subdividing the single case of LSDPC into multiple observations and adding depth and details in form of dense data or rich data. This strategy of focusing on a single unit, but subdividing it into multiple (or repetitive) cases has been used by earlier researchers to achieve robust findings (Mukhija, 2010). Authors like Yin, (1994), and Gerring, (2007) refer to this strategy as "within case" approach. They suggest that it allows researchers greater latitude in generalizing findings. There is also the issue of external validity. According to Yin (1994), this refers to establishing the domain to which the findings of a study can be generalized. He further claims that for case studies external validity can be achieved by applying replication logic rather than sampling logic. Thus, he advocates that case study researchers should generalize to a theory rather than to a population. In the present study, evaluation theories were used as reference for achieving replication and generalizing findings. However, the interest of the current study was limited to detailed information specific to the particular study context of LSDPC's multifamily apartments, rather than information easily generalizable to a large population.

Another issue of validity examined in this research was to ensure that the questionnaire instrument measures the concepts the questions were intended to measure. A pilot study to pre-test the questionnaire was adopted. The pilot testing also ensured that questions were pertinent and worded appropriately. This process provided an opportunity to try out the questions with people who would not be in the final sample. The pilot study for the present research was conducted on small samples of multifamily apartments selected from three housing estates using exactly the same questionnaire. These estates were FESTAC Town, Iponri Estate at Iponri and Jakande Estate at Mile II, Lagos. The questionnaire was pre-tested for clarity of the wording of the questions, length of time to administer, and question sequencing.

The pilot study also helps to provided a basis for carrying out a preliminary analysis to see whether the wording and format of questions will present difficulties when the main data are analyzed. The omission of a question on marital status of other residents apart from head of household was detected. It was also discovered that respondents had difficulty in interpreting the questions that sought to know occupants who were usual residents and occupants who did not usually reside in the apartment, but were now there on holiday or short visit. The questionnaire was promptly edited and paraphrased to elicit the answer that this investigation was seeking. Again, based on the pilot study, it was decided to avoid questions on detailed income and other potentially sensitive monetary matters that carry higher risk of upsetting the respondents and making them view the researcher with suspicion. After effecting the changes occasioned by the pilot test, the questionnaire was submitted to selected experts consisting of professors and senior lecturers to ensure that the changes did not affect its content validity. Al-Khalaileh (2004) called this method peer examination. He used the method in a doctoral research, asserting that a research endeavour gains more validity if the data collection instruments are made available to peers familiar with the research for review and feedback. After the review by these experts, the final questionnaire was prepared for distribution to the selected sample.

A key strength of the case study method involves using multiple sources and techniques in the data gathering process. In order to ensure construct (internal) validity in this study, multiple sources of evidence were used to provide multiple measures of the same phenomenon. Having more than one method provided an opportunity to compare the results so that if they were in agreement, it adds to the certainty of the validity of the results, and if they did not agree, it provides a basis for suspecting that something had gone wrong. The multiple kinds of data sources adopted in the present study include drawings, observation, and direct physical measurements. This method of validation is referred to as triangulation. The concept of triangulation is predicated on the use of multiple methods by a researcher to collect and analyze data so that all sources converge on the facts of a case (Yin 1994; Kohn, 1997). The purpose of triangulation is to reduce the likelihood of misinterpretation by employing various procedures (Stake, 1995). Triangulation offers stronger potential to validate and cross-check findings as well as for generalization. According to Stake, a finding that has been triangulated with several independent data holding is usually more credible than one that has not. The adoption of case-within-case approach was to enhance the external validity or generalizability of research findings.

Kohn (1997) identifies elite bias as one other major threat to validity in case study research. According to him this occurs when researchers give greater weight to highly rated or more articulate respondents. He cautioned that such informants are non-representative and researchers should guard against it. The current research on dwelling density in LSDPC's multifamily housing addressed the problem of elite bias by adopting the stratified random technique in selecting the apartments to be investigated. This approach made the status of the household inconsequential.

3.7. **RELIABILITY ISSUES**

Reliability refers to the stability, accuracy, and precision of measurement. The aim of addressing reliability (also referred to as internal consistency) issues is to ensure that repeated measurements of the same variable produce similar results. The goal of reliability is to minimize errors and biases in a study (Yin 1994). In this research, the reliability of the questionnaire instrument was assessed by repeating the same questions using different formats in different parts. The answers respondents gave to such questions on one occasion were compared with answers the same respondent gave to them a short time later. The pre-test pilot study was used to establish the degree of consistency of the answers. If respondents' answers were different for a question that was repeated, then the questions are not reliable and therefore rewritten.

Another issue envisaged to affect reliability of data for this study was the possibility of differences in frame of reference between the researcher and the respondents. Estimates of household crowding, for instance, are dependent upon a respondent's interpretation of how rooms are defined in the study area. In most housing surveys, respondents report fewer numbers of bedrooms than their houses actually contain. They simply do not think of a study, a play room, a sewing room, or a guest room as "bedrooms" in the sense intended by the survey. Kerwin, Heltemes, Franklin, Nelson and Popovic (2005), on the other hand suggests that respondents are more likely to overestimate the number of rooms in their apartments because of difficulties associated with room identity. Overestimation of the number of rooms biases the results. These point to the need for clarity, precision and proper definitions, to guide both the researcher and the respondents. To achieve this, the present study adopted a new visual cognitive method developed by the U.S. Census Bureau in 2007, called "visual vignettes" (Carter, 2008). In the context of this study, visual vignette implies representing areas or sections within the apartment using photographs and annotated floor plan drawings that clearly show the rooms and their measurements (that is, dimensions In this study, triangulation was also used to strengthen reliability.

In addition to overestimating or underestimating the number of rooms, the problem of reliability can also manifest from miscounting individuals within the household. This can bias the dwelling density measure upwards or downwards. In the present study, two approaches were examined for purposes of obtaining data on household size. These are the de-facto and de-jure. The de-facto household size refers to all usual residents and visitors who slept in the sample housing unit three months or less prior to the survey interview. The de-jure household size, on the other hand, refers to all usual residents of the sample housing unit, including those who did not sleep in the house within three months to the survey interview. The de-facto and de-jure household sizes may differ because of temporary population movements. In this study, the de-facto household situation was applied. It was regarded as more reliable because it takes care of all occupants, wherever they are staying. The current research further addressed the ambiguities surrounding the miscounting of individuals within the household by ensuring that respondents' thoroughly understood what constitutes an adult equivalent. This was achieved by proper delineation of the age categories. Biases arising from separation of sexes were also taken care of by ensuring that gender of occupants in different age categories was recorded.

In order to further address the question of reliability and quality of data collected, only well trained research assistants were engaged to conduct the actual fieldwork. The training program covered the basic concepts of the study, terminology, processes, and methods.

3.8. ADMINISTRATION OF DATA COLLECTION INSTRUMENT

The validated questionnaires were administered to every 13th apartment in the selected multifamily blocks within the estates chosen for the case study. The researcher and eight (8) field assistants, who underwent special training for the purpose of the present study, administered the questionnaires. Two research assistants were assigned to each of the four estates selected for this study. Even though the questionnaires were intended to be self explanatory, there were instances where barriers of language and education hindered the respondents from filling the questionnaires by themselves. For example, a few elderly residents who could not see well and other residents who lacked the necessary skills to complete the questionnaires were identified. Under such circumstances, the research assistants supplemented with personal interviews and helped in filling out the questionnaires on behalf of the respondents.

The process of distributing the questionnaire and collecting the instrument took approximately four weeks. Each questionnaire contains a cover letter. The cover letter requested that heads of households respond to the questions. All the site visits were made during weekends or in the evenings of weekdays in other to reach working household heads.

Each informant was requested to respond to a questionnaire containing mostly structured questions. The first part of the questionnaire sought to reveal data on the profile of the informants, for example, age, sex, marital status, length of residence, etc. the second part sought information about the housing units.

3.9 PROCEDURE FOR DATA ANALYSES

The research design for this dissertation is a mixed research design that combined a case study with some aspects of evaluation analysis. The specific focus was on dwelling density in LSDPC's multifamily housing projects. This point requires further clarification. The analytical techniques that are associated with case studies and programme evaluations were useful in this study for determining the strengths and weaknesses of spaces in LSDPC's multifamily housing programmes. This could enable LSDPC to understand whether to modify or eliminate some of its multifamily designs currently in use. One reason to justify this is that the research design provides for insights to be made about program accountability. Emphasis was on outcome accountability, which evaluated how established goals had been achieved in terms of dwelling density. The issue of focus was on the relationship between the occupancy goals of LSDPC's multifamily prototype housing programme and its outcomes. This approach provided a way to measure how the occupancy propositions have worked (that is, its effectiveness), and proffer suggestions on ways to improve it. In this way, a major concern regarding how far LSDPC's multifamily occupancy programme has succeeded or failed to meet the occupancy needs of users during habitation was addressed.

Yin (1994) had identified two general analytical strategies which a researcher using case studies can select from before data can actually be analyzed: a) using theoretical prepositions as a frame of reference to compare the research findings, b) developing a case description for studies that focus in an area where little research dad been done previously. Yin gave further explanation by recommending two forms of analyses for case study data, which are relevant to the present research. These are discussed below:

1. ***Within case analysis*** – this requires comparing the research data against the relevant theories that the study relies on, as presented in the conceptualization and frame of reference. The idea of

comparing data to previous theory is to seek emerging patterns. The goal is to understand how far the data fits the theoretical frame of reference. Within-case analysis, as one of two ways to analyze case study data, involves repeating (or summarizing) both the data collected and the theory used in the study's frame of reference.

2. ***Cross-case analysis*** – this requires comparing data in one case to data in other cases. This approach in majority of cases leads to discoveries of more patterns, hence making the data richer and more generalizable.

Upon completing data collection for the present study, the within-case analysis and cross-case analysis procedures for data analysis were followed. This research focused on post-occupancy evaluation of dwelling density in LSDPC's multifamily apartments. The quantitative analytical technique was adopted. Quantitative approaches seek to gather factual data and to study relationships between facts, and how such facts and relationships accord with theories and the findings of any previously executed research documented in the literature. On the contrary, qualitative approaches seek to gain insights and to understand people's perceptions of the 'world' – whether as individuals or groups. In a case study research, one of the first steps in using a quantitative analytical process is to state the theory of reference. Case studies' conclusions are generalized to a theory. Case studies can be used either for theory testing (pattern matching) or theory building (explanation building). Where such a theory is completely absent or not good enough, researchers are advised to explore the use of logic models (also referred to as a theory of action) to isolate and define the most critical issues to be examined during a case study analyses (Kohn, 1997). According to Kohn, a theory of action should thus be developed during the early phases of design development, so that it becomes the theory for interpreting outcomes. The present study utilized the logic model idea to appropriately establish the theories that were tested in this research. Design density (also regarded as the rated capacity) of the LSDPC's multifamily apartments was the "theory" that was tested.

3.9.1 The Logic Model

A logic model is a useful tool for researchers who work with the program theory. As earlier noted a logic model is also referred to as a "theory of action". It provides one good way for an evaluator to visually link the program theory with what the outcomes should be. This helps to identify where to evaluate the program to check whether it is working the way it was intended to work. A logic model is basically a systematic and graphic depiction or picture of the relationships among the inputs/resources operating a programme, the planned activities, and the anticipated result.

A typical logic model can be presented either in pictorial or tabular form or both, depending on the discretion of the researcher. Obeng-Odom (2009), in an evaluation of the impact of public housing in Ghana employed Logic model to compare the objectives and outcomes of the housing programmes in two communities (Table 3.4). Similarly, Ibem, (2011) used logic model in evaluating public housing schemes in Ogun State, Nigeria. The adoption of logic model was justified on the basis that the study was goal-based, and focussed on the extent to which public housing met the set objective of addressing key social challenges posed by inadequate provision in Ogun State.

Figure 3.1 identifies the basic components of a typical logic model. These include: (i) goals and objectives (ii) inputs and resources (iii) programme activities (iv) outputs (v) target group definition (vi) outcomes (immediate/intermediate/long term or impact). Where a logic model is used, it is interpreted as the theory against which critical explanations relating to the research findings are tested. The logic model is closely associated with the conceptual model of the present study.

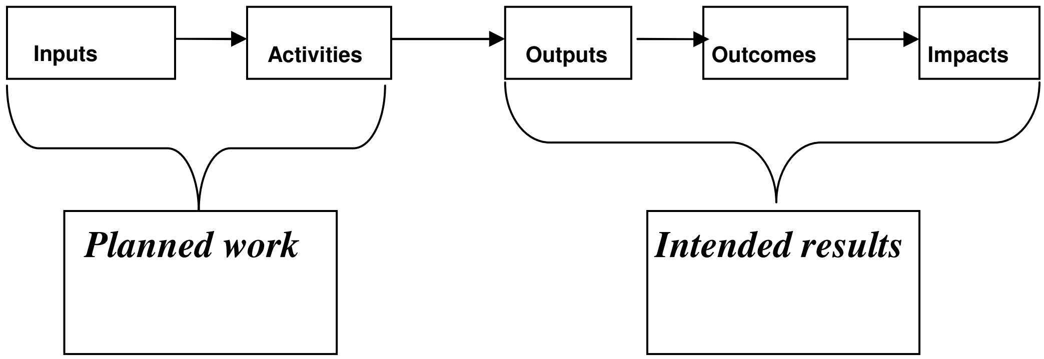


Figure 3.2: Basic Logic Model
Source: Ibem (2011) p. 42

Table 3.4: LSDPC's Dwelling Density Goals/Estimates

Spatial provision: design density	**Space utilization**	**Space utilization**
	Estimated total number of adult equivalent occupants:	Actual number of adult equivalent occupants
-number of habitable rooms	-per habitable room	-per habitable room
-number of bedrooms	-per bedroom	-per bedroom
-amount of floor spaces	-amount of floor spaces	-amount of floor spaces
-household demographics	- aggregate area of space for cooking, eating and living (CEL)	- aggregate area of space for cooking, eating and living (CEL)
	-total size of apartment	-total size of apartment
Planned work	*Intended results*	*Outcome*

Khon (1997) had noted that for case studies, the focus of quantitative analysis is either variable-oriented or case-oriented. According to him, variable-oriented analysis examines the relationship and effect of predictor variables on the outcome. Conversely, case-oriented analysis, on one hand, examines the interrelationships among variables within each case, and on the other hand, makes comparisons across cases to identify any similarities and patterns. The present study utilized these two approaches. Replication logic was used as a key analytical tool. This strategy focused on how far the observed variable fitted the predicted one. The predicted variable in the present study was the design density, inferred from existing floor plans of selected prototype of LSDPC's multifamily apartments. The observed variable was the actual dwelling density of these same prototypes as revealed from the questionnaire survey. Two main strategies in the replication logic are pattern matching and replication seeking. In pattern matching findings are compared across cases or to a study's theoretical proposition in order to demonstrate patterns.

For pattern matching, several pieces of information from the same case could be associated to some theoretical proposition enunciated in a study (Yin, 1994; Toker, 2004). In the present study, the design density was understood to mean LSDPC's solution to dwelling density problems in existing multifamily apartments at the programming stage. Clearly, this evaluation research assesses the effectiveness of this design density as a programme, to determine whether it is working as it was intended. The evaluation criterion for this research study focused primarily on the match between the inferred occupancy goals from the design of LSDPC's multifamily prototypes and the occupancy during habitation. One of the problems of the current type of evaluation research is how to specifically measure and analyze LSDPC's success in achieving its implied dwelling density estimates.

The purpose of the evaluation analysis serves as a means of contributing to the improvement of dwelling density program in LSDPC's multifamily apartments. In order to conduct an evaluation research of LSDPC's multifamily housing apartments, one of the first steps is to operationally observe and recognize the variable under study. If LSDPC's multifamily apartments were intended to be occupied by a certain number of persons, it should be possible to be able to measure that number of persons as dwelling density benchmark. This research attempted to determine specific dwelling density benchmarks of LSDPC's multifamily housing apartments, and then assessed the degree to which they have been achieved.

Descriptive statistical methods were applied to analyze and compare quantitative data obtained from questionnaire.

CHAPTER FOUR

4.0 DATA PRESENTATION AND ANALYSES

The conceptual model of this study sought to determine and record how the existing LSDPC's multifamily apartments were designed to be occupied. The results were then applied to establish how this correlated with the actual occupancy during habitation, taking household characteristics into consideration. In this study, the actual dwelling density of LSDPC's multifamily apartments during occupancy was systematically and rigorously compared with explicitly stated dwelling density criteria at the design stage. The difference between the two constitutes the evaluation. However, it was found that LSDPC does not have any explicitly articulated and documented criteria on how its multifamily apartments were intended to be occupied. The first objective of the present research sought to extract and describe the intended occupancy as expected by the apartments' designers. This is the traditional evaluation thinking and practice that stresses the importance of goals in evaluation studies. It reiterates the need to explicitly specify measurable programme goals before the programme can be evaluated. This means that an evaluator should be reasonably acquainted with the goals of the programme before the evaluation research is executed (Weiss, 1997).

The data analyses for this study were based on identifying the patterns of relations between the design density (obtained by inference) and the occupancy density (obtained by actual measurement of occupants' experiences). Thus, the strength of association between the outcome occupancy and the predicted occupancy was determined.

The variables were analyzed based on the conceptual model adopted for this study. By way of recapitulation, the conceptual model was extracted from three related models viz: the GAP model and discrepancy evaluation paradigm. The conceptual equation derived from these models was fully applied in the data presentation and analysis for the present study. It provides a relationship that could be useful in creating urban housing policies that are sensitive to occupancy issues in multifamily apartments. The equation is restated as follows:

$$\left\{\begin{array}{l}\textbf{\textit{Post-occupancy}}\\ \textbf{\textit{Dwelling density}}\end{array}\right\} = \left\{\begin{array}{c}\textbf{\textit{Total number of adult equivalent}}\\ \textbf{\textit{occupants of an apartment}}\end{array}\right\} \div \left\{\begin{array}{c}\textbf{\textit{maximum design}}\\ \textbf{\textit{or rated capacity}}\end{array}\right\} \quad \textbf{\textit{.... (1}}$$

A value of 1.0 implies that the apartment is occupied as designed. Similarly a value of less than 1.0 means that the apartment is under-occupied (deficit), while more than 1.0 suggests that the apartment is over-occupied (surplus).

The relationship can also be expressed in another way:

$$\left\{\begin{array}{l}\textbf{\textit{Post-occupancy}}\\ \textbf{\textit{Dwelling density}}\end{array}\right\} = \left\{\begin{array}{c}\textbf{\textit{Total number of adult equivalent}}\\ \textbf{\textit{occupants of an apartment}}\end{array}\right\} - \left\{\begin{array}{c}\textbf{\textit{maximum design}}\\ \textbf{\textit{or rated capacity}}\end{array}\right\} \quad \textbf{\textit{.... (2)}}$$

A value of zero implies that the apartment is occupied as designed. Similarly a value of less than zero means that the apartment is under-occupied (deficit), while higher than zero suggests that the apartment is over-occupied (surplus).

Over all, the equations show that results of analyzing the occupancy status of a residential apartment can be depicted in one of three ways.

1. The apartment can be occupied as designed.
2. The apartment can be over-occupied/over-crowded, in which case it has more inhabitants than it was designed to accommodate.
3. The apartment can be under-occupied/under-crowded, in which case it has fewer inhabitants than it was designed to accommodate.

4.1 CLASSIFICATION AND ANALYSIS OF HOUSE TYPES

This section provides a classification of different dwelling unit typologies found in LSDPC's housing estates selected for this study. Discussion on house types is of relevance for two main reasons: 1) to properly distinguish and give identity to specific multifamily apartments in the study area, for the purpose of assessing how they were designed to be occupied; 2) to assess the *post-occupancy dwelling density* across various design models of LSDPC's multifamily apartments in the study area. These two issues were the objects of inquiry in objectives one and three of this research.

For the purpose of this study, the dwelling units were arranged according to whether they are two-bedroom type, three-bedroom type or four-bedroom type. These classifications were further grouped according to variations in the spatial organization of the floor plans. It is considered that the understanding of house types in the selected case study areas would provide information on how best the dwelling units were designed to be occupied or utilized. This would help to establish thresholds at which occupants of LSDPC's multifamily prototype apartments were likely to experience space optimization. The housing units were conceptualized as products of a program or policy within the institutional or organizational context of LSDPC. The idea was about design density.

The first objective of this study was to determine how existing LSDPC's multifamily apartments were designed to be occupied. This, in a more explicit term, provides a logical and reasonable description of how LSDPC's multifamily apartments were supposed to be occupied. This represents the official version of how LSDPC as an organization ought to operate occupancy issues in its multifamily housing programmes. In this study, this official version is the rated capacity (also called design density, or predicted occupancy). It is distinct and distinguishable from the theory-in-use, which is the way the multifamily apartments were actually occupied during usage. This can be interpreted as the effects the multifamily apartments eventually produced on the users. A major issue in this thesis, however, was the absence or non-existence of a programme document that clearly spelt out the rated capacity of LSDPC's multifamily apartments. This was achieved by derivation, deduction and by inference from the spatial provisions in specific multifamily apartments, using established occupancy norms. This is the programme theory for dwelling density for the selected housing types in LSDPC, representing the implicit assumptions about how the apartments were to be occupied (that is, the intended occupancy goal).

Design density was operationalized as the maximum rated occupancy of the housing units as designed. The rated capacity became the theory against which the actual dwelling density during habitation was tested. It provided useful data for comparison across various design types. The rated capacity for each existing LSDPC's multifamily apartment type was computed in this research for adult-equivalent occupants, to represent the benchmark at which dwelling space optimal occupancy occured. Over-occupancy (or, over-crowding) occurs when the size of a household is larger than the capacity of the dwelling to provide adequate accommodation. Housing unit design types that were occupied in accordance with their rated capacity were identified. Similarly housing unit design types that were operating above or below their rated capacity were established. Comparisons such as these are capable of revealing non-significant differences, thereby providing information about strength of association for even non-significant differences between predicted occupancy and actual occupancy. The goal is to discover and compare relationships. The purpose of this analysis was not just to classify LSDPC's multifamily designs as crowded, but to gain an understanding of which design types were more likely to experience crowding.

It is therefore necessary to find out what type of housing was provided in each selected case study area and its spatial configuration. This can be obtained from the architectural drawings of the housing units found in each selected case study, which reflects the original interior design and form of housing provided. The architectural drawings purchased from LSDPC were used to extract the initial interior design of the six apartment prototypes covered in this research. The identities and classification of the six apartment types in this study are shown in Figures 4.1; 4.2; 4.3; 4.4; 4.5 and 4.6. To ensure consistency, data collected from the architectural drawings were cross-checked with data obtained through direct measurement and participant observation of the housing units during the field work.

4.2 RESEARCH VARIABLES FROM PHYSICAL MEASUREMENT OF FLOOR PLANS

Alternative measures of dwelling density were employed in analyzing the data for this study. Six different methods derived from the literature (articulated in numbers one to five below) were used for computation and analyses of data.

1. **Estimate of dwelling density based on the number of habitable rooms (same procedure is also used for number of bedrooms only)**:

(a) Obateru's occupancy index of 1.75 for low income housing in Nigeria:

{Number of rooms} X {1.75} = {Number of adult equivalent occupants}

(b) Obateru's occupancy index of 1.50 for medium income housing in Nigeria:

{(Number of rooms} X {1.5} = {number of adult equivalent occupants}.

In applying these indexes, spaces higher than 19.0 square metres are counted as two.

2. **Estimate of dwelling density based on Area of Habitable Rooms:** Table 2.5 shows the relationship between the combined area of habitable rooms and the number of persons expected to occupy the spaces.

3. **Estimate of dwelling density based on aggregate Area of Space for Cooking, Eating and Living (CEL):** In this study, CEL spaces are defined as the kitchen, the dining and the living rooms. Table

2.7 shows the relationship between the aggregate area of CEL and the number of persons expected to occupy the spaces.

4. **Estimate of dwelling density based on total size of each dwelling:** Based on 7.0 square metres allowed per person by the UN-Habitat: {Total area of apartment} ÷ {7.0} = {Number of adult equivalent occupants}

4.3 COMPUTATION OF DESIGN DENSITY ESTIMATES FOR LSDPC PROTOTYPES

4.3.1. Design density score for different apartment types selected for this study

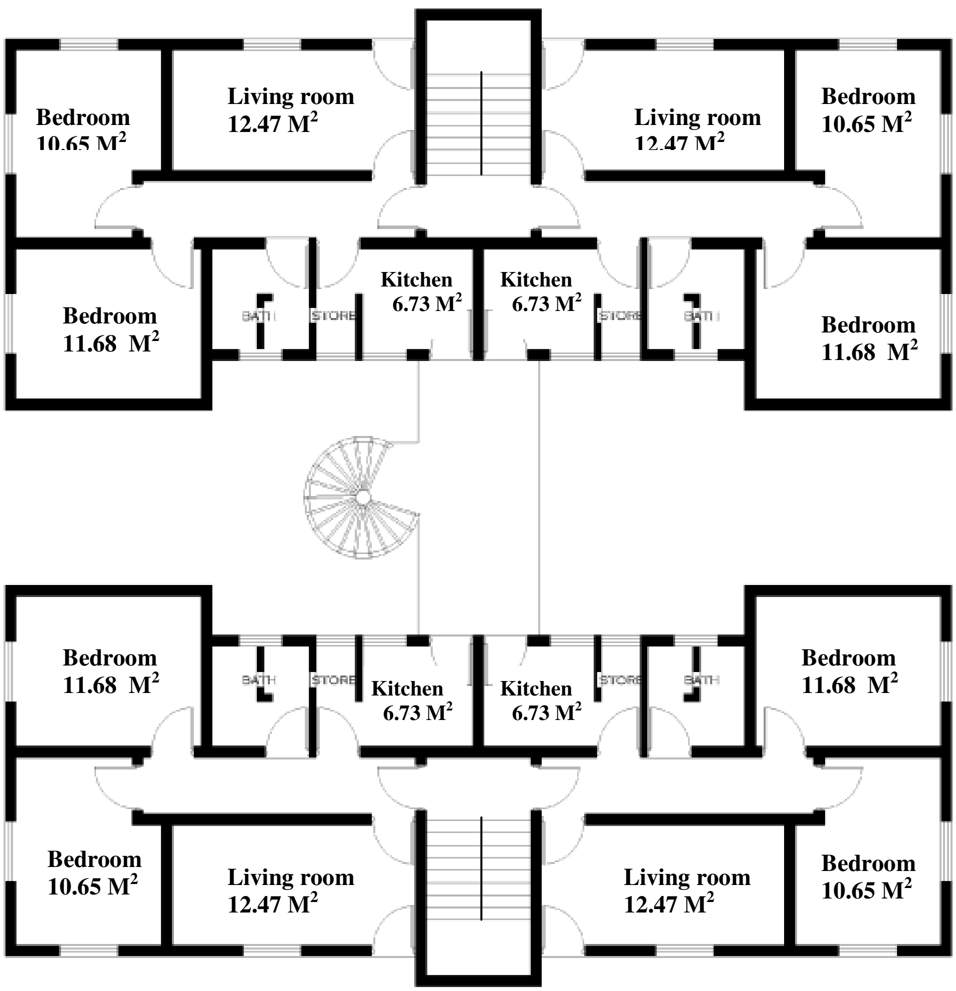


Figure 4.1: Type one (two-bedroom) at Abesan

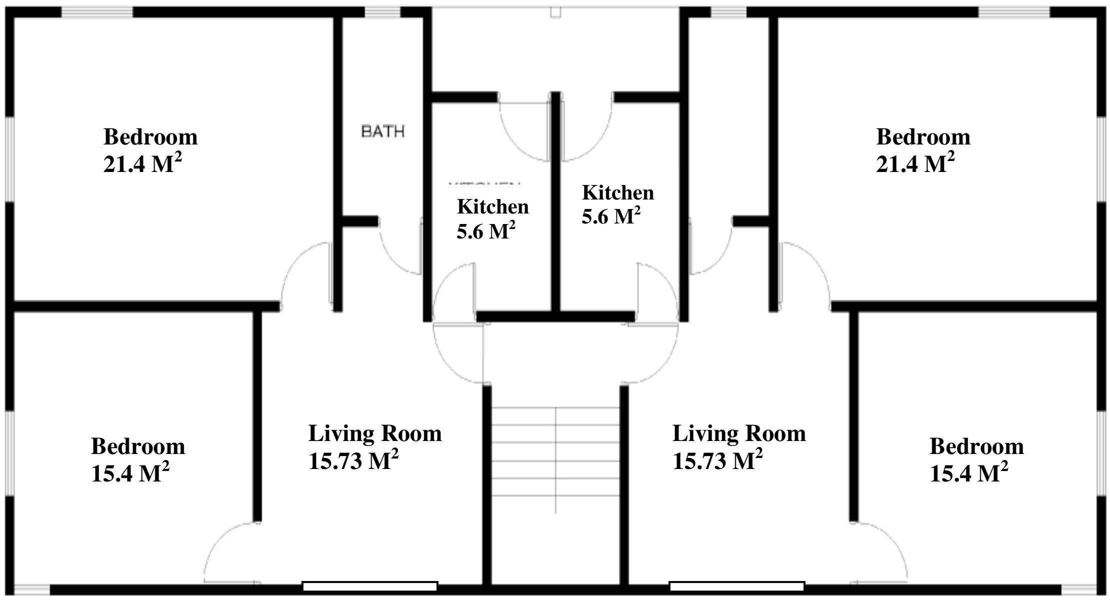


Figure 4.2: Type 2 Two-Bedroom at Dolphin II

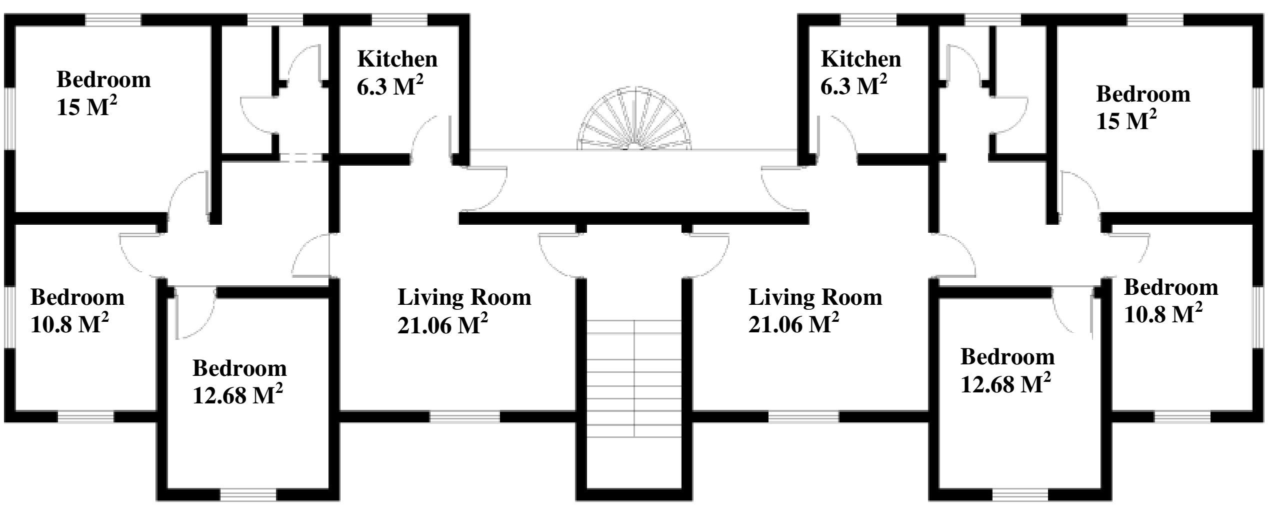


Figure 4.3: Type three (three-bedroom) at Abesan

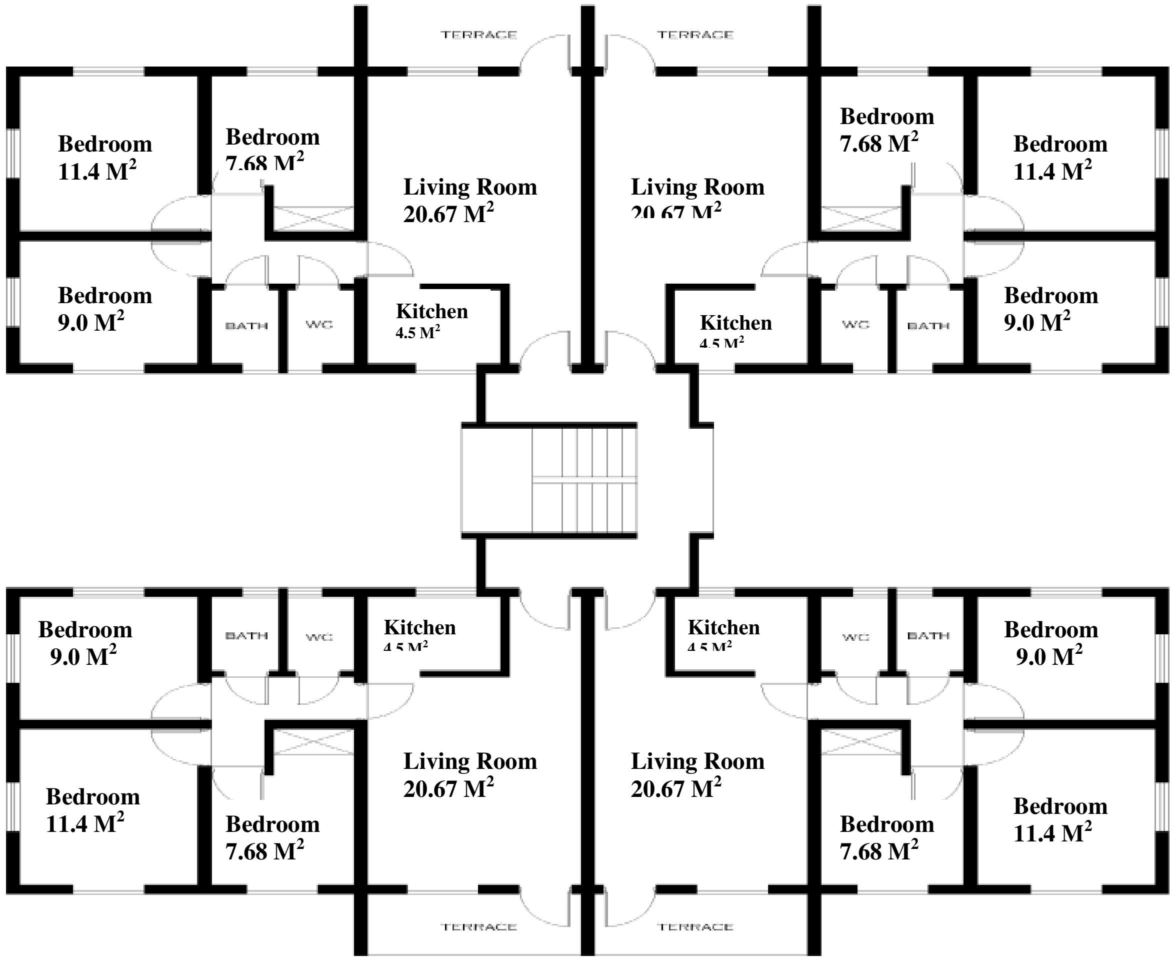
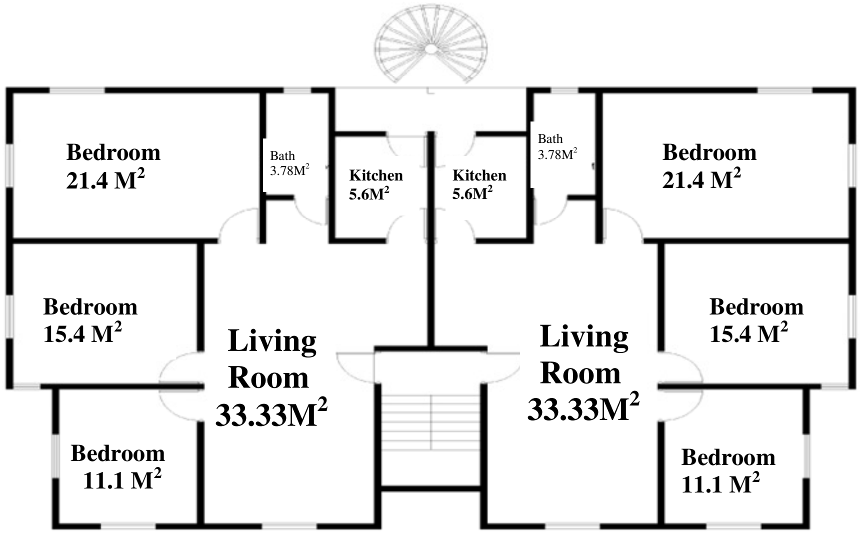


Figure 4.4: Type four (three-bedroom) at Iba



Type five (three-bedroom) at Dolphin

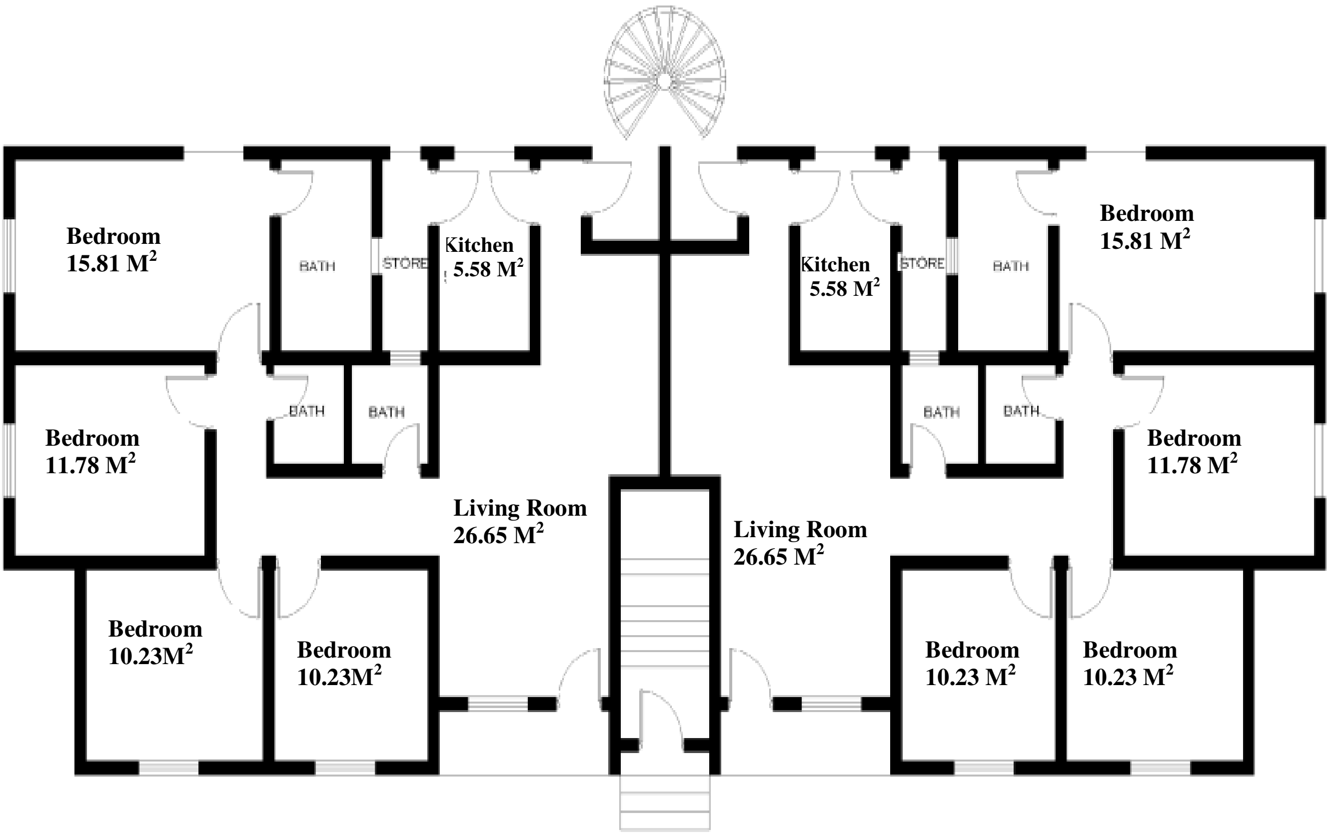


Figure 4.6: Type six (four-bedroom) at Ebute-Metta

A density score was created and assigned to each apartment type for each of the six measurement criteria employed in this study to assess dwelling density. Details of design density scores for each apartment are shown in Table 4.1. These scores refer to the amount of space available and the number of people expected to occupy them. This is in line with the theoretical postulations adopted in this study which hinges on goal accountability, summative and theory-based approach. Architectural plans of buildings to be evaluated were relevant for the gathering of these data (Figures 4.1; 4.2; 4.3; 4.4; 4.5 and 4.6). The scores in Table 4.1 yield answers to objective one and question one addressed in this research.

Table 4.1: Design Density Scores for each Apartment

		Type 1 2-Bedroom Abesan	Type 2 2-bedroom Dolphin II	Type 3 3-bedroom Abesan	Type 4 3-bedroom Iba	Type 5 3-bedroom Dolphin II	Type 6 4-bedroom Ebute-Metta
1	**Number of Habitable rooms**	4	4	5	5	6	6
	Design density rating based on Habitable room i.e. maximum adult equivalent occupants	7.0	7.0	8.75	8.75	10.5	9
2	**Number of bedrooms**	2	2	3	3	3	4
	Design density rating based on bedroom i.e. maximum adult equivalent occupants	3.5	3.5	5.25	5.25	5.25	6.0
3	**Combined Area of Habitable Room (M^2)**	41.53	52.53	59.54	48.75	81.23	74.7
	Design density rating based on total Area of Habitable Rooms i.e. maximum adult equivalent occupants	4.52	5.84	6.68	8.26	9.72	8.79
4	**Aggregate Area of Cooking Eating & Living CEL (M^2)**	19.2	21.33	21.36	25.17	38.93	32.23
	Design density rating based on aggregate Area of CEL i.e. maximum adult equivalent occupants	0.5	0.5	0.5	3.0	9.0	5.0
5	**Total Area of Apartment (M^2)**	52.05	62.96	79.57	67.6	91.53	107.49
	Design density rating based on total area of apartment i.e. maximum adult equivalent occupants (7.0 square metres per person)	7.44	8.99	11.37	9.66	13.08	15.36

4.4. MEASUREMENT OF RESEARCH VARIABLES FROM THE QUESTIONNAIRE

The variables selected for this study which could be measured or extracted from the questionnaire are presented in this section. Data analyses for this study strongly suggest that the most significant factors explaining dwelling density were demographic, and that demographic factors such as ethnicity, gender, age, and marital status, are important determinants of crowding and household size. An analysis of the occupancy profile of households was also done with a focus on the relative importance of other characteristics of the households such as income, education, whether the house is rented or owned and its geographic location in predicting the likelihood of a household being crowded. The household's geographic location is pertinent because it gives an indication of the influence of different market conditions on household crowding. Data from the questionnaire were useful in addressing research questions two, three, four and five.

A. Estate Information

1. Classification of apartment (**V_1**): This helped to establish the location of the apartment among the four estates selected for this study. These are (i) Abesan (ii) Iba (iii) Ebute-Metta (iv) Dolphin II. The location information was matched with the different categories of apartments found there. Only three apartment categories were indicated: (i) two-bedroom (ii) three-bedroom (iv) four-bedroom. The matching of location with apartment category was used to obtain the grouping of apartments into Type 1, Type 2, Type 3, Type 4, Type 5 and Type 6, for the purpose of analyses.

B. Personal Information of Head of Household

2. Gender of household head (**V_2**): This was used to establish whether there is an increase in the number and size of female-headed households compared to male-headed households. This was also intended to reveal the proportion of males to females among the dwelling unit household heads. It will further indicate the patterns of occupancy. They were grouped as either male or female.

3. Marital status of household head (**V_3**): This variable established the total number persons in different marital arrangements in specific dwelling unit types, and estates. It provided a means of comparing dwelling densities. Once all other factors were controlled, the probability of a

household being crowded was determined for households headed by males, single persons, younger persons, etc. The variable is evaluated using (i) married (ii) separated (iii) divorced (iv) widowed (v) single mother (vi) single father (vii) just single (viii) others (specify).

4. Socio-economic class of household head (**V_4**): Income is one of the most cited determinants for crowding. There are arguments that people live in crowded conditions because they cannot afford larger houses. Lack of income may induce families to live with other members of the family or acquaintances. Thus, the probability of a household being crowded is expected to be higher for households headed by persons whose incomes are lower. In this study, the monthly income, derived by summing personal income for the household head, provides basic information about whether a household was low-income, medium-income or high-income. It was taken as an indicator of relative standard of living, and was capable of accounting for household composition. This allowed for comparison of household income across household types and household composition. Overall rating income status of household head was used to determine the level of gentrification, the number and proportion of different income groups in various classifications of apartments. It was also used to establish the patterns of crowding for each income group. To overcome questionnaire response difficulties, total personal income of household head was collected as an income range rather than an actual income figure. Each household head belongs to one of three groups (i) low-income [Less than ₦45,000.00] (ii) medium-income [₦45,000.00 and above, but less than ₦100,000.00] (iii) high-income [₦100,000.00 and above]

5. Ethnicity of household head (**V_5**): Ethnicity is the ethnic group or groups that people identify with or feel they belong to. It is a measure of cultural affiliation, as opposed to race, ancestry, nationality or citizenship. In this study an ethnic group is defined as a social group whose

members share a sense of common origins, claim a common and distinctive history and destiny, or possess one or more dimensions of collective cultural individuality. Ethnicity is an individual characteristic. Therefore, the ethnic group of the household head was taken as a measure of the ethnicity of the household. This classification does not identify specific combinations hence all household members are grouped and assigned the same ethnic identity as the head of household. While this was useful for summarizing ethnic group for households, it ignored the existence and extent of multiple ethnic identities within households. Hence the study does not give any measure of whether household members were of different ethnic groups and, if so, whether this difference occurs between or within generations in a household. Again, different identities between spouses where one partner has a different ethnic group from his/her partner were ignored in favour of the head of household. The analysis in this research hence used the individual ethnicity responses of household heads to compile the ethnic data for a household.

The study established the relationship between ethnic background of household head and crowding in LSDPC's multifamily apartments. The study further indicated the probable number of indigenes of various ethnic groups accommodated in LSDPC's multifamily apartments. This helped to establish ethnic groups that maintain relatively larger households thereby resulting in more crowded apartments. In addition, this enabled the study to understand the ethnic nationalities for whom LSDPC's multifamily apartments were most suited. The ethnic group was evaluated using (i) state of origin (ii) local government area of origin (iii) major ethnic group in place of origin.

6. Age of household's head (**V_6**): This is the actual age (in years) of the head of household. It was used to distinguish those that are seniors or elderly and those that are not. This helped to determine the dominant age bracket of occupants of LSDPC's multifamily apartments by age of the

household heads. The occupancy level for each age bracket was equally established. It also indicated which age group was more likely to be married with children, and whether households headed by seniors had fewer members on average than those headed by younger adults. Furthermore, the prevalence of households headed by children below 18 years or senior citizens above 65 years were established. This will help LSDPC in programming who the occupants of its future apartments will likely be. The age groups were categorized as: (i) less than 18 years (ii) 18-30 years (iii) 31-40 years (iv) 41-50 years (v) 51-65 years (vi) above 65 years.

7. Education level of household's head (**V_7**): This measured the implication of household's head's educational exposure and enlightenment on number of occupants in his apartment. It also provided data on the distribution of residents of LSDPC's multifamily housing units in terms of exposure to different levels of education. The criteria used to evaluate the level of education were: (i) below primary school (ii) primary school (iii) secondary school (iv) college of education (v) polytechnic (vi) university (vii) others (specify).

8. Employment status of household head (**V_8**): This study regarded a person as employed if he or she was in the working-age population (aged 18 years and over) and worked for pay or profit in the context of a) an employee/employer relationship; b) self-employment; or c) works without pay in work that contributes directly to the operation of a farm, business or professional practice owned or operated by a relative. The study established the relationship between employment status of household head and crowding in LSDPC's multifamily apartments. It also provided data on the distribution of residents of LSDPC's multifamily housing units in terms of different occupations. The criteria used to evaluate the employment status were: (i) Self employed (ii) Retired or Pensioner (iii) Private firm employee (iv) Government employee (v) Daily paid casual Worker (vi) Unpaid family work (vii) Unemployed

C. Tenure

9. Length of residency (**V_9**): This is the total number of years a household had lived in LSDPC's multifamily housing. It was computed according to the move-in date. It helped to ascertain how the number of years a household occupied an apartment affected the level of crowding in such apartment. It also provided information on the length of residency of prospective occupants of LSDPC's multifamily apartments. They were categorized as: (i) 0-5 years (ii) 6-10 years (iii) 11-15 years (iv) 16-20 years (v) 21-25 years (vi) 26-30 years (vii) above 30 years.

10. Ownership structure of apartment (**V_{10}**): In this study ownership structure refers to the nature of the occupancy of a household in a dwelling. This sought to ascertain if the apartment was rented or owned by the household. Ownership was treated as an attribute of the household rather than of the dwelling. It does not refer to the ownership of the land on which the dwelling is situated. This established if owner-occupiers or renters had particular influence on the way an apartment was crowded. In other words, whether rented apartments were more crowded than owned apartments. This also enabled the study to establish whether among the owner-occupiers, the specific nature of the person who owns the apartment had any influence on crowding. These were evaluated using: (i) owned by household head (ii) owned by a spouse (iii) jointly owned by head of household and spouse (iv) owned by a child (v) owned by a relative (vi) household rented the apartment.

11. Mode of ownership of apartment (**V_{11}**): This study determined the variability in occupancy between the original allottees of LSDPC's multifamily apartments and occupants who purchased their apartments from previous owners. Mode of ownership was measured as (i) originally purchased from LSDPC (ii) Purchased from previous private owners.

D. Dwelling Unit Characteristics

12. Number of bedrooms (**V_{12}**)**:** This is the total number of bedrooms in each apartment. The measure does not include kitchen and bathrooms. A room was considered to be a bedroom if it was designated as a bedroom in the original architectural drawings, even if it had never been used or was not being used at the time of the data collection. When counting the number of bedrooms, no distinction was made between total square metre of the unit. Practically, what this means is that a two-bedroom unit with an area of 60.0 square metres was functionally considered higher and better (for occupancy purposes) than a one-bedroom unit with the same square metre.

    This served to validate the data from direct physical measurements for bedrooms. The study established the number of adult-equivalent household members occupying one bedroom.

13. Number of habitable rooms (**V_{13}**)**:** Habitable rooms are the living and sleeping areas that are contained in a dwelling. A habitable room includes living and sleeping areas, such as a bedroom, lounge or living room, dining room, kitchen, family room, study, studio, but excludes service areas, such as a shower, pantry, hall, garage, or walk-in wardrobe. This served to validate the data from direct physical measurements for habitable rooms. The study established the number of adult-equivalent household members occupying one habitable room. The spaces in the apartment were divided into: (i) sitting room/living room (ii) dining room (iii) bedroom (iv) kitchen (v) reading room (vi) bathroom and toilet (viii) veranda and balcony.

E. Household Characteristics

14. Age distribution (**V_{14}**)**:** This is the actual count of the total number of household members belonging to different age brackets**.** Rating of individuals according to age provided a basis to determine the number of adult-equivalent occupants in an apartment. Households that have minors

were identified. The number of persons in different age brackets was ascertained. This study considered it useful to view age in terms of age composition, as well as age blending. Age blending refers to a deliberate practice that purposely houses older occupants with younger occupants. The study endeavoured to find out the different combinations for achieving optimum occupancy in LSDPC's multifamily apartments. The parameters used were: (i) under 1 year old (ii) 1 year and above but below 5 years (iii) 5years and above but below 10 years (iv) 10years and above but below 12 years (v) 12years and above but below 15 years (vi) 18years and above but below 65 years (vii) above 65 years.

15. Gender distribution (**V_{15}**)**:** This is sought to achieve sex segregation on moral and cultural grounds. The sexes and number of persons in different age brackets were ascertained. The parameters used for individuals in each age bracket described in variable 14 were: (i) male (ii) female.

16. Regular household members in marital relationship (**V_{16}**)**:** This was needed for the rating of adult-equivalent occupants. The study determined the composition of adult occupants by marriage in order to establish the probable living arrangements to achieve optimum occupancy. The criteria were: (i) Your spouse's parents (ii) Your own parents (iii) Your married children (iv) Your married children (vi) Married extended family members (v) Spouses of your children (i.e. children-in-law) (vi) Widowed children (vii) Widowed extended family members.

17. Employment status of household members (**V_{17}**)**:** This study sought to find out the relationship between employment status of occupants and level of crowding in LSDPC's multifamily apartments. This variable was evaluated using (i) working (ii) retired (iii) unemployed (iv) schooling.

18. Total number of persons living in the household (**V_{18}**)**:** This was an important factor used to predict the probability of living in overcrowded. It represented the actual count of the total number of people living in a housing unit at the time of the survey. The measure did not consider temporary residents. Understanding crowding was considered important because it might be a sign of housing stress. Household size is statistically very closely related to crowding, and therefore it was regarded as a good proxy to measure crowding in this study. This variable is important because it helped to determine the total number of bedrooms by type, which each household required, to meet shelter requirements. Due to the close association between household size and crowding, household size was considered useful in analyzing trends of overcrowding in different categories of LSDPC's multifamily apartments, according to the demographic and socio-economic conditions of the household head. Thus it provided a basis to assess whether a household was overcrowded or over-housed.

The benefit of using household size is that it revealed the actual data that could be useful for comparative analyses. Household size is only descriptive in nature, showing simple associations. Discussions about the likelihood of a household being crowded normally looks at the independent relationship between crowding and a given determining factor, once all other characteristics were taken into account. The number of people living in a household is a function of income, and extended family living arrangements. Income and extended family living arrangements are a function of the socioeconomic and demographic characteristics of the householder.

4.5 VERIFICATION OF RETURNED QUESTIONNAIRES FOR COMPLETENESS, ACCURACY AND UNIFORMITY.

The questionnaires employed in this study were used to answer the research questions two, three, four and five. They were administered on household heads in LSDPC's multifamily apartments. All the returned questionnaires were appraised for completeness, accuracy and uniformity.

In terms of completeness, the questionnaires were checked to ensure that there was an answer to every question. This process helped to identify cases where it was possible to deduce from answers to other questions what the missing answers could have been. The identified questionnaires in this category were edited and the gaps filled accordingly. There were also cases where the questions were not applicable to the respondent. Under such circumstances, the responses to the questions were missing.

For test of uniformity, the questionnaires were edited to ensure that responses to the questions reflected uniformity in the interpretation of instructions. This was intended to reduce errors during the analyses stage. Lastly, the questionnaires were checked to confirm that the responses were accurate and consistent.

4.6 RESPONSE RATE

The total effective return rate was 32% (184) out of a total of (582) distributed. The distribution and return rates for the housing units in different estates are shown in Table 4.2. Eight (4.3%) of all returned questionnaires could not be used in the data analyses because they were incomplete or illegible. High return rates were recorded in estates located in metropolitan areas. These were Dolphin II 98% (42) and Ebute-Metta 90% (36). Conversely, the suburban estates located at Iba and Abesan recorded low return rates. The return rate at Iba was 9% (16) while it was 28% (90) at Abesan estate. From one perspective, the response rate for this study is considered to be somehow low when compared to similar studies in South-Western Nigeria. For instance, among other studies that examined public housing in South-West Nigeria, Illesanmi (2005)'s study yielded a response rate of 48%. From another perspective, a comparison with similar studies in the United Kingdom justifies that the present study's response rate is adequate. CABE (2009), in a study of residents' satisfaction in private homes built since 2002 in Greater London and Southern England obtained a response rate of 20% against 11,500 questionnaires distributed.

Table 4.2: Questionnaire Return Rates for Different Apartment Types

Apartment type	**Number distributed**	**Number returned**	**Defective**
Type one (two-bedroom), Abesan	125	19 (15%)	1
Type two (two-bedroom), Dolphin II	15	15 (100%)	nil
Type three (three-bedroom), Abesan;	195	71 (37%)	3
Type four (three-bedroom), Iba	179	16 (9%)	1
Type five (three-bedroom), Dolphin	28	27 (96%)	2
Type six (four-bedroom), Ebute-Metta	40	36 (90%)	1
Total	582	184 (32%)	8

The random procedure adopted in the present study gave every apartment in the population an equal chance of being selected. Hence each returned questionnaire was seen as being capable of providing facts from which conclusions could be drawn. In addition, the large sample size of 7.5% (582) used in this study, compared to 2.1% (376) recommended by Krejcie and Morgan (1970) took care of the possibility of errors that may arise from the non-response by respondents.

4.7 DATA PRESENTATION

Upon completion of data collection, the data obtained from the returned questionnaires were sorted out, and summarized into tables as well as graphical representations. The data generated were subjected to a wide variety of micro-level measures of crowding, including ratios, proportions, percentages and means.

Cross-tabulations of other personal and socio-economic characteristics of the respondents in the selected LSDPC's multifamily apartments were also done to allow for a general description of the respondents and their households. These comprise their age, gender, marital status, socio-economic status, nature of employment, educational attainment. Since the data generated from the questionnaire were mainly quantitative in nature, the analyses had to be conducted quantitatively.

Descriptive statistics were compiled for the returned questionnaires, in addition to basic cross-tabulations. The cross-tabulation was useful in gleaning a relationship between the different variables.

4.8 ANALYSES

The procedure followed for data analyses was composed of identifying overall patterns, including apartment types, spaces and demographic profiles. The purpose of these was to answer the research questions. Specifically, the first research question sought to determine how the existing LSDPC's multifamily apartments were designed to be occupied. The second question sought to investigate whether LSDPC's multifamily apartments in the study area were under-occupied, over-occupied or occupied as programmed in the design. The third research question sought to determine the extent to which dwelling density varies across various design models of LSDPC's multifamily apartments in the study area. The fourth research question, on the other hand, sought to establish the extent to which occupants' household characteristics affect dwelling densities in LSDPC's multifamily apartments within the study area?

In this study, the criteria that stipulate suitable separation of rooms used for sleeping according to age and sex of household configuration were applied to determine the number of rooms needed in each dwelling prototype. The Canadian National Occupancy Standard (CNOS) and the Equivalized Crowding Index (ECI) were modified and adopted in these analyses. Based on these standards:

i. A husband and wife were allotted one room.
ii. All children below one year were counted as zero
iii. All persons one year and above, but below five years were paired and allotted one room irrespective of sex.
iv. All persons five years and above, but below eighteen years of the same sex were paired and allotted one room. Any single person left over on this age range requires a separate bedroom.
v. Every single person age eighteen years and above was allotted one room

The scores obtained for design density are already detailed in Table 4.1, and represent answers to question one of the current research. In this study, the theoretical proposition for each apartment classification is the design density (also called rated capacity, or predicted occupancy, or expected occupancy).

Research question two was addressed by using tables, column charts and percentages to depict and compare the design density with the actual dwelling density during habitation. The analysis for this question involved comparing findings from the survey to theoretical propositions. Research question three was also addressed by computing descriptive tables and producing charts.

In attempting to answer research question four, cross-tabulation strategy was employed for different household characteristics.

Chi-square test and one sample T-test were used at relevant points in the analyses to validate the results of this research. The detailed analyses of the research are discussed in the following sections.

4.9 DWELLING DENSITY BY ESTATE LOCATION

Table 4.3: Dwelling Density distribution at Different Locations

Location	**Dwelling density groupings**			**Total**
	1-2	**3-5**	**6 & above**	
Abesan	20	59	7	86 (48.9%)
Dolphin	4	27	9	40 (22.7%)
Iba	4	8	3	15 (8.5%)
Ebute-Metta	9	23	3	35 (19.9%)
Total	37 (21.0%)	117 (66.5%)	22 (12.5%)	176 (100%)

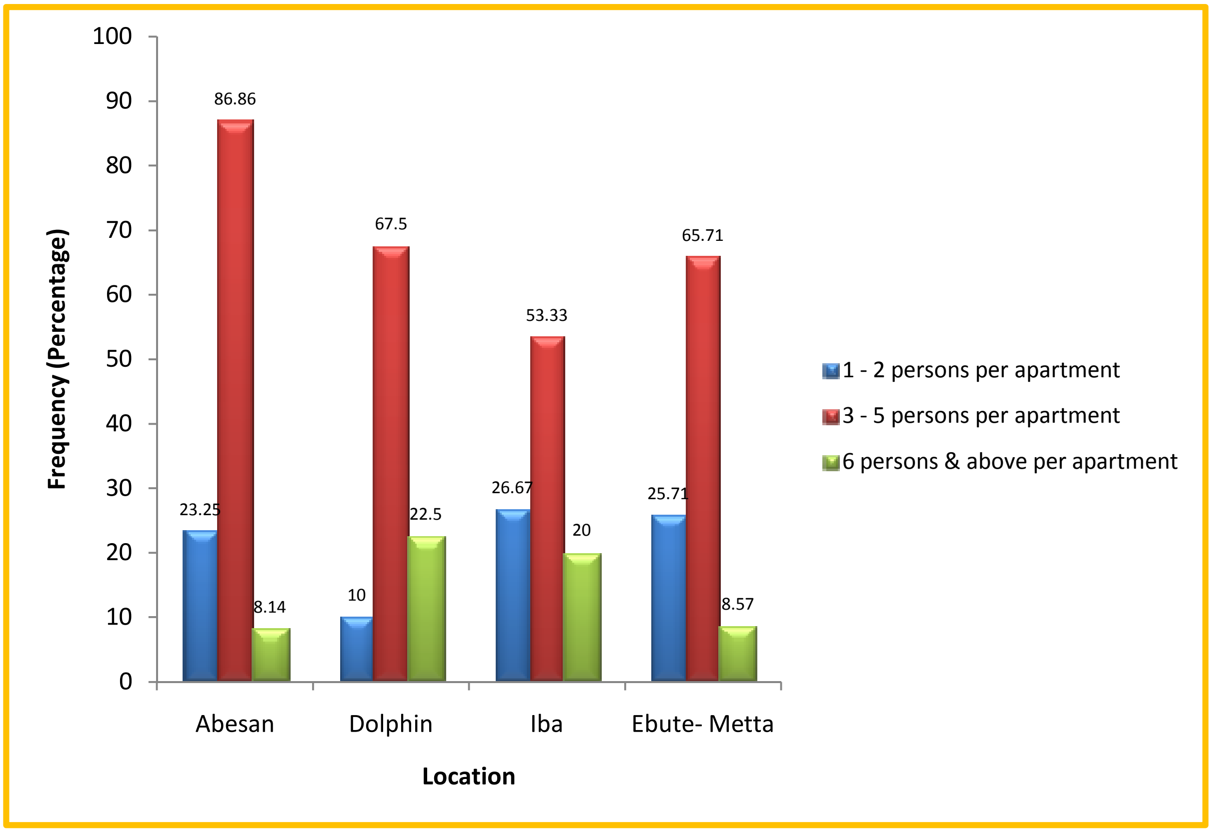


Figure 4.7: Dwelling density groupings by apartment location

Table 4.3 shows that 48.9% (86) of the respondents were located in Abesan Housing Estate. 22.7% (40) of the respondents were based in Dolphin Estate while 19.9% (35) were located in Ebute-Metta. The least number of respondents was in Iba Estate 8.5% (15).

As observed in Figure 4.7, the most prevalent dwelling density group in all the locations were apartments containing 3.0 to 5.0 adult-equivalent number of persons (66.5%). This group constitutes 68.6% (59) at Abesan, 67.5% (27) at Dolphin II, 53.3% (8) at Iba, and 65.7% (23) at Ebute-Metta. Altogether, 21.5% (37) households were between one and two persons, while 12.5% (22) contain six or more adult-equivalent persons. The least number of households containing one to two persons was found in Dolphin II (10%) while the highest in this category was found at Iba (26%).

A statistical validation of the effect of location on dwelling density gave a chi-square value of 9.183, and a p-value of 0.164. This suggests that location of apartments had no significant effect on dwelling density outcome.

4.10 DWELLING DENSITY BY APARTMENT TYPE

Table 4.4: Dwelling Density by Apartment Type

Apartment	**No. of occupants during habitation**		
	1-2	**3-5**	**6 & above**
Type 1	3(16.6%)	14 (77.8%)	1(5.6%)
Type 2	1(6.7%)	10 (66.7%)	4(26.7%)
Type 3	17(25.0%)	45 (66.2%)	6(8.8%)
Type 4	4(26.7%)	8 (53.3%)	3(20.0%)
Type 5	3(12.0%)	17 (68.0%)	5(20.0%)
Type 6	9(25.7%)	23 (65.7%)	3(8.6%)
Total	37 (21.0%)	117 (66.5%)	22(12.5%)

Table 4.4 shows that households containing three to five persons were the most dominant in all apartment types. Type 1(two-bedroom) at Abesan ranked highest with 77.8% (14) respondents belonging to this group, while Type 3 (three-bedroom) at Iba ranked least with 53.3% (8). The results for other apartment types were Type 2 (two-bedroom) at Dolphin, 66% (10); Type 3 (three-bedroom) at Abesan 66.2% (45); Type 5 three-bedroom) at Dolphin, 68.0% (17); and Type 6 (four-bedroom) at Ebute-Metta, 65.7% (23).

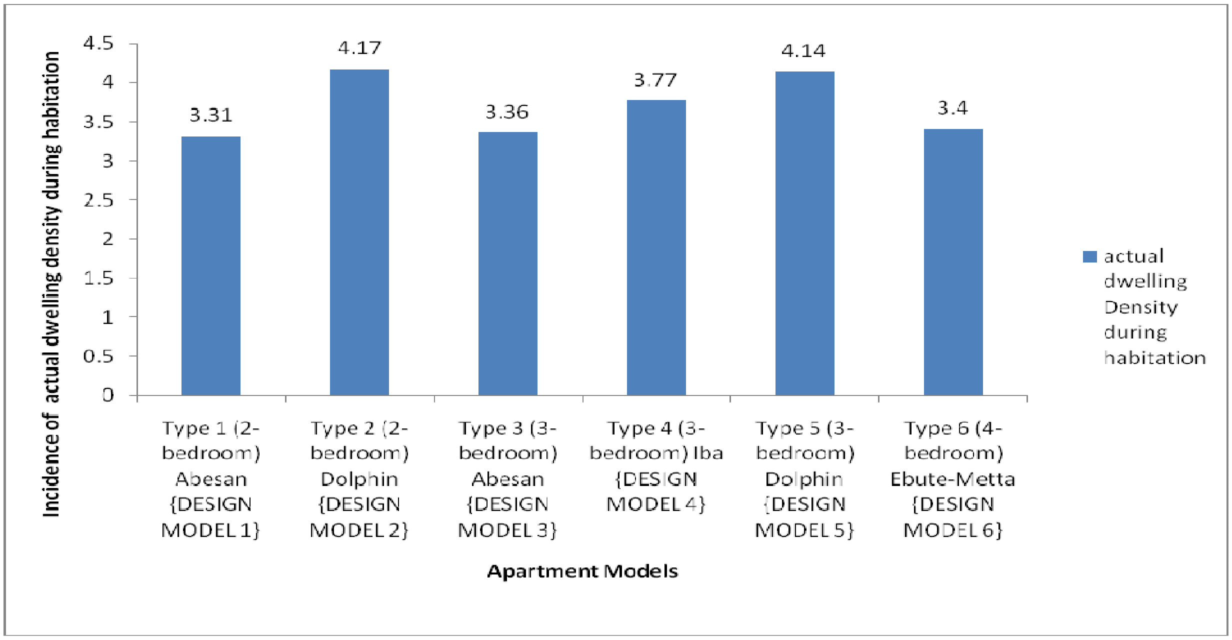


Figure 4.8: Single Measure of Actual Dwelling Density during Habitation Across Various Design Models.

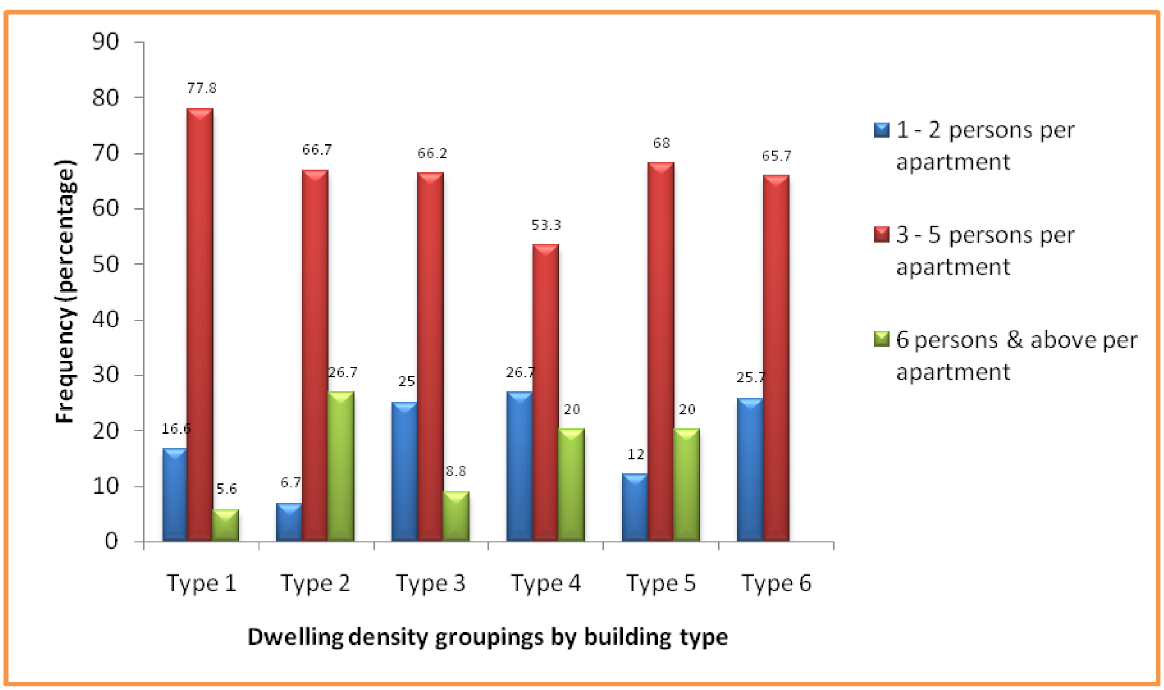


Figure 4.9: Actual Dwelling Density by Building Type (Grouped measures)

Figures 4.8 and 4.9 further illustrate the levels of occupancy in the various types of apartments. The result shows that households comprising one to two persons constitute the second most dominant in apartment Types One, Three, Four, and Six. On the other hand, household sizes comprising six persons and above were the most prevalent. Generally, the result shows that there was no substantial disparity in the incidence of dwelling density among various households occupying different apartment types. However, the low value of 3.4 occupants recorded in Type 6 (four-bedroom) at Ebute-Metta shows that respondents in four bedroom apartments were more likely to live in under-crowded conditions than those in Type 2 (two-bedroom) at Dolphin II and Type 5 (three-bedroom) apartments also at Dolphin II (Figure 4.8).

A chi-square test was used to evaluate the effect of apartment type on dwelling density. A chi-square value of 10.525 and P-Value of 0.396 were observed. This result implies that apartment type had no significant effect on dwelling density, at 95% confidence interval.

Table 4.5 and Figure 4.10 show the dwelling density variability among the six apartment types investigated. As shown, three apartment types were completely under-occupied, based on all the five measurement indicators applied in this research. These apartments are Type 4 (three-bedroom) at Iba, Type 5 (three-bedroom) at Dolphin II, and Type 6 (four-bedroom) at Ebute-Metta. Type 1 (two-bedroom) at Abesan and Type 3 (three-bedroom) at Abesan were over-occupied, when assessed based on aggregate area of CEL. Both apartment classifications were, however, under-occupied, based on the four other indicators namely Number of Habitable Rooms, Number of Bedrooms, Combined area of Habitable Rooms, and Total Area of Each Apartment.

The highest record of over-occupancy was recorded in Type 2 (two-bedroom) at Dolphin II. This apartment type was over-occupied when assessed based on Combined Area of Habitable Rooms and Aggregate Area of CEL. The variability arising from these results are merely indicative. In this study, the ranking order was considered to be more significant if it was based on the degree of under-occupancy or over-occupancy. The results reveal that for each apartment classification, the dwelling density varied according to the measurement indicator applied.

Table 4.5: Number of Adult Equivalent Occupants during Habitation in Specific Apartment Design Models

Maximum Number of Adult Equivalent Occupants During Habitation in Specific Apartment Design Models.		**Apartment design models**					
		Type 1 2-bedroom Abesan	Type 2 2-bedroom Dolphin II	Type 3 3-bedroom Abesan	Type 4 3-bedroom Iba	Type 5 3-bedroom Dolphin II	Type 6 4-bedroom Ebute-Metta
Based on Number of Habitable rooms	Design density rating i.e. maximum adult equivalent number of occupants	7.0	7.0	8.75	8.75	10.5	9
	Actual dwelling density	3.31	4.17	3.36	3.77	4.14	3.40
	Surplus/deficit per apartment (i.e. mean)	**-3.69**	**-2.83**	**-5.39**	**-4.98**	**-6.36**	**-5.60**
Based on Number of bedrooms	Design density rating i.e. maximum adult equivalent number of occupants	3.5	3.5	5.25	5.25	5.25	6.0
	Actual dwelling density	3.31	4.17	3.36	3.77	4.14	3.40
	Surplus/deficit per apartment (i.e. mean)	**-0.19**	**+0.67**	**-1.89**	**-1.48**	**-1.11**	**-2.60**
Based on Combined Area of Habitable Rooms (ref. table 2.5)	Design density rating i.e. maximum adult equivalent number of occupants per m^2 of habitable room	4.52	5.84	6.68	8.26	9.72	8.79
	Actual dwelling density	3.31	4.17	3.36	3.77	4.14	3.40
	Surplus/deficit per apartment (i.e. mean)	**-1.21**	**-1.67**	**-3.32**	**-4.51**	**-5.58**	**-5.39**
Based on Aggregate Area of CEL (ref. table 2.7)	Design density rating i.e. maximum adult equivalent number of occupants per m^2 of CEL	0.5	0.5	0.5	3.0	9.0	5.0
	Actual dwelling density	3.31	4.17	3.36	3.77	4.14	3.40
	Surplus/deficit per apartment (i.e. mean)	**+2.81**	**+3.678**	**+2.86**	**+0.77**	**-4.86**	**-1.60**
Based on Total Area of Each Apartment (7.0 M^2 per person)	Design density rating i.e. maximum adult equivalent number of occupants	7.43	8.99	11.37	9.66	13.08	15.36
	Actual dwelling density	3.31	4.17	3.36	3.77	4.14	3.40
	Surplus/deficit per apartment (i.e. mean)	**-4.12**	**-4.82**	**-8.01**	**-5.89**	**-8.94**	**-11.96**

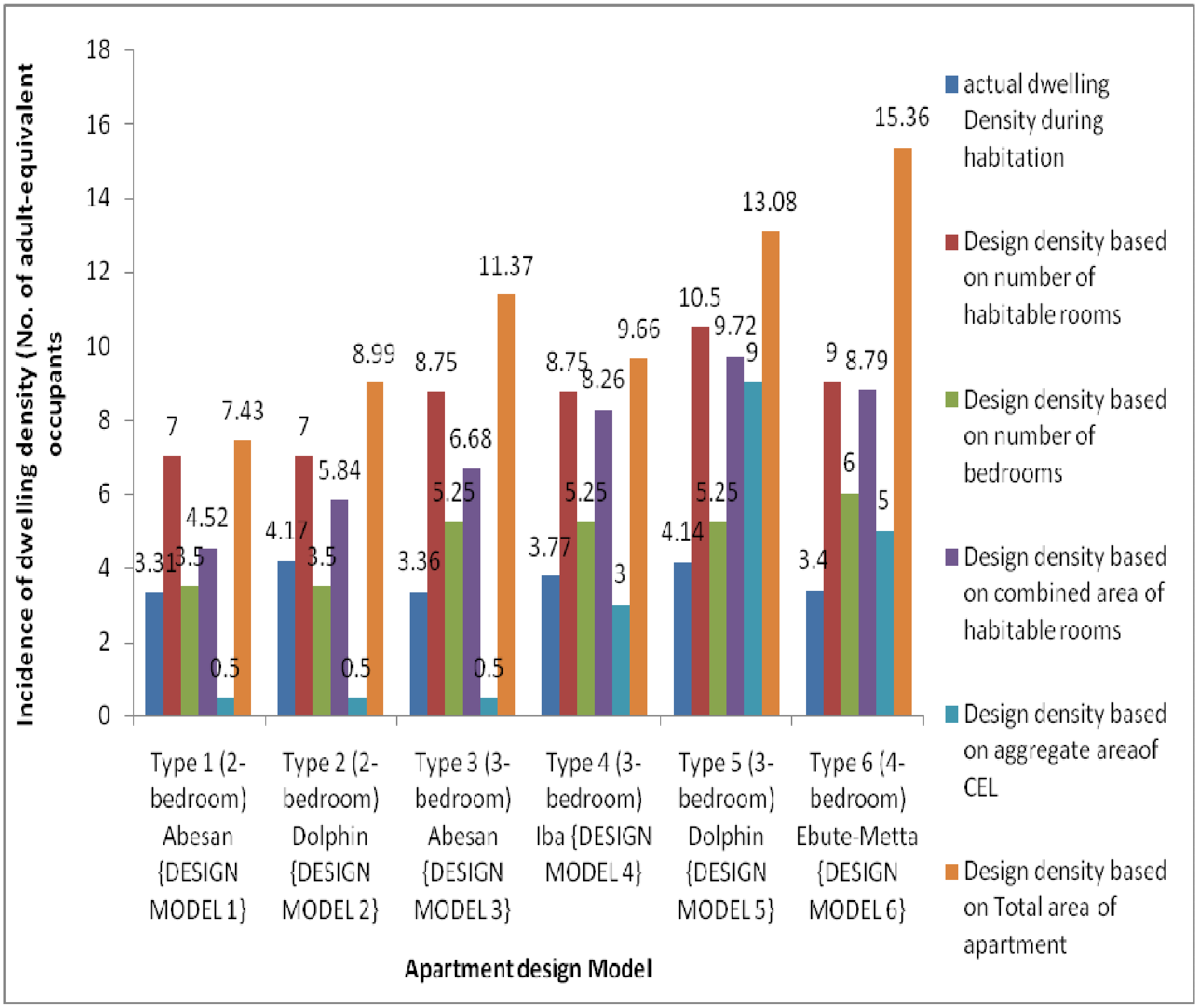


Figure 4.10: Actual Dwelling Density during Habitation versus Design Density in Specific Apartment Design Models

4.10.1 Statistical Validation of the Differences between Actual (Observed) Dwelling Density and Expected (Design) Density.

The difference between the expected dwelling density (i.e. design density) and the actual dwelling density during habitation (i.e. observed density) was verified using one-sample t-test. The test was carried out for each of the five assessment measures applied in this study, namely, Number of Habitable rooms, Number of Bedrooms, Combined Area of Habitable Rooms, Aggregate Area of

CEL, and Total Area of Apartment. The results of the t-test are shown in Table 4.6. The statistical level of significance for acceptance or rejection was set at 95% confidence interval. Thus P-Value (that is, T tabulated) represents the difference between expected design density and the observed dwelling density. The decision rule is that at the same degree of freedom, if the P-Value is less than 0.05, it is classified as “significant”. This implies that at the same degree of freedom, if the P-Value is higher than 0.05, it is classified as “not significant”. The inference from Table 4.6 shows that:

a) Based on Number of Habitable rooms, the difference between the design density and the observed dwelling density was significant in all the six apartment types.

b) Based on number of bedrooms the difference between the design density and observed dwelling density was not significant for Type 1 (2-bedroom) at Abesan, and Type 2 (two-bedroom) at Dolphin. Interestingly, these are two-bedroom apartments. Conversely, the difference was very significant in the three-bedroom and four bedroom apartment types. These are Type 3 (3-bedroom) at Abesan, Type 4 (3_bedroom) at Iba, Type 5 (3-bedroom at Dolphin, and Type 6 (4-bedroom) at Ebute-Metta).

c) Based on combined area of habitable rooms, the difference between the design density and observed density was significant in all the six apartment types.

d) Based on aggregate area of CEL, the difference was significant in all the apartment types except Type 4 (3-bedroom) at Iba.

e) Based on Total area of Apartment, the difference is significant in all the six apartment types investigated.

From the results, it is clear that out of the thirty t-tests carried out, twenty-seven indicate a significant difference between the design density (i.e. predicted dwelling density) and the observed density (i.e. actual dwelling density during habitation). There were only three instances where the difference was not significant. These are: (i) Type 1 (2-bedroom at Abesan using number of bedrooms; (ii) Type 2 (2-bedroom) at Dolphin using number of bedrooms; (iii) Type 4 (3-bedroom) at Iba, using Aggregate Area of CEL.

Table 4.6: Statistical Validation of the Differences between Actual (Observed) Dwelling Density and Expected (Design) Density

	Type 1 2-bedroom Abesan			**Type 2 2-bedroom Dolphin II**			**Type 3 3-bedroom Abesan**			**Type 4 3-bedroom Iba**			**Type 5 3-bedroom Dolphin II**			**Type 6 4-bedroom Ebute-Metta**		
	One Sample t-test **T cal**	**D.F**	p-value **T tab**	One Sample t-test **T cal**	**D.F**	p-value **T tab**	One Sample t-test **T cal**	**D.F**	p-value **T tab**	One Sample t-test **T cal**	**D.F**	p-value **T tab**	One Sample t-test **T cal**	**D.F**	p-value **T tab**	One Sample t-test **T cal**	**D.F**	p-value **T tab**
Number of habitable Rooms	-11.238	17	0.000	-6.132	14	0.000	-25.601	67	0.000	-11.219	14	0.000	-19.744	24	0.000	-25.838	34	0.000
Number of bedrooms	-0.591	17	**0.562**	1.443	14	**0.171**	-8.976	67	0.000	-3.339	14	0.005	-3.446	24	0.002	-11.996	34	0.000
Combined area of habitable Rooms	-3.694	17	0.002	-3.622	14	0.003	-15.769	67	0.000	-10.116	14	0.000	-17.322	24	0.000	-24.869	34	0.000
Aggregate Area of CEL	8.534	17	0.000	7.936	14	0.000	13.587	67	0.000	1.726	14	**0.106**	-15.087	24	0.000	-7.382	34	0.000
Total area of apartment	-12.546	17	0.000	-10.439	14	0.000	-38.047	67	0.000	-13.268	14	0.000	-27.753	24	0.000	-55.182	34	0.000

Remarks/interpretation

P-Value (that is, T tabulated): difference between expected density and the observed dwelling density.

Decision rule: At the same degree of freedom, if the P-Value is less than 0.05, it is classified as "significant"; if the P-Value is higher than 0.05, it is classified as "not significant".

4.11 DWELLING DENSITY BY GENDER OF HOUSEHOLD HEAD

Survey respondents were requested to mark if they were male or female in item number three of the questionnaire. Of the 171 household heads responding to this item, 137 (80.1%) indicated that they were males. Thirty-four responses (19.9%) were indicated as being female. Five individuals did not respond when asked their gender. As shown in Table 4.7, the survey indicates that household heads were predominantly male. The percentage of female respondents can be regarded as minimal. This trend seems to be influenced by the prevailing social and cultural norms which encourage males more than females in property ownership.

This result is consistent with findings of Illesanmi (2005) that the predominance of male-headed household, accords with the traditional notion which regards men as heads of households.

Table 4.7 Gender Classification of Heads of Households

Apartment Type	Gender				Total
	Male		Female		
	No	%	No	%	
Type one (two-bedroom), Abesan	13	72.2	5	27.8	18
Type two (two-bedroom) Dolphin II	14	93.3	1	6.7	15
Type three (three-bedroom) Abesan;	50	73.5	18	26.5	68
Type four (three-bedroom) Iba	12	85.7	2	14.3	14
Type five (three-bedroom) Dolphin	23	100	0	0	23
Type six (four-bedroom) Ebute-Metta	25	75.8	8	24.2	33
Total	137	80.1	34	19.9	171

Note: 5 respondents did not answer the question on gender of household head.

Many occurrences of female heads were largely due to cases where the woman is a widow of the original owners of the apartments. Some cases were also recorded among the respondents where the female heads of households were divorcees. Very few of the female-headed respondents were actually married and currently living with their husbands. Though minimal, this represents a significant shift from the traditional male dominated household headship.

Figures 4.11 to 4.16 show the dwelling density outcome for the six apartment types based on gender of household heads. Households headed by males were most prevalent in all the apartment types. In fact, there were no female-headed households in Type 5 apartment at Dolphin II. Among the three dwelling density groupings applied in this research households containing three to five adult-equivalent occupants were dominant, irrespective of whether the household head was a male or female. Again, the three dwelling density groupings were more likely to be found in male-headed households than in female-headed households.

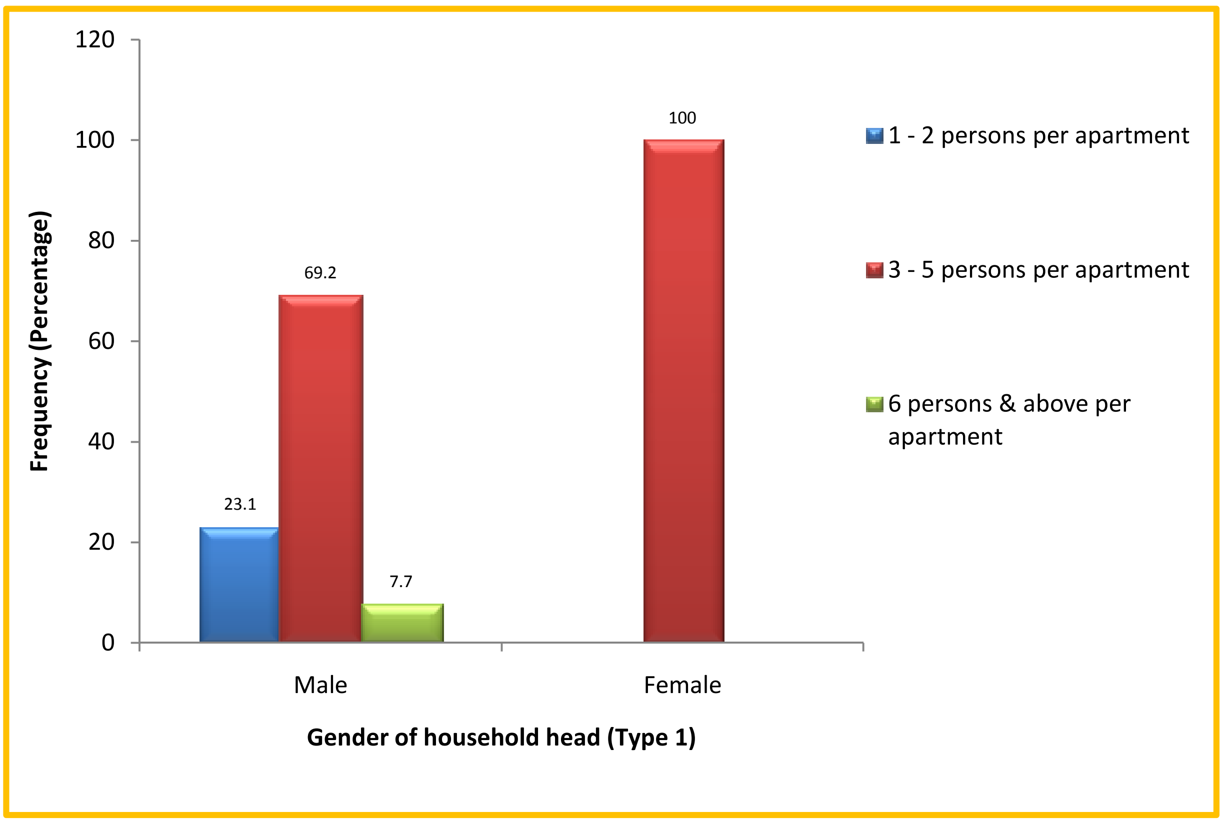


Figure 4.11: Actual Dwelling Density for Apartment Type 1 Based on Gender

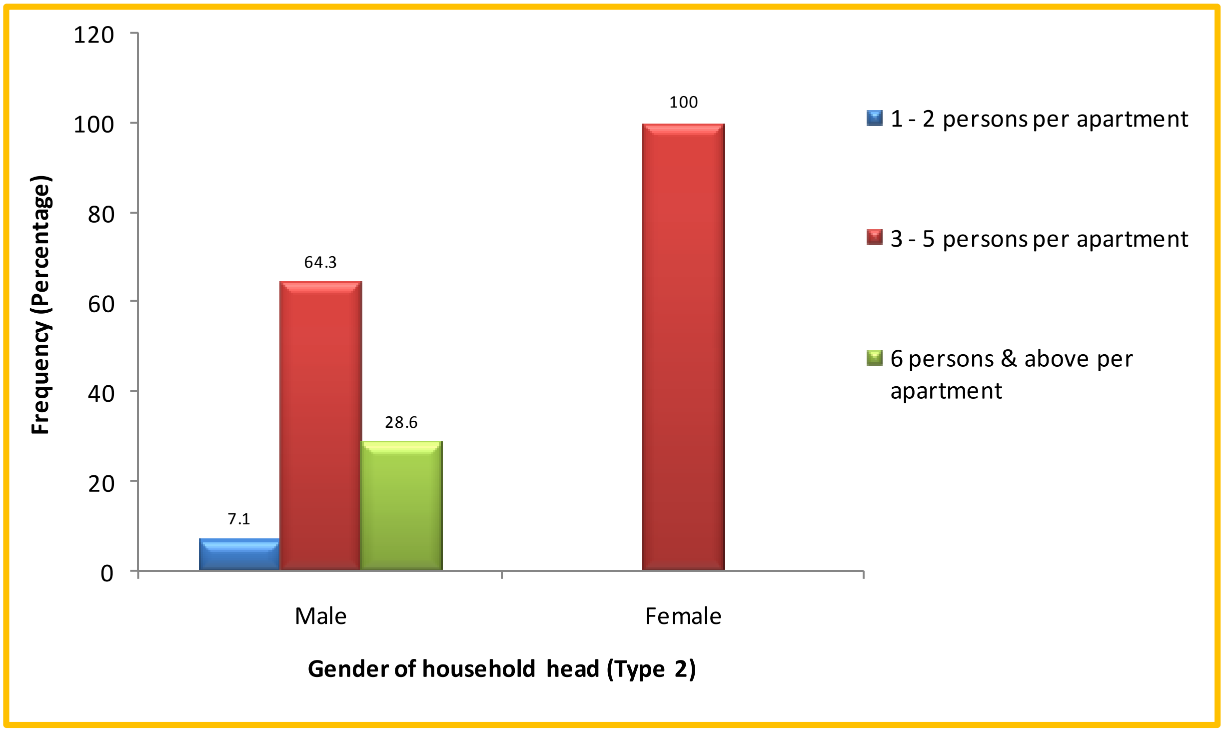


Figure 4.12: Actual Dwelling Density for Apartment Type 2 Based on Gender

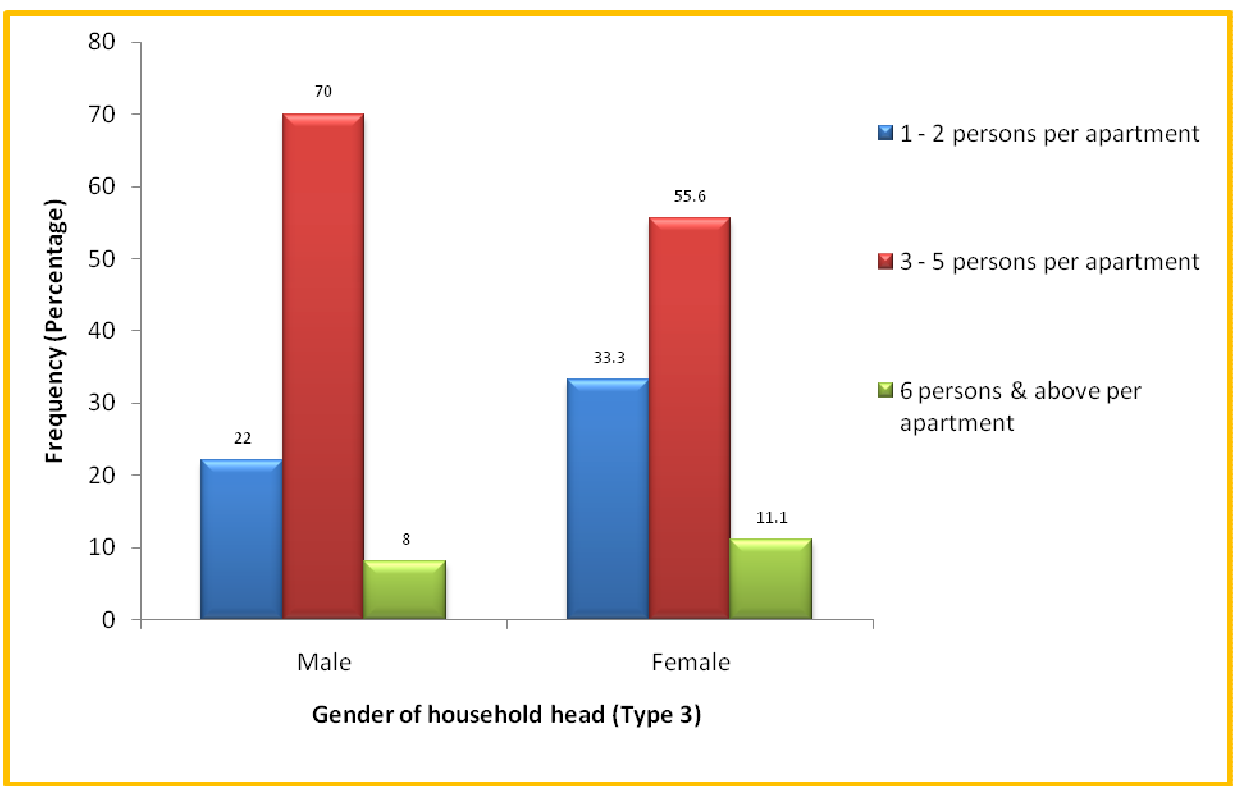


Figure 4.13: Actual Dwelling Density for Apartment Type 3 Based on Gender

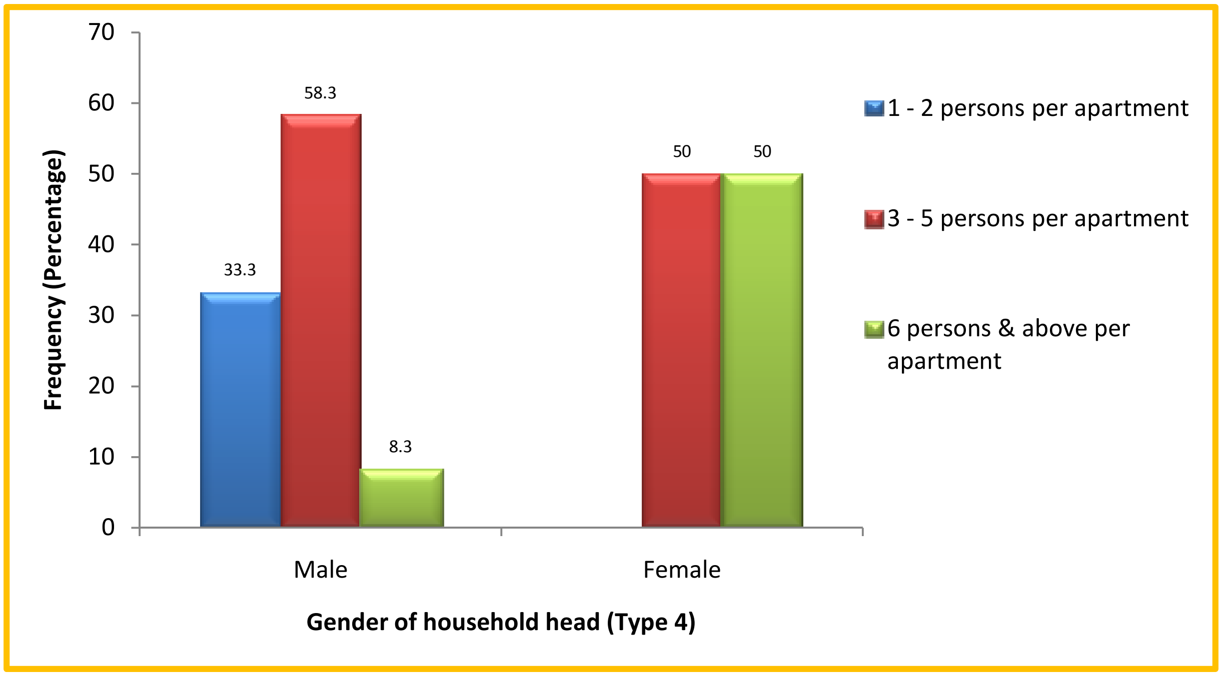


Figure 4.14: Actual Dwelling Density for Apartment Type 4 Based on Gender

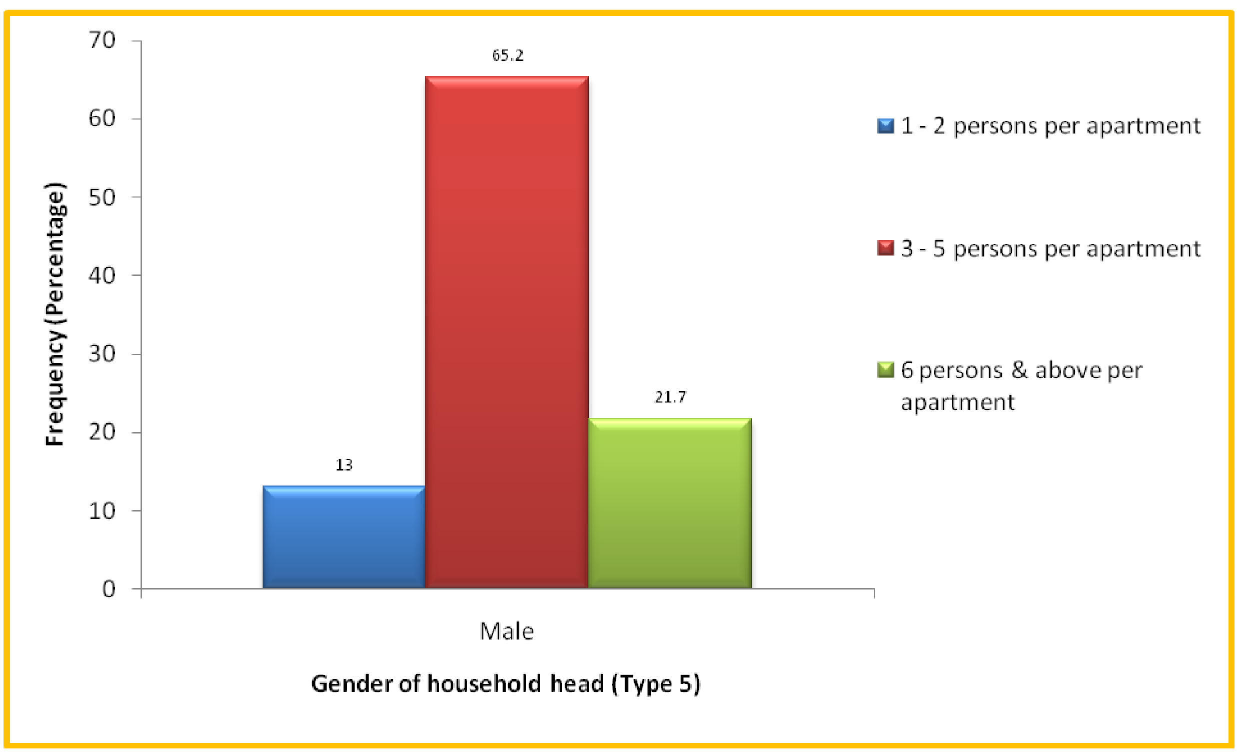


Figure 4.15: Actual Dwelling Density for Apartment Type 5 Based on Gender

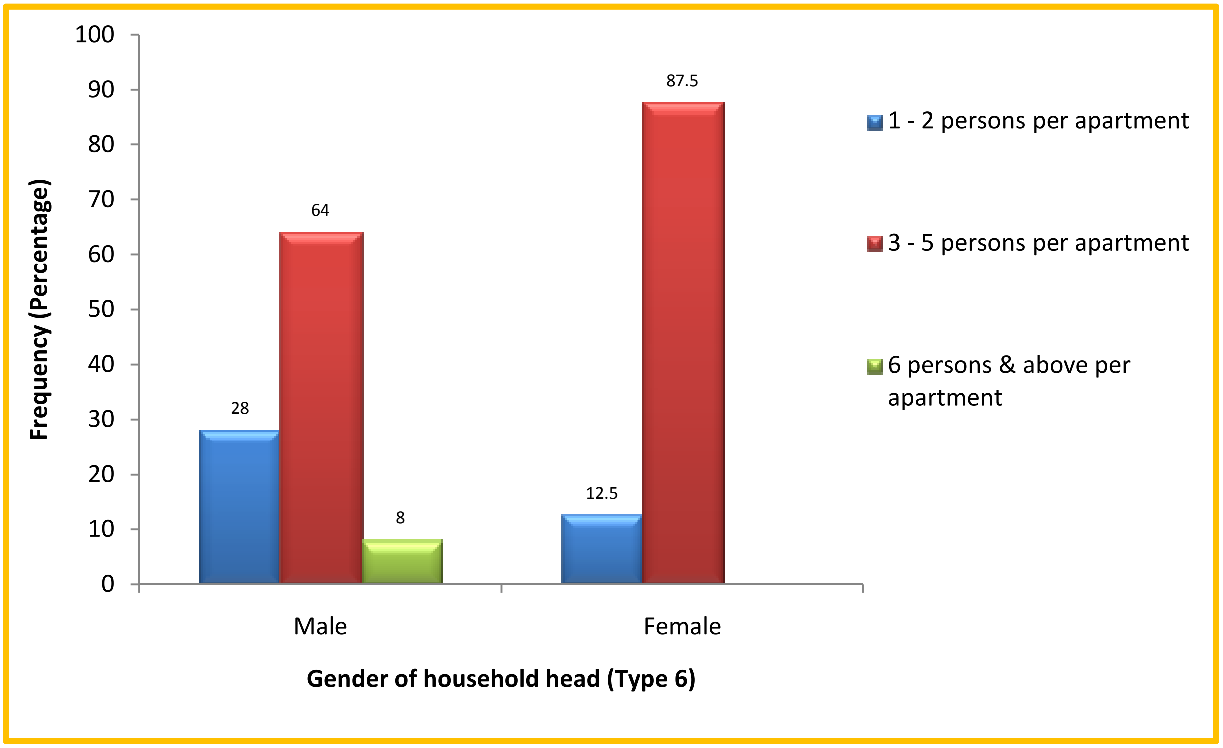


Figure 4.16: Actual Dwelling Density for Apartment Type 6 Based on Gender

A chi-square test was carried out to indicate the effect of gender on dwelling density in the six apartments investigated. The results are shown in Table 4.8. The statistical level of significance for acceptance or rejection was set at 95% confidence interval. Thus P-Value (that is, T tabulated) represents the effect of gender on dwelling density. The decision rule is that at the same degree of freedom, if the P-Value is less than 0.05, the effect of gender on dwelling density is classified as "significant". This implies that at the same degree of freedom, if the P-Value is higher than 0.05, the effect of gender on dwelling density is classified as "not significant". The inference from Table 4.6 shows that in all the six apartment types, the gender of household head has no significant effect on dwelling density, at 95% confidence level. Therefore, whether the household head is a male or female is not likely to be relevant in formulating an occupancy policy for LSDPC's multifamily apartments in future.

Table 4.8: Effect of Gender on Dwelling Density

Apartment type	Chi-square Value X^2	D.F.	P-Value (T-tabulated)	Remarks
Type one (two-bedroom), Abesan	1.978	2	0.372	Gender has no significant effect on dwelling density in all apartment types
Type two (two-bedroom), Dolphin II	0.536	2	0.765	
Type three (three-bedroom), Abesan;	1.242	2	0.537	
Type four (three-bedroom), Iba	2.771	2	0.250	
Type five (three-bedroom), Dolphin	CONSTANT			
Type six (four-bedroom), Ebute-Metta	1.721	2	0.423	

Remarks/interpretation

P-Value (that is, T tabulated): effect of gender on dwelling density. Decision rule: At the same degree of freedom, if the P-Value is less than 0.05, effect of gender on dwelling density is classified as "significant"; if the P-Value is higher than 0.05, effect of gender on dwelling density is classified as "not significant".

4.11.1 Dwelling Density in Male-Headed Households

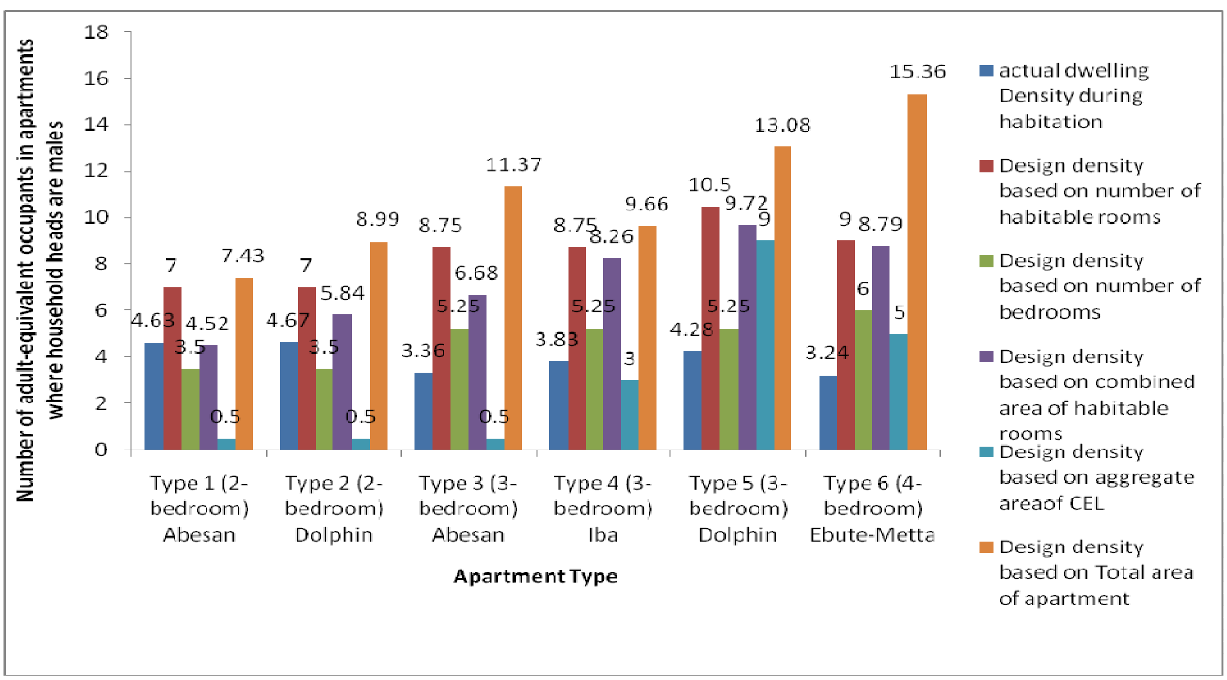


Figure 4.17: Decomposition of Dwelling Density Incidence in Male-Headed Households

Figure 4.17 shows the incidence of dwelling density in male-headed households for various apartment types, according to five measuring criteria adopted in this study. As can be observed from the figure, three of the measurement criteria indicate that all apartments were under-occupied, irrespective of type. The three criteria that gave this result are: Number of Habitable Rooms, Number of Bedrooms, and Total Area of Each Apartment. Using the Aggregate Area of CEL indicator, the table shows that only Type 5 (three-bedroom) at Dolphin and Type 6 (four-bedroom) at Ebute-Metta were under-occupied. All the other four types of apartment were over-occupied. These are: Type1 (two-bedroom) at Abesan, Type 2 (two-bedroom) at Dolphin II, Type 3(three-bedroom) at Abesan, and Type 4 (three-bedroom) at Iba. The use of Combined Area of Habitable Rooms, on the other hand, revealed that five apartment types were under-occupied, while only one was over-occupied. The over-occupied apartment is the Type 1 (two-bedroom) at Abesan.

4.11.2 Dwelling Density in Female-Headed Households

Figure 4.18 shows results of dwelling density outcome for respondents in female-headed households.

As can be observed from the figure, five measurement criteria were employed in the measurement of dwelling density rating for each of the five apartment types. Three of the measurements revealed that all apartments, regardless of type, were under-occupied. The three criteria that gave this result are: Number of Habitable Rooms, Combined Area of Habitable Rooms, and Total area of Each Apartment. Computation of dwelling density using Number of Bedrooms indicated an interesting outcome in Type 4 (three-bedroom) at Iba. This apartment was occupied as designed. All other apartments were marginally under-occupied. The use of CEL also gave an interesting result. All the apartments were over-occupied in this circumstance.

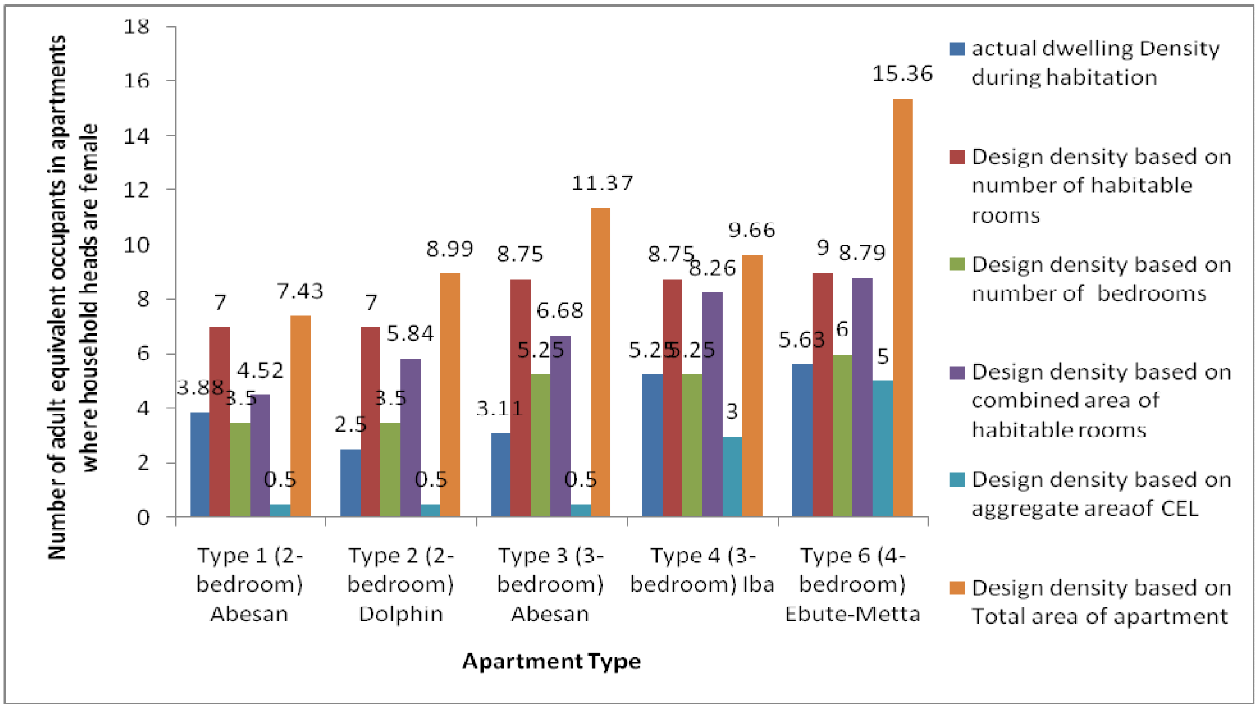


Figure 4.18: Decomposition of Dwelling Density Incidence in Female-Headed Households

4.12 DWELLING DENSITY BY MARITAL STATUS OF HOUSEHOLD HEAD

Table 4.9: Marital Status of Household Head

Marital situation category	No of Respondents	Percentage (%)
Married	121	69.1
Separated	5	2.9
Divorced	3	1.7
Widow(er)	12	6.9
Single Mother	4	2.3
Single Father	1	0.6
Just Single	29	16.5
Total	**175**	**100**

Note: one respondent did not answer the question marital status.

A question was posed to the respondents to know their marital status. The survey offered six choices in the following categories: “married” “separated” “divorced” “widowed” “single mother” “single father” “just single” “others (specify)”. The results from this question are outlined in Table 4.9. No respondent marked “others”. Table 4.9 shows that 69.1% (121) households in the study area were headed by married persons. This was the most frequently occurring response. Households headed by individuals who were categorized as “just singles” constituted 16.5% (29). These persons were presumed to be young adults who are yet to be married. The result indicated that the third highest group of household heads were the widow(ers), who constituted 6.9% (12). Theses three types of households are generally regarded as what urban residents are used to. Table 4.9, however, further reveals the existence of household types in other forms of marital arrangement though in smaller proportion than the traditionally recognized types. The four marital types identified in this study are “separated” 2.9% (5), “divorced” 1.7% (3), “single mother” 2.3% (4), and “single father” 0.6% (1).

Although these household types may have existed historically, it is likely that cultural instincts have over the years discouraged people from willingly accepting to be identified with them. The social unacceptability of “single fatherhood” and ‘divorced” households was evident from the data. The least figure of 0.6% (1) of respondents belongs to single fatherhood. This is closely followed by respondents from households headed by divorced persons 1.7% (3).

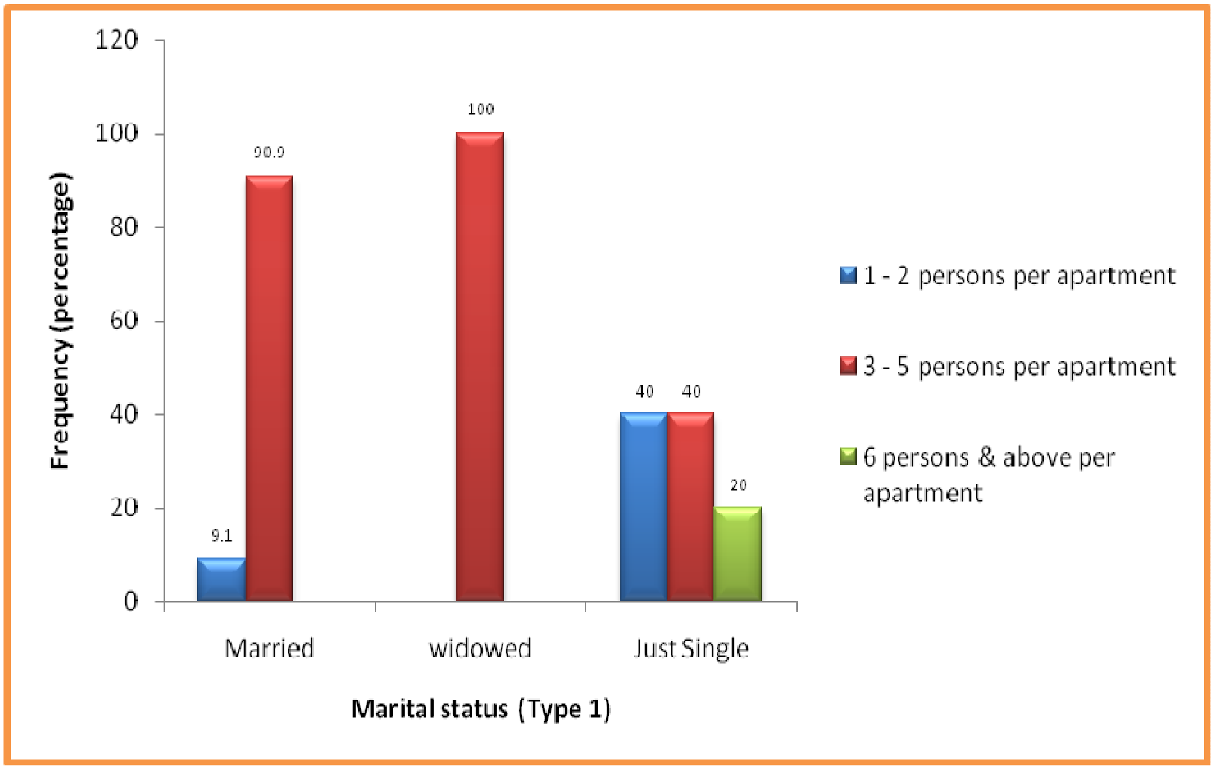


Figure 4.19: Actual Dwelling Density for Apartment Type 1 Based on Marital Status

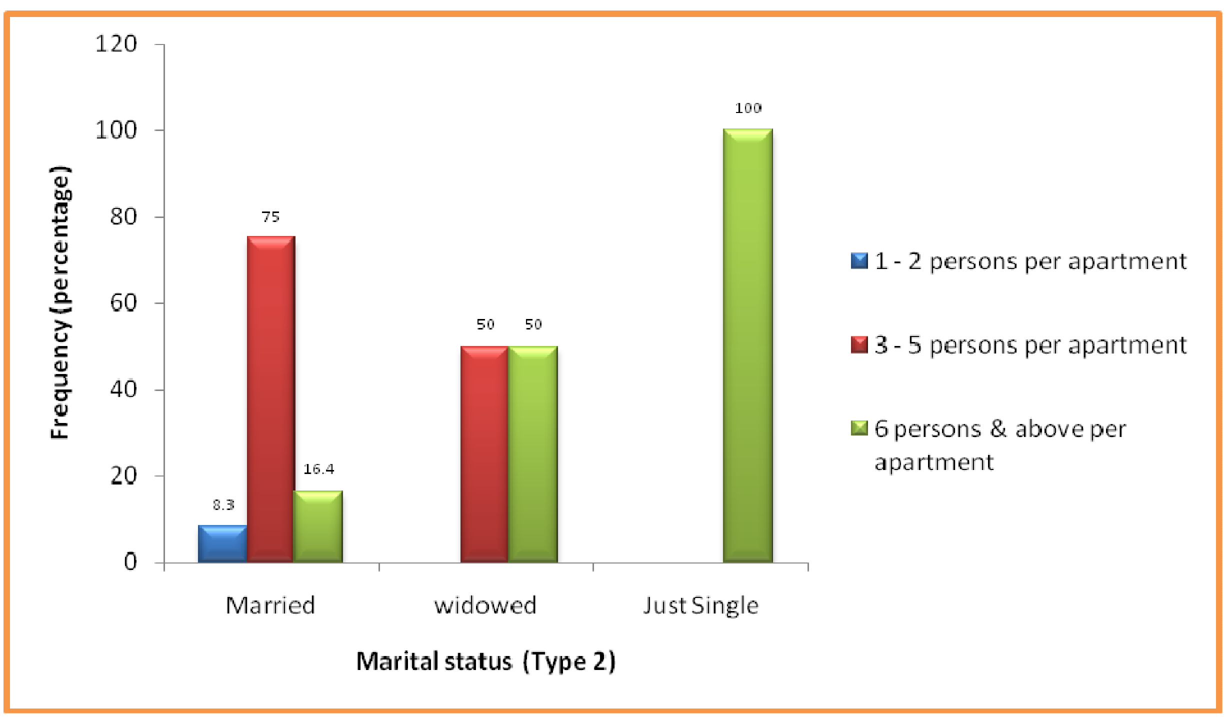


Figure 4.20: Actual Dwelling Density for Apartment Type 2 Based on Marital Status

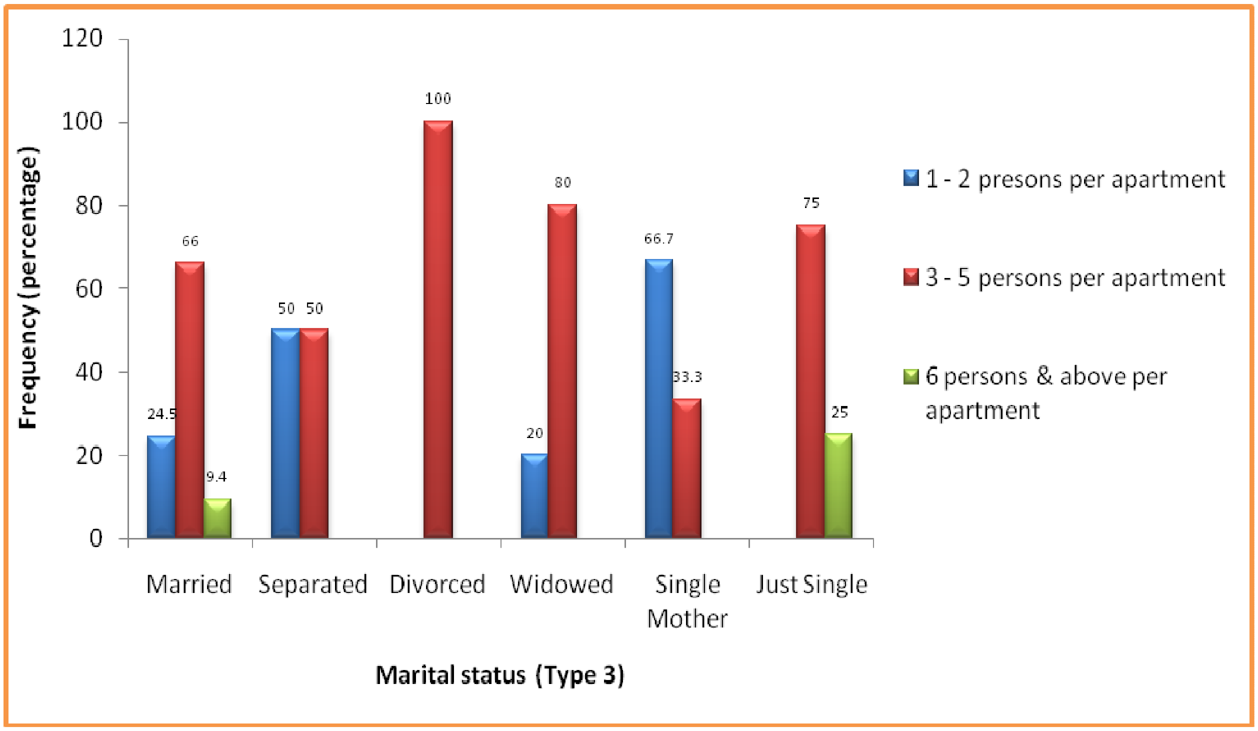


Figure 4.21: Actual Dwelling Density for Apartment Type 3 Based on Marital Status

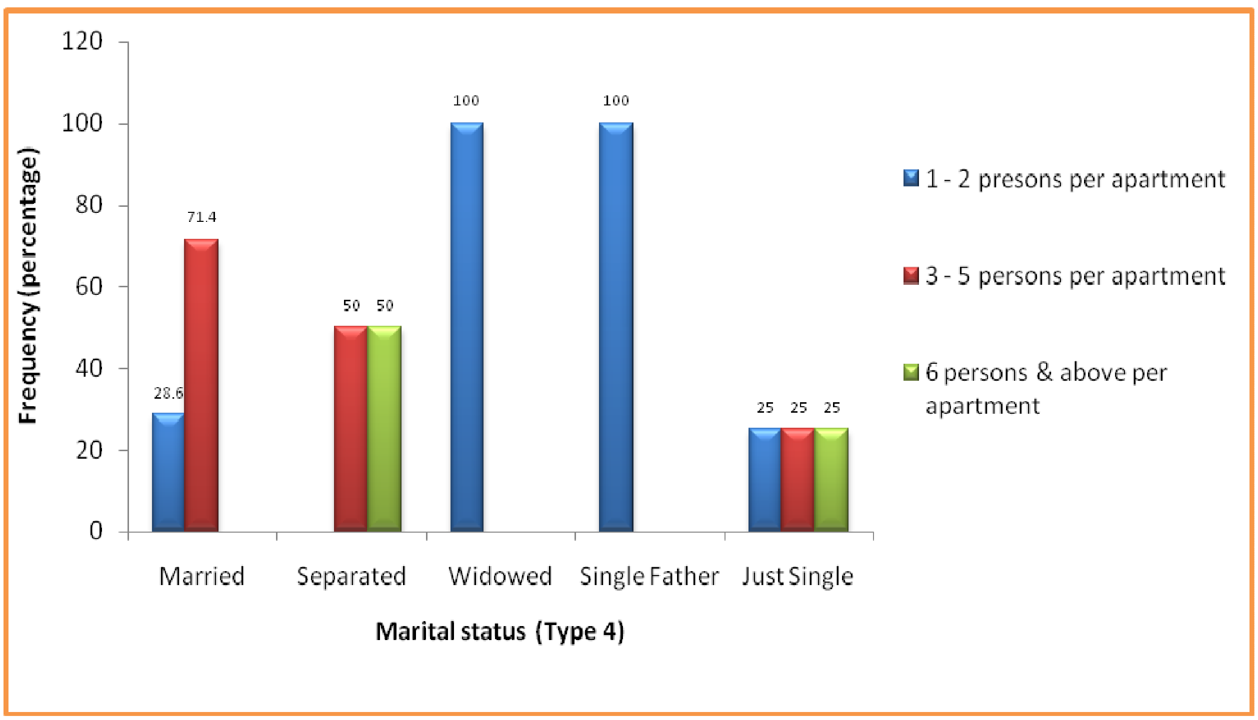


Figure 4.22 Actual Dwelling Density for Apartment Type 4 Based on Marital Status__

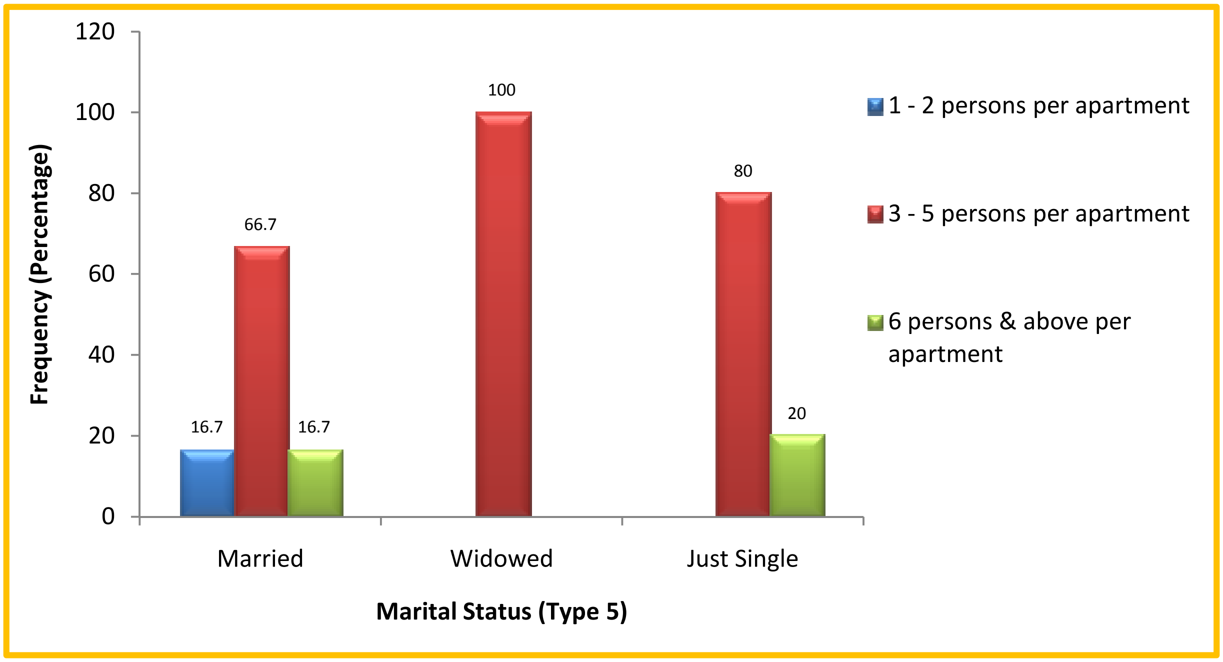


Figure 4.23: Actual Dwelling Density for Apartment Type 5 Based on Marital Status

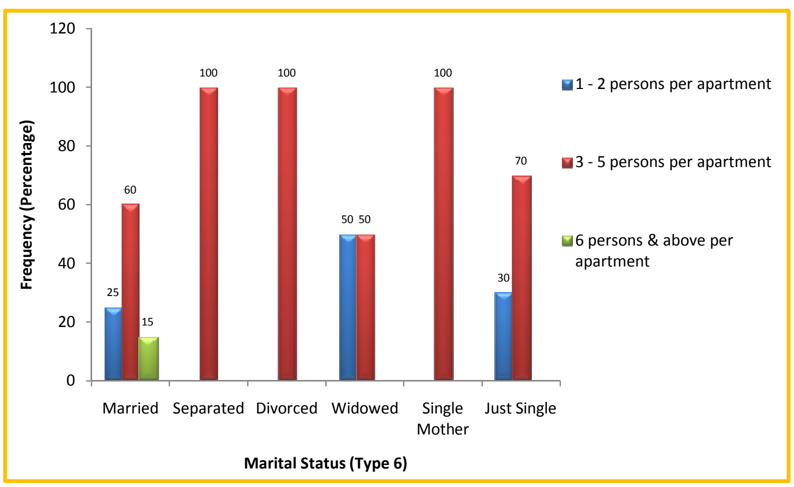


Figure 4.24: Actual Dwelling Density for Apartment Type 6 Based on Marital Status

4.12.1 Statistical Validation of Effect of Marital Status on Dwelling Density Outcome

Table 4.10: Effect of Marital Status on Dwelling Density

Apartment type	Chi-square Value X^2	D.F.	P-Value T tabulated	Remark
Type one (two-bedroom), Abesan	6.234	4	0.182	Marital Status has no significant effect on dwelling density in all apartment types
Type two (two-bedroom), Dolphin II	4.000	4	0.406	
Type three (three-bedroom), Abesan	7.000	10	0.725	
Type four (three-bedroom), Iba	9.308	8	0.317	
Type five (three-bedroom), Dolphin	4.960	4	0.291	
Type six (four-bedroom), Ebute-Metta	4.295	10	0.933	

Remarks/interpretation

P-Value (that is, T tabulated): effect of marital status on dwelling density. Decision rule: At the same degree of freedom (D.F) if the P-Value is less than 0.05, effect of marital status on dwelling density is classified as "significant"; if the P-Value is higher than 0.05, effect of marital status on dwelling density is classified as "not significant".

The actual dwelling density outcome during habitation in the six selected apartment types based on marital status of respondents is shown in Figures 4.18 to 4.24. Also, the effect of marital status on dwelling density is shown in Table 4.10. The statistical level of significance for acceptance or rejection was set at 95% confidence interval. Thus P-Value (that is, T tabulated) represents the effect of marital status on dwelling density. The decision rule is that at the same degree of freedom, if the P-Value is less than 0.05, the effect of marital status on dwelling density is classified as "significant". This implies that at the same degree of freedom, if the P-Value is higher than 0.05, the effect of marital status on dwelling density is classified as "not significant". The inference from Table 4.10 indicates that at 95% confidence level, marital status had no significant effect on dwelling density.

4.12.2 Dwelling Density Incidence in Apartments where Household Heads are Married

The dwelling density in apartments where the household heads were married is shown Figure 4.25.The figure reveals that all the apartments were under-occupied, when assessment methods of Number of Habitable Rooms and Total Area of Apartments were used. The use of Number of Bedrooms indicator shows that all the two bedrooms investigated were over-occupied while the three-bedroom and four-bedroom units were under-occupied. The Combined Area of Habitable Rooms indicator reveals that over-occupied apartments could be found only among the two-bedroom units located at Abesan estate.

All the other two bedroom units at Dolphin II were under-occupied. Similarly, all the three-bedroom and four-bedroom units investigated remained largely under-occupied.

The highest level of over-occupancy in households headed by married persons occurred when the indicator of Aggregate Area of Cooking, Eating and Living (CEL) was applied. Four apartment types were over-occupied, namely, Type 1 (two-bedroom) at Abesan, Type 2 (two-bedroom) at Dolphin II, Type 3 (three-bedroom) at Abesan, and Type 4 (three bedroom) at Iba. On the other hand, only two apartment types were under-occupied. These are, Type 5 (three-bedroom at Dolphin II, and Type 6 (four-bedroom) at Ebute-Metta.

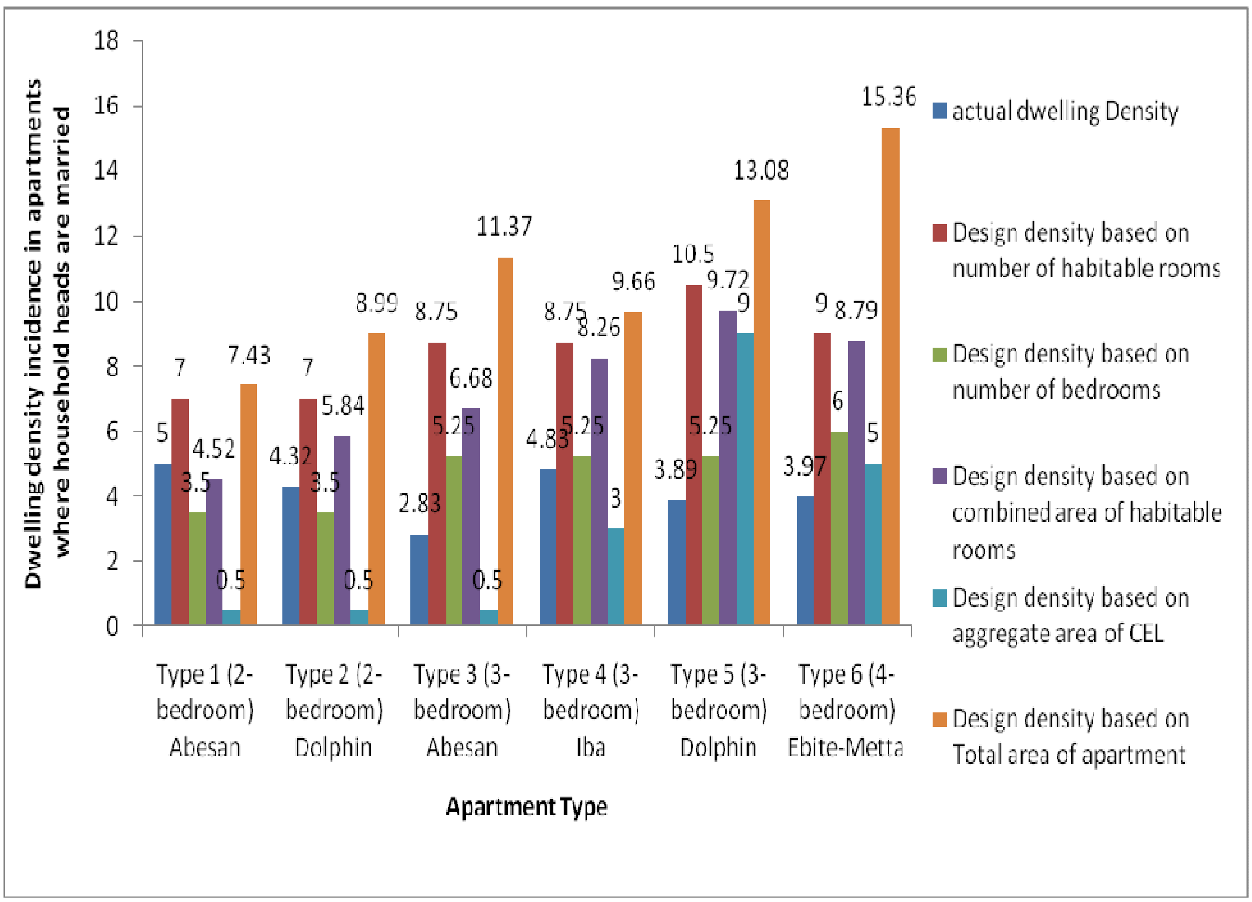


Figure 4.25: Adult Equivalent Occupants in Apartments where Household Heads are Married

4.12.3 Dwelling Density Incidence in Apartments where Household Heads are Separated

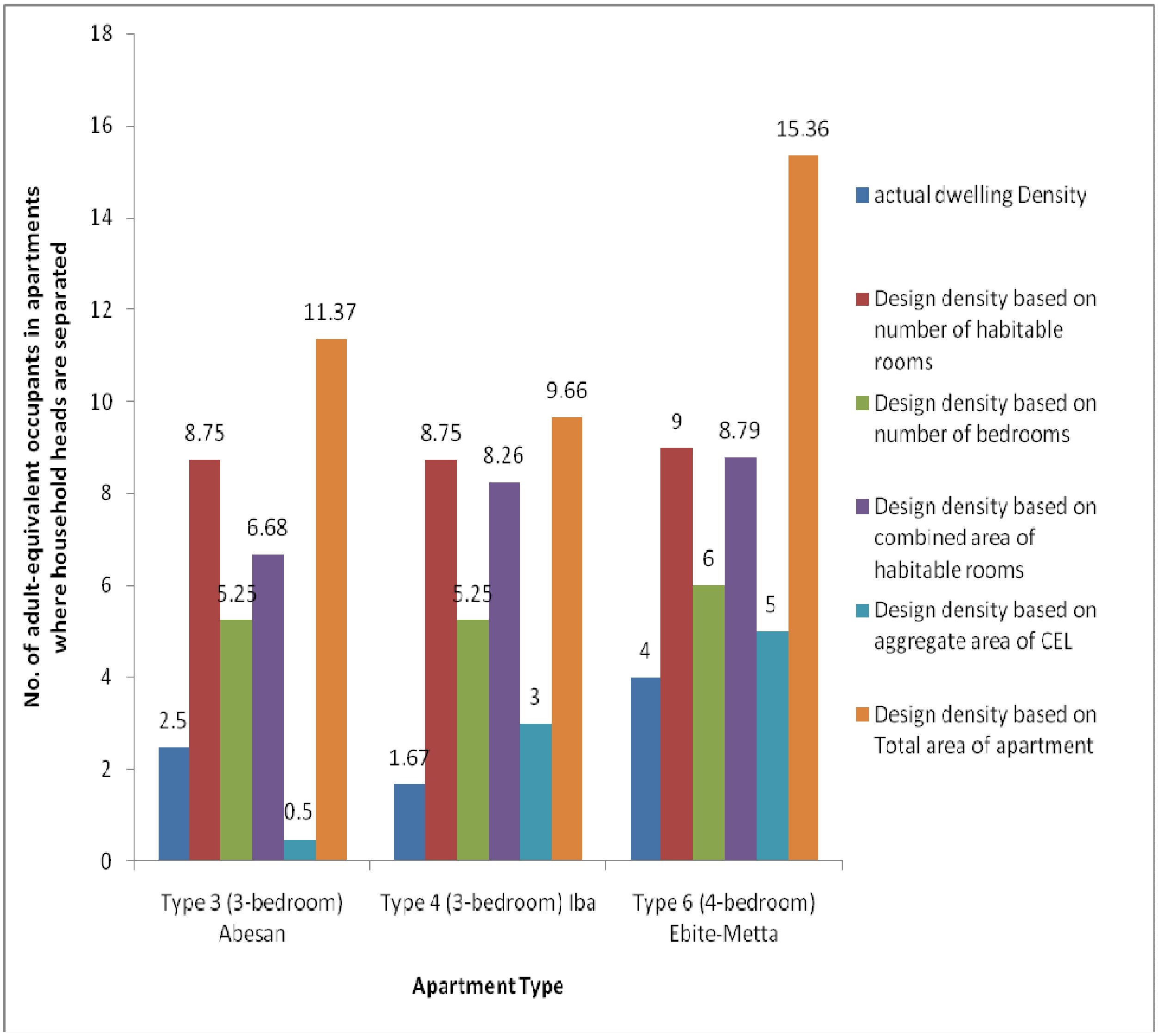


Figure 4.26: Adult Equivalent Occupants in Apartments where Household Heads are Separated

Among the respondents, household heads whose marital status fall under the category "separated" were not found in three apartment types. These are the Type 1 (two-bedroom) units at Abesan Estate, the Type 2 (two-bedroom) units at Dolphin II Estate an Type 5 (three-bedroom) at Dolphin II. The data shows that persons who are separated from their spouses were more likely to be found either in three-bedroom units or four-bedroom units (Figure 4.26). None of the respondents in Dolphin Estate belong to this marital classification, both in the Type 2 (two-bedroom), and Type 5 (3-bedroom) apartments. The situation was slightly different at Abesan Estate. In Abesan Estate, Type 1 (two-bedroom) did not harbour separated household heads among the respondents. This household type could only be found in type 3, (3-bedroom) apartments. Except at one instance, the dwelling density in the three types of apartments where separated household heads were found, showed a common trend for the five measurement indicators. All the apartments were under-occupied.

The only exception where an apartment was over-occupied was Type 3 (3-bedroom) at Abesan, based on Aggregate Area of Cooking, Eating and Living (CEL). The data further show that three-bedroom apartments at Abesan were more under-occupied than the four-bedroom apartments at Ebutte-Metta. Generally, apartments where the household heads are separated were less likely to be found in two-bedroom units than three-bedroom and four-bedroom units. Also, persons in this marital category were more likely to be found in four-bedroom units than three-bedroom types.

4.12.4 Dwelling Density Incidence in Apartments where Household Heads are Divorced

Data from the research show in Figure 4.27, that household heads that are divorced were not found among residents of three apartments types. These are: Type 1, (two-bedroom) at Abesan, Type 2, (two-bedroom) at Dolphin II, and Type 4, (three-bedroom) at Iba Estate. The close link between “Separated” and “Divorced” was revealed in this research, as both household types were not found among respondents living in two-bedroom apartments. This shows that divorced households are more likely to occupy three-bedroom and four-bedroom housing units. Figure 4.27 also shows that Type 6 (four- bedroom) at Ebute-Metta was under-occupied, not withstanding the measurement criteria used. There is only one instance where households headed by divorcees were over-occupied in Type 3 (three-bedroom) at Abesan, not withstanding the criteria used. This occured when Aggregate Area of

Cooking, Eating and Living (CEL) indicator was applied. Similarly, Type 5 (three-bedroom) at Dolphin II showed under-occupancy in all indicators except one. The exception for Type 5 (3-bedroom) at Dolphin II occurred when Number of Bedrooms indicator was applied.

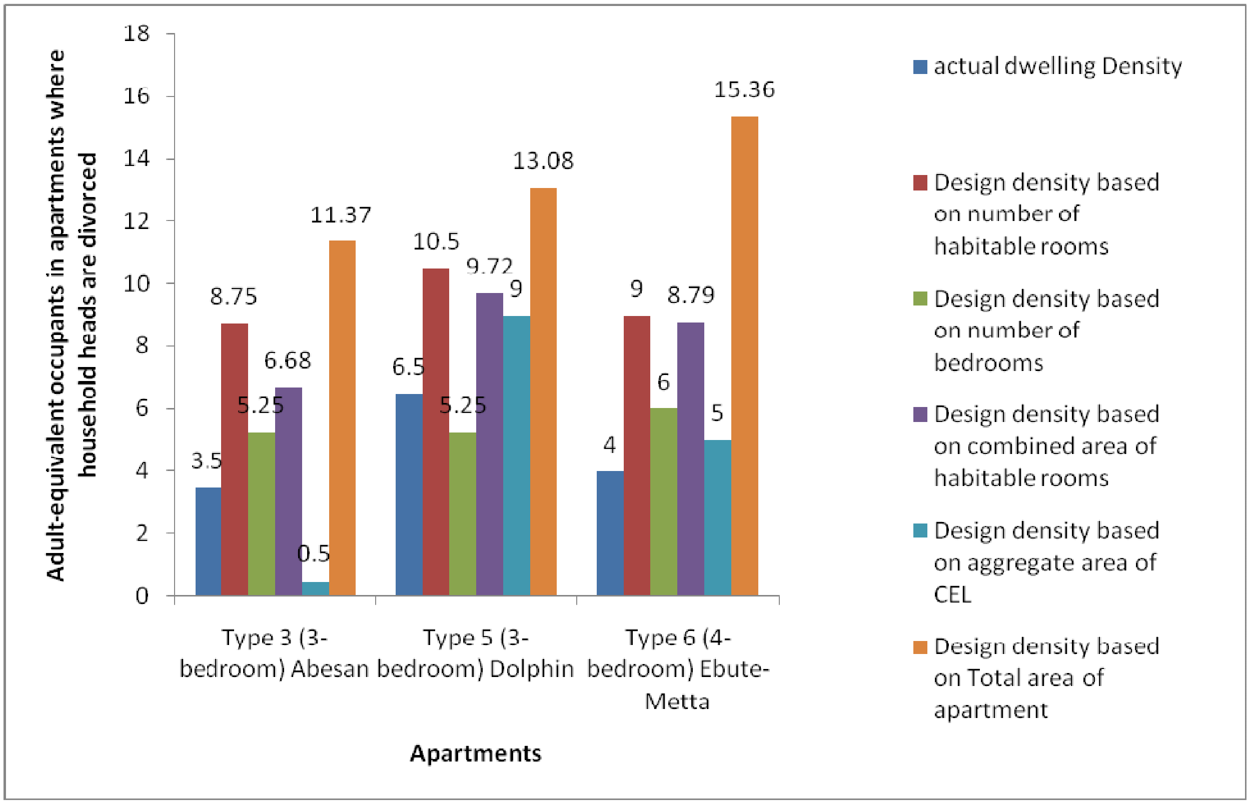


Figure 4.27: Maximum Number of Adult Equivalent Occupants during Habitation in Apartments where Household Heads are Divorced

4.12.5 Dwelling Density Incidence in Apartments where Household Heads are Widowed

As shown in Figure 4.28, respondents who are widows(ers) were not found among the residents of Type 5 (three-bedroom) apartments in Dolphin II Estate. All the other five building types investigated in this study harbour widows(ers). Of the five indicators used to assess dwelling density in this study, three clearly revealed that all the apartments were under-occupied. The three indicators are Number of Habitable Rooms, Combined Area of Habitable Rooms, and Total Area of Each Apartment. The situation was not too different when the Number of Bedroom indicator was applied. In this circumstance, all the four apartment types were under-occupied, while only one was over-occupied. The over-occupied apartment, based on Number of Bedrooms was found in Type 2 (two-bedroom) units at Dolphin II. The apartments have exceeded their optimum design density by 1.75 adult equivalents.

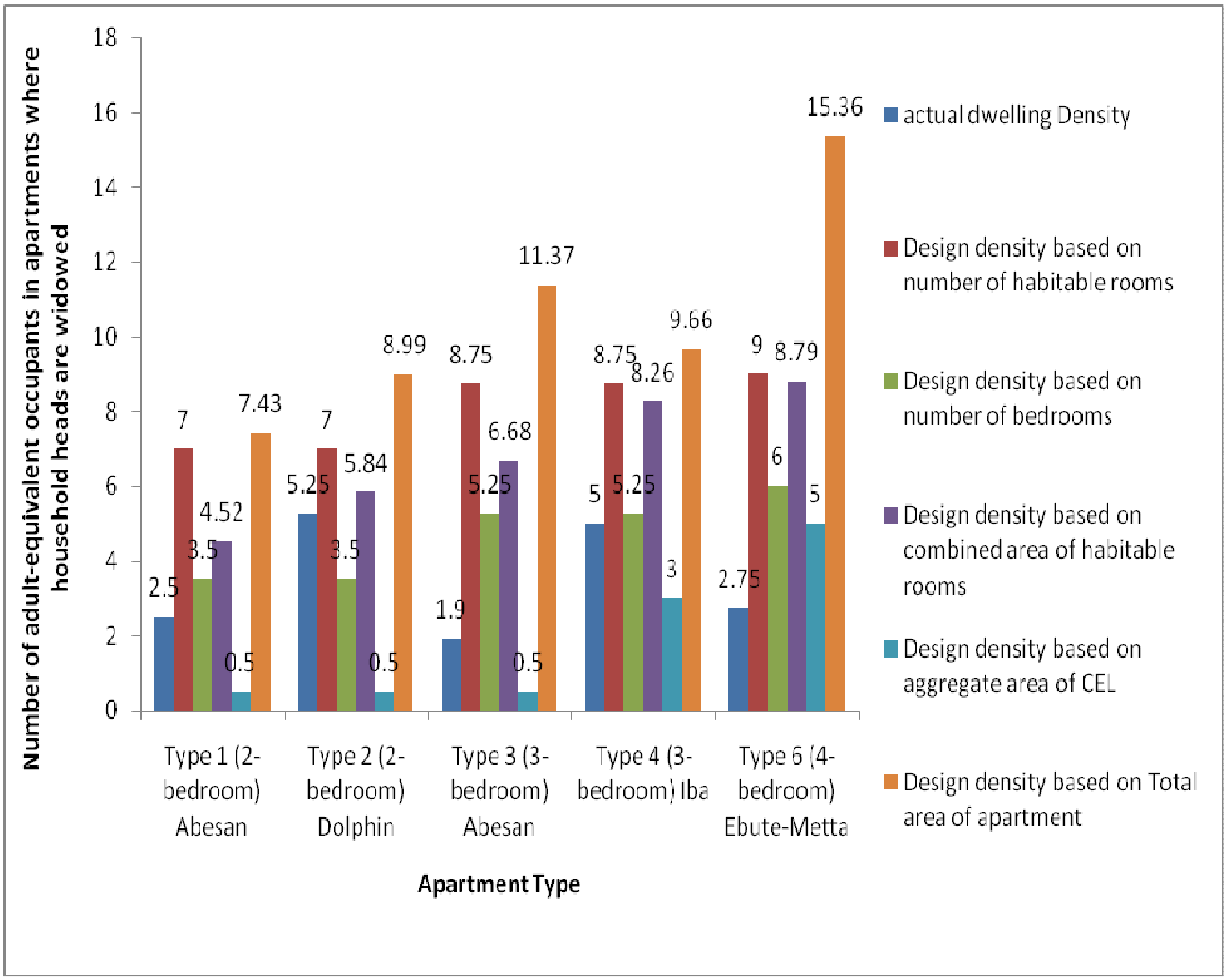


Figure 4.28: Adult Equivalent Occupants in Apartments where Household Heads are Widowed

4.12.6 Dwelling Density Incidence in Apartments where Household Heads are Single Mothers

Figure 4.29 shows that when a measurement indicator of Aggregate Area of Cooking, Eating and Living (CEL) was applied, all apartments in the three-bedroom category were over-occupied. The Type 6 (four-bedroom) apartments at Ebute-Metta were marginally under-occupied, requiring additional 1.0 adult-equivalent occupants to attain optimum design density. The cultural reluctance in accepting the reality of this emerging type of "single mother" household was reflected in the paucity of respondents in this category. Only respondents in two dwelling unit types indicated that they belong to "Single Mother" classification. The apartments are Type 3 (three-bedroom) at Abesan and Type 6, (four-bedroom) at Ebute-Metta.

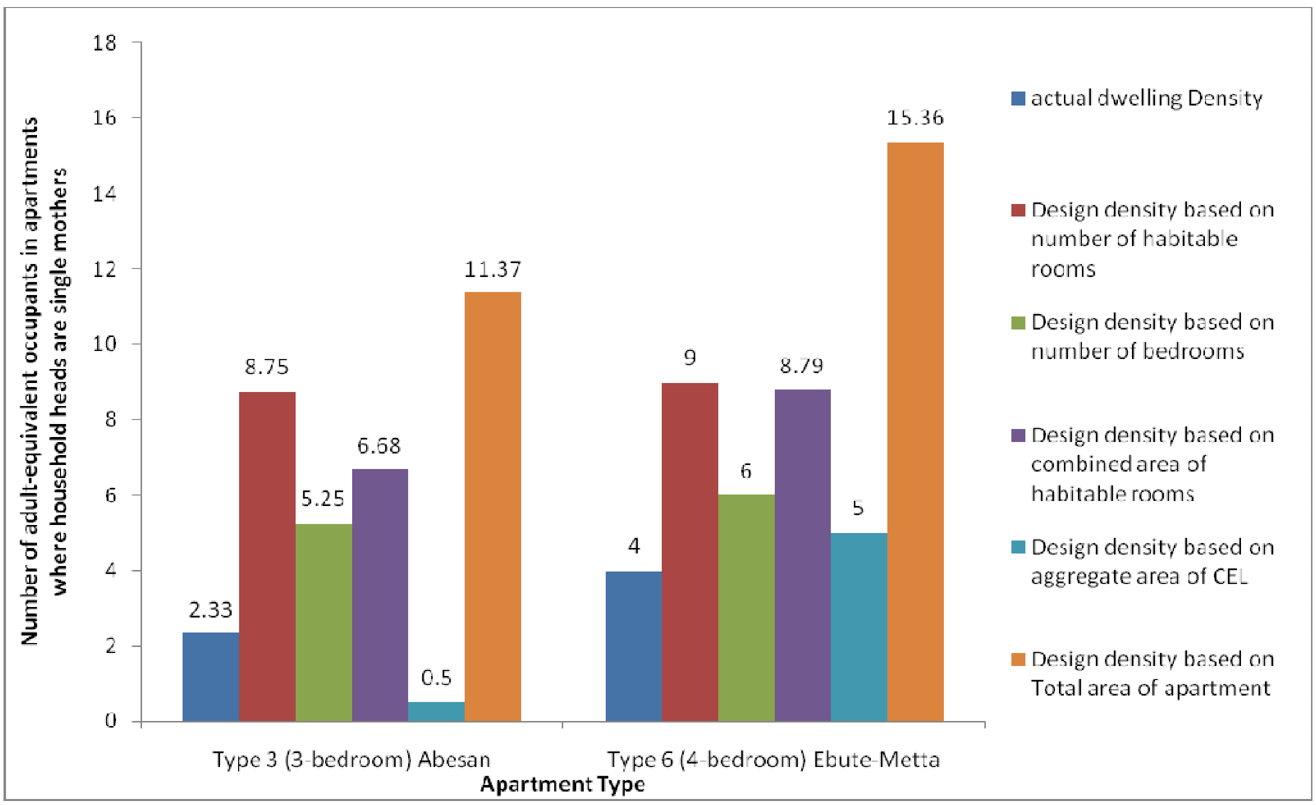


Figure 4.29: Adult Equivalent Occupants in Apartments where Household Heads are Single Mothers

Conversely, the single mother group was not found among the respondents in four apartments types. These are: (1) Type 1 (two-bedroom) at Abesan, (2) Type 2 (two-bedroom) at Dolphin II, (3) Type 4 (three-bedroom) at Iba, (4) Type 5 (three-bedroom) at Dolphin II. This tends to imply that single mother heads of household are rarely found among residents of two bedroom apartments. This is contrary to expectation, given the largely held view that this household type is characterized by fewer numbers of occupants. One possible explanation is that the population density in neighbourhoods where two-bedroom apartments are located is usually high. Moreover, the two bedroom units tend to provide accommodation to higher number of persons belonging to the lower social ladder in an urban setting. Single mothers probably avoid clustering among these people to avoid stigmatization.

Figure 4.29 tends to further suggest that single mother households were largely under-occupied, using all the measurement indicators adopted in the study. The only exception occured in Type 3 (three-bedroom) at Abesan Estate when the Aggregate Area of Cooking, Eating and Living (CEL) indicator was applied. This indicator recorded over-occupancy of 1.83 adult equivalent occupants. Generally, it is likely that socio-cultural considerations aimed at privacy and reducing stigmatization are assigned higher weight than mere space adequacy for normal daily living among single mother household heads in this study.

4.12.7 Dwelling Density Incidence in Apartments where Household Heads are Single Fathers

Figure 4.30 reveals the reality of socio-cultural inhibitions that tend to discourage residents in the study area from identifying themselves as single fathers. Of the six apartment types covered in this research, respondents who indicated that they are single fathers were found only in Type 4, (three-bedroom) at Iba Estate. In the study area, single fatherhood is regarded as an aberration and attracts stigmatization. It is likely that this reason accounted for the low number of respondents who expressed that they belong to this category. Nevertheless, the data points out that single father household type is an emerging identity in LSDPC's multifamily apartments.

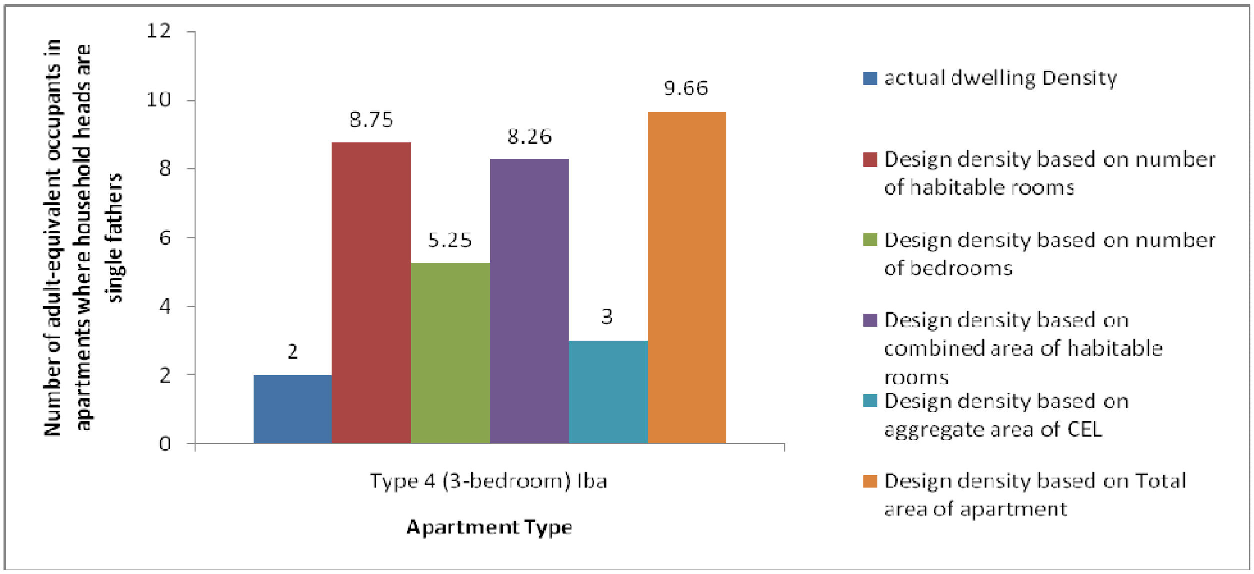


Figure 4.30: Adult Equivalent Occupants in Apartments where Household Heads are Single Fathers

An application of all the five measurement indicators adopted in this study shows that apartments headed by single father households were under-occupied. The apartments were capable of accommodating more than six adult equivalent occupants, based on Number of Habitable rooms. Also, an additional number of 3.25 adult-equivalent occupants could be absorbed based on Number of bedrooms; while 7.66 would be needed to attain optimum density, if an indicator of Total Area of Apartment was applied.

4.12.8 Dwelling Density Incidence in Apartments where Household Heads are Just Singles

Figure 4.31 shows that persons who belong to the marital status "just single" were spread among the six apartment types investigated in this research. Figure 4.31 further shows the results of dwelling density computation using five different approaches adopted in this study. Only one of the measurement indicators reveals that all apartment classifications headed by "just single" persons were under-occupied. The indicator that gave this result was Number of Habitable Rooms.

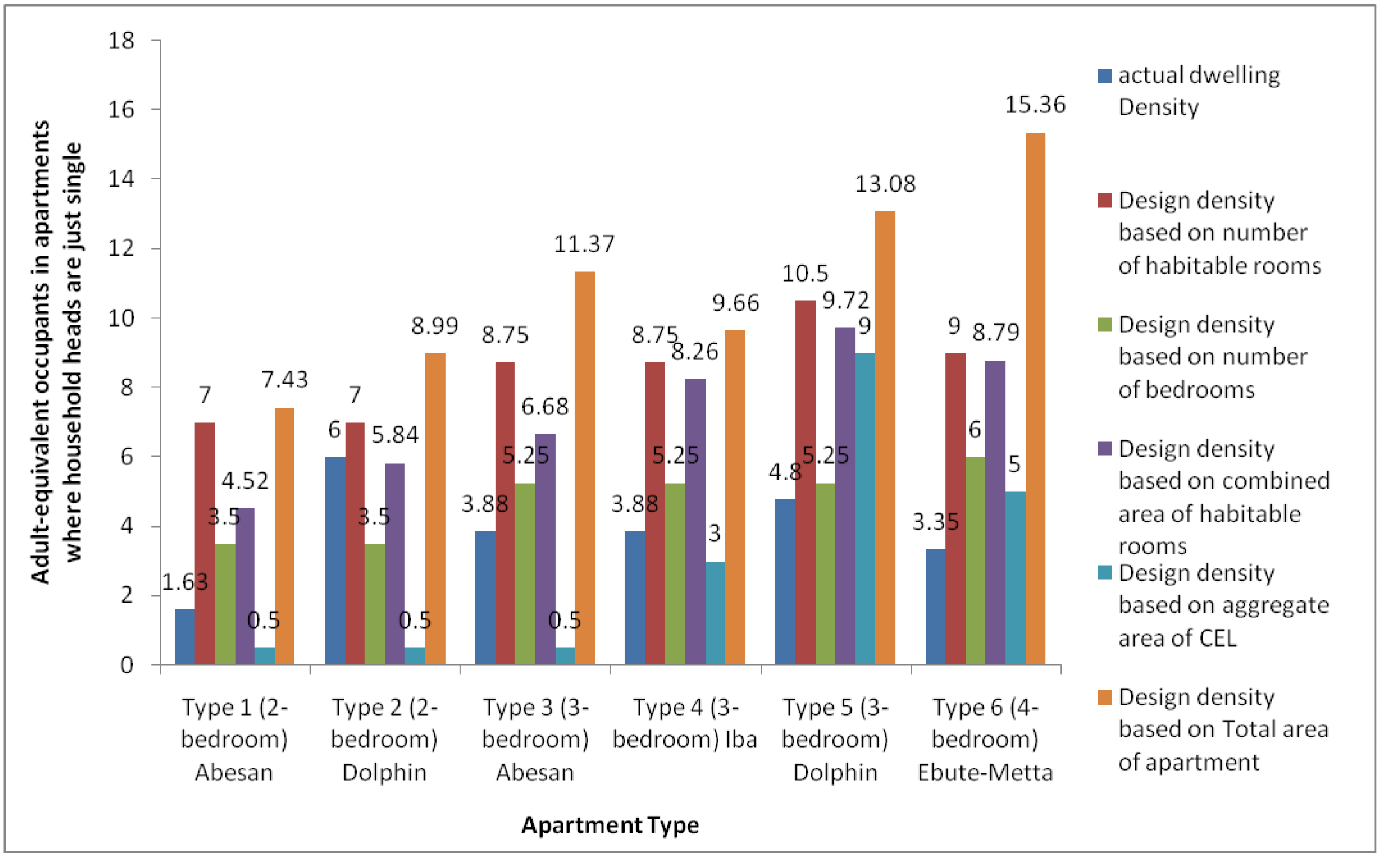


Figure 4.31: Adult Equivalent Occupants in Apartments where Household Heads are Just Singles

Figure 4.31 further shows that households headed by "just single" were over-occupied, based on Aggregate Area of CEL in four apartment types, namely Type 1 (2-bedroom) at Abesan, Type 2 (2-bedroom) at Dolphin II, Type 3 (three-bedroom) at Abesan and Type 4 (three-bedroom) at Iba. The space available for every adult-equivalent occupant in these four apartment types was inadequate. All the four apartment types are therefore unsuitable for persons headed by "just single". On the contrary, the use of Aggregate Area of CEL to determine dwelling density as seen in Figure 4.31 clearly revealed that Type 5 (3-bedroom) at Dolphin II and Type 6 (four-bedroom) at Ebute-Metta were under-occupied.

Specifically, Figure 4.31 shows that the record of over-occupancy occurs in Type 2 (2-bedroom) apartment at Dolphin II Estate on two occasions: (1) when the number of Bedroom was applied, and (2) when Combined Area of Habitable Rooms, was applied.

4.13 DWELLING DENSITY BY HOUSEHOLD INCOME (SOCIO-ECONOMIC GROUP)

Socio-economic grouping was derived using an income estimate for the head of household. The survey item requesting information about income was worded: “how would you describe your average monthly income?” Respondents were given the option of “less than ₦45,000.00”, “₦45,000.00 and above, but less than ₦100,000.00”, “₦100,000.00 and above” (Table 4.11). Only 165 respondents indicated their income group while eleven did not.

The most frequently reported (n =70, 42.4%) household income level was the (₦100,000.00 and above category). Forty percent (61) of the respondents reported their monthly household income as above ₦45,000.00 but below ₦100,000.00 per month. The least number of respondents 20.6% (34) indicated that they earn below ₦45,000.00 per month. In this study, the high income group are those who earn ₦100,000.00 and above. Those who earn ₦45,000 and above but below ₦100,000.00 are classified as medium income, while household heads earning below ₦45,000.00 are grouped as low income. Theoretically, only respondents living in Ebute-Metta Type 6 apartments are supposed to belong to the medium income group. This constitutes only 18.5% (33) of the total number of respondents. The rest 81.5% (145) were expected to be low-income earners. None of the respondents was supposed to belong to the high income group. The data from Table 4.11, however, reveals that contrary to expectation, only 20.6% (34) of the respondents were actually low-income. The implications are far reaching because policies targeted towards low income urban residents will end up largely with the medium and high income groups. One of the likely explanations is scarcity of the right type of accommodation, thereby escalating the resort to gentrification.

Table 4.11: Socio-Economic Group

Socio-economic income category	No of Respondents	Percentage (%)
Low-income (Below ₦ 45,000.00 per month)	34	20.6
Medium-income (Above ₦ 45,000.00 but below ₦ 100,000.00 per month)	61	40.0
High-income (₦ 100,000.00 & above per month)	70	42.4
Total	165	100.0

Note: eleven of the study participants did not provide data for the variable household income.

In this study all household heads whose monthly income was below ₦ 45,000.00 (forty-five thousand naira only) were classified as low-income earners. Persons in this income category were found in all the housing unit types investigated. Four out of the five measuring indicators used to assess dwelling density in this study reveal that all the six types of apartments were largely under-occupied. The situation was however, different when an indicator of Aggregate Area of Cooking, Eating and Living (CEL) was applied. The result shows that four types of apartment were over-occupied while two were under-occupied. All the two-bedroom units are over-occupied. Again, two out of the three types of three of three-bedroom units were over-occupied. The over-occupied three-bedroom types are Type 3 at Abesan, and Type 4 at Iba. Type 5 (3-bedroom) at Dolphin II, and Type 6 (four-bedroom) at Ebutte-metta were under –occupied.

In this research, respondents whose monthly income are #45,000.00 and above, but less than #100,000.00 were classified as medium income earners. Persons who belong to this category were spread among the six apartment types investigated. The results of dwelling density outcome are shown in Figures 4.32 to 4.39. As can be observed from Figure 4.39, five criteria were employed in the determination of dwelling density rating for each apartment classification. Three of the measurement criteria reveal that all apartments, irrespective of type, were under-occupied.

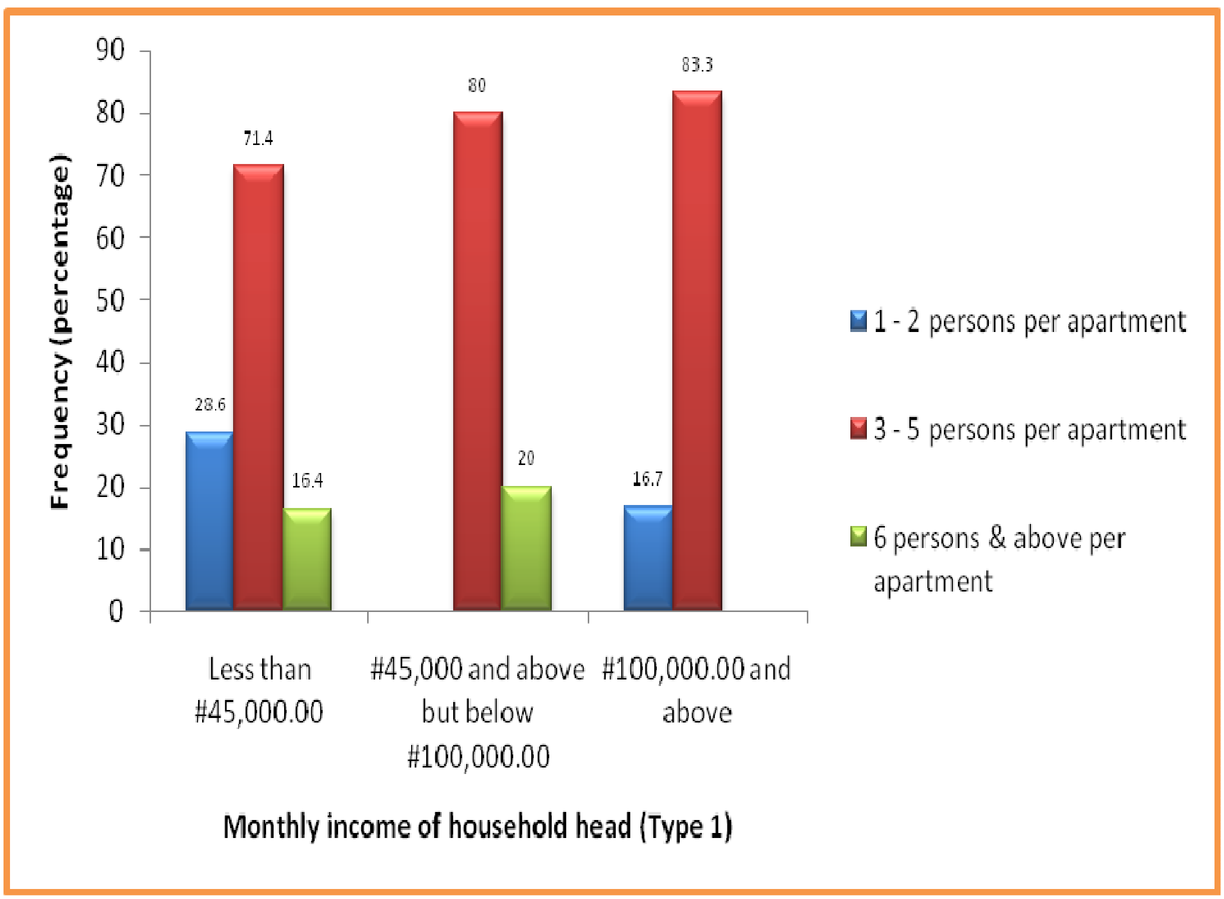


Figure 4.32: Actual Dwelling Density for Apartment Type 1 Based on Socio-Economic Status

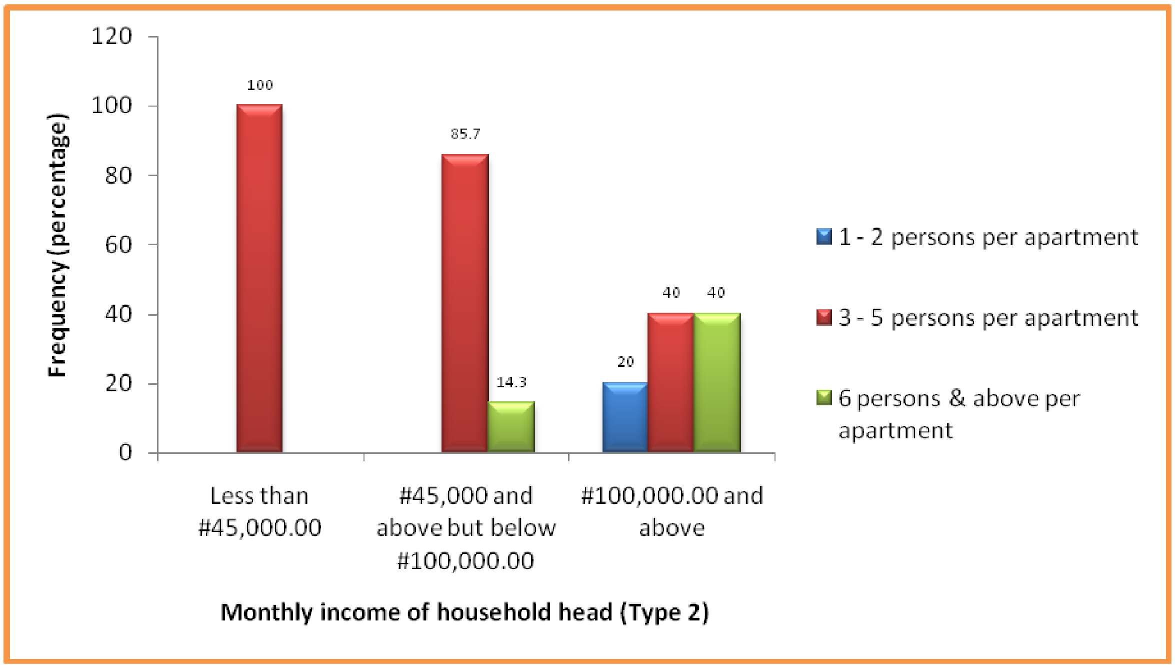


Figure 4.33: Actual Dwelling Density for Apartment Type 2 Based on Socio-Economic Status

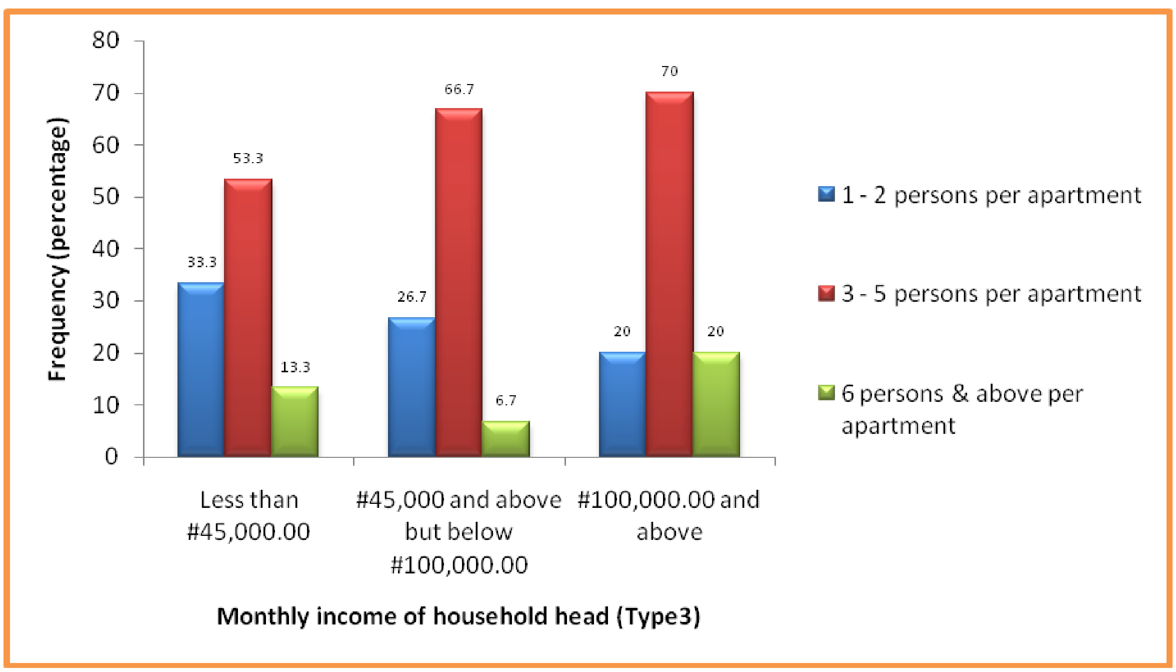


Figure 4.34: Actual Dwelling Density for Apartment Type 3 Based on Socio-Economic Status

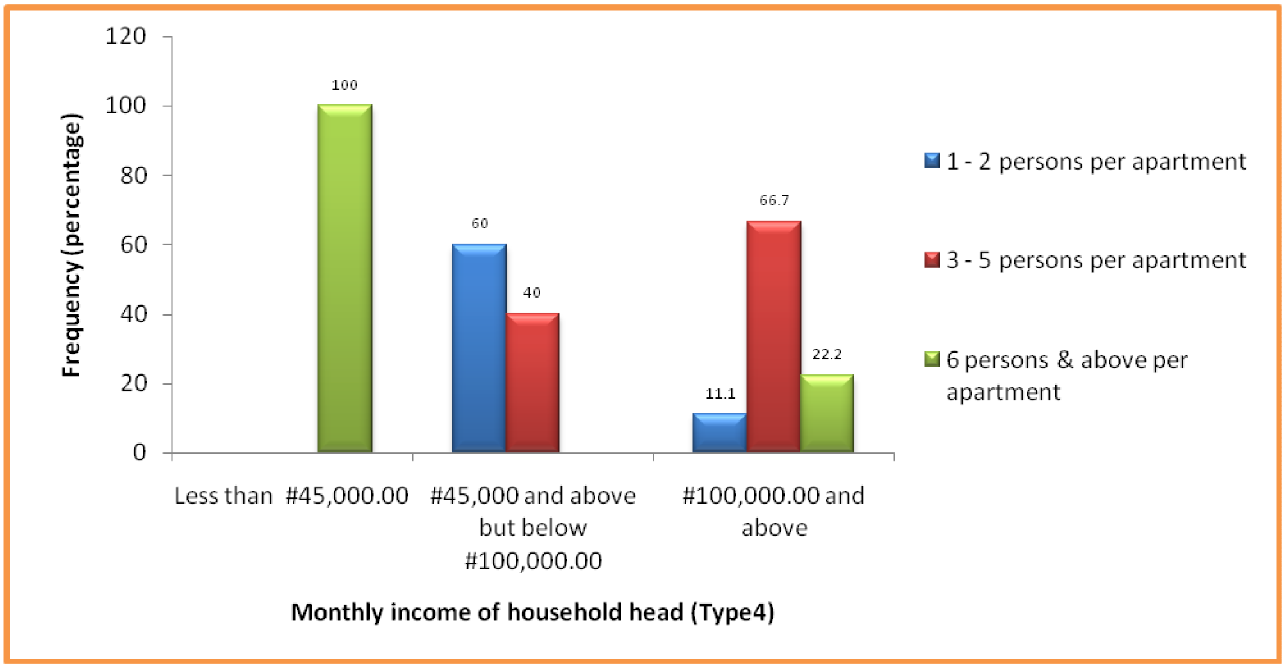


Figure 4.35: Actual Dwelling Density for Apartment Type 4 Based on Socio-Economic Status

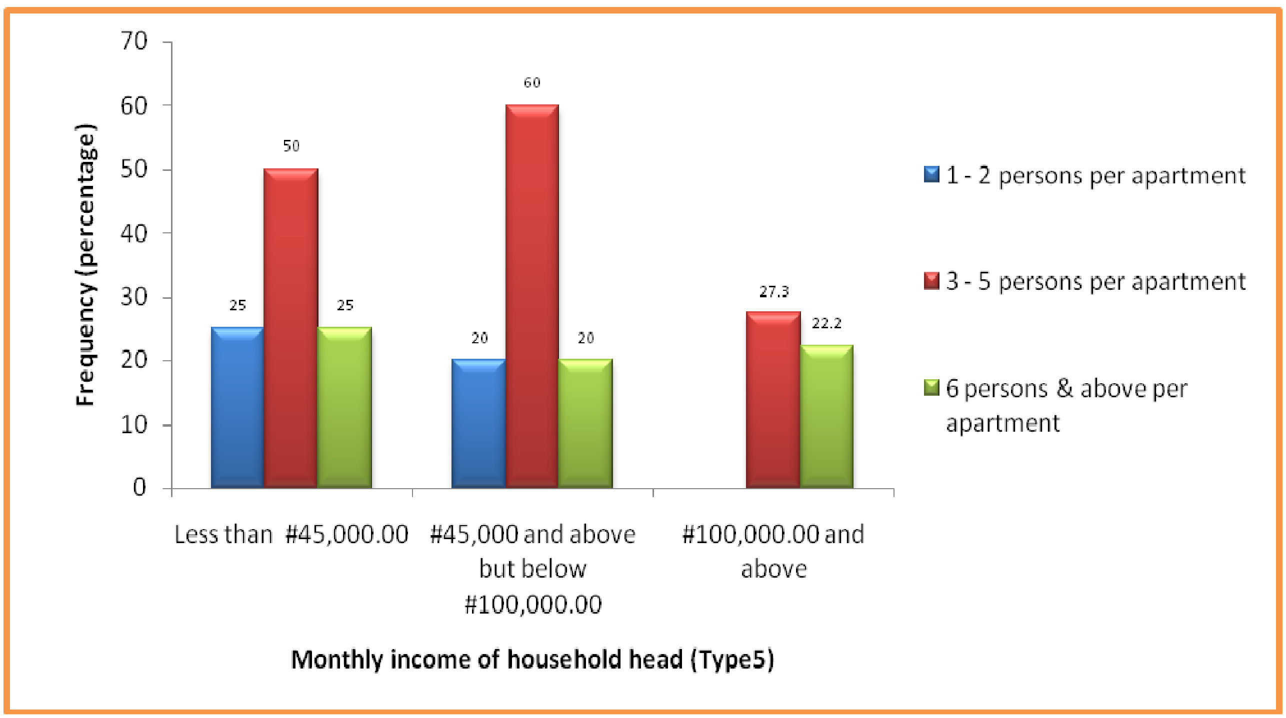


Figure 4.36: Actual Dwelling Density for Apartment Type 5 Based on Socio-Economic Status

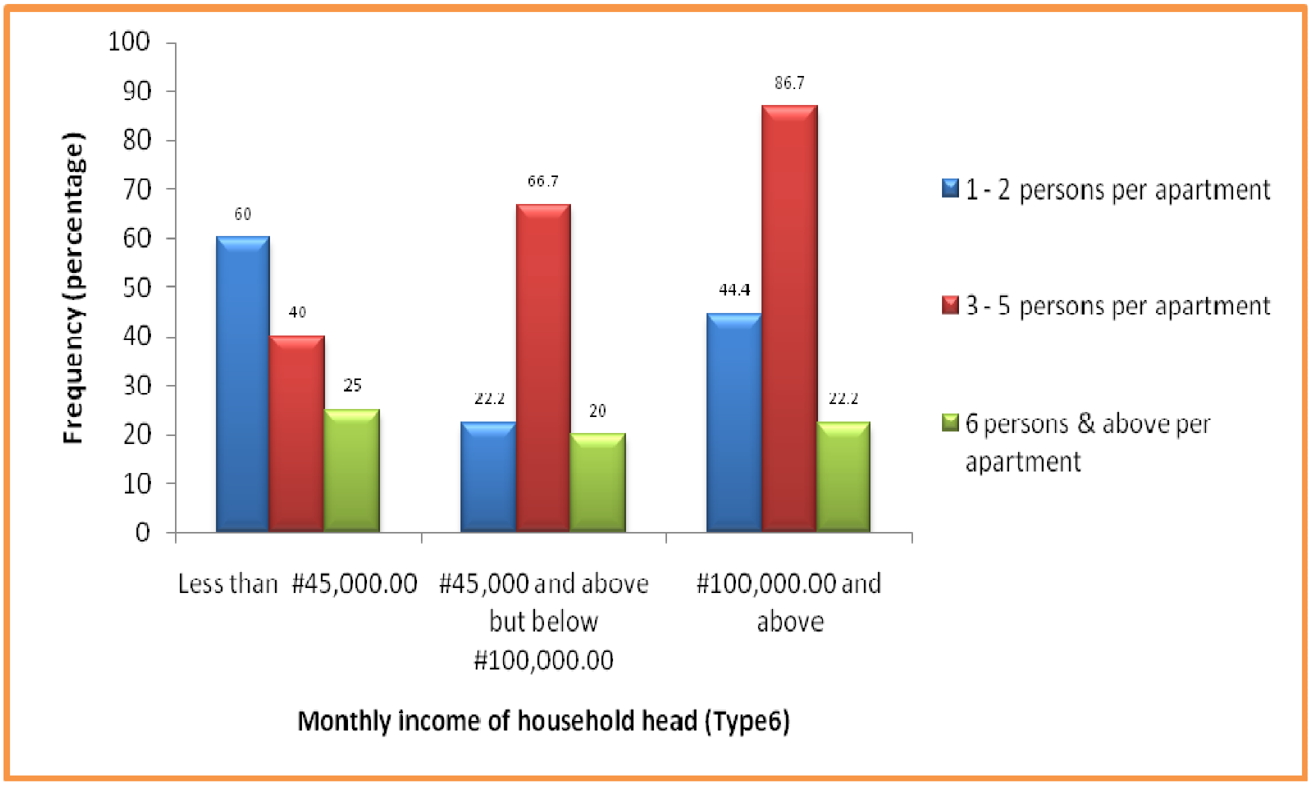


Figure 4.37: Actual Dwelling Density for Apartment Type 6 Based on Socio-Economic Status

4.13.1 Estimate of Room Deficit or Surplus, Based on Adult Equivalent Number of Persons and Number of Rooms in Apartments where Household Heads are Low-Income

The three criteria that gave this result are: Number of Habitable Rooms; Combined Area of Habitable Rooms; and Total Area of Each Apartment. Results of dwelling density based on these three criteria further reveal that generally, the difference between design density during occupancy was minimal in the two-bedroom apartments. On the other hand, the degree of under-occupancy was higher in three-bedroom apartments than in four-bedroom apartments. For example, Type 5 (three-bedroom) at Dolphin II required additional 6.7 adult equivalent occupants to attain optimum dwelling density, based on Number of Habitable Rooms.

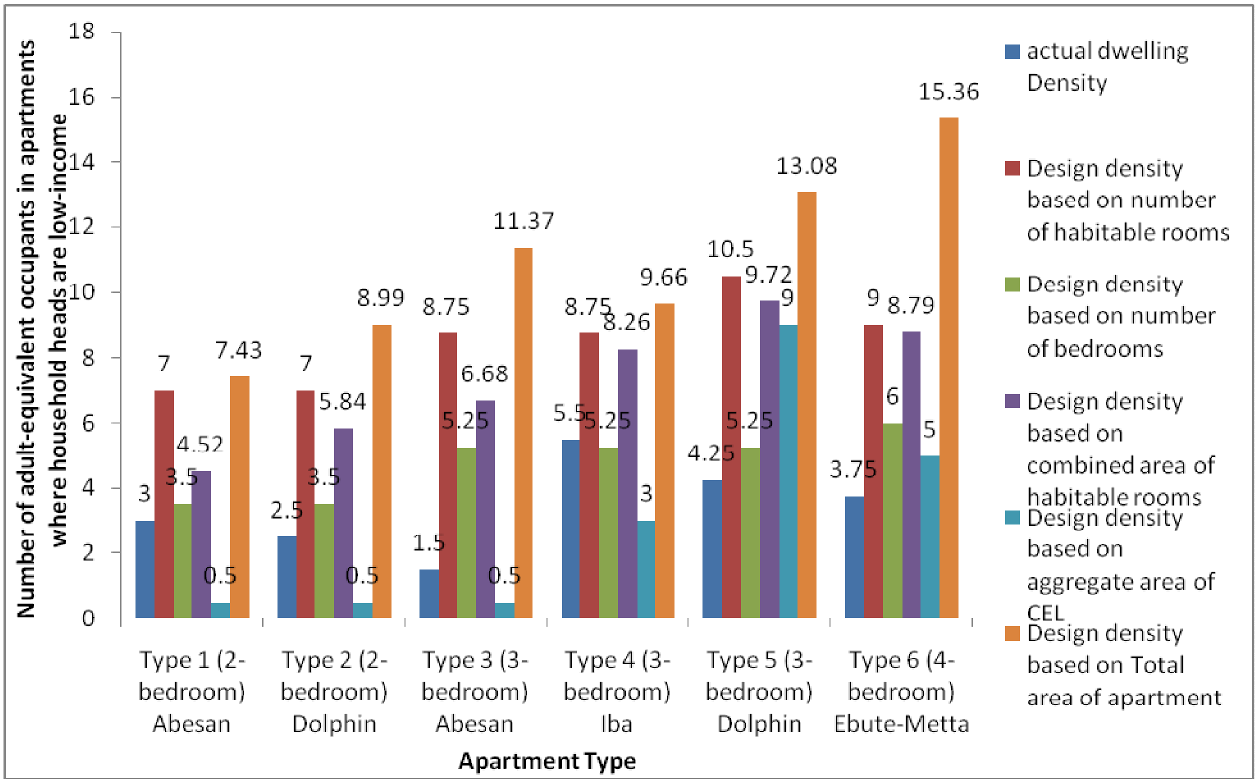


Figure 4.38: Adult Equivalent Occupants in Apartments where Household Heads are Low-Income

4.13.2 Estimate of Room Deficit or Surplus, Based on Adult Equivalent Number of Persons and Number of Rooms in Apartments where Household Heads are Medium-Income

Figure 4.39 further reveals that Number of Bedrooms, and Aggregate Area of Cooking, Eating and Living (CEL) gave divergent results. Using the Number of Bedrooms, it was observed that all the apartments occupied by medium-income respondents were over-occupied. On the contrary, the same Number of Bedroom indicator shows that all the three-bedroom apartments harbouring medium-income respondents were under-occupied. The Type 3 (three-bedroom) at Abesan depicts an under-occupancy level of 2.43, while Type 6 (four-bedroom) at Ebute-Metta depicts an under-occupancy level of 1.75. This implied that the three-bedroom required additional 2.43 adult-equivalent occupants to attain optimum dwelling density level, while the four-bedroom needed only 1.75 adult-equivalent occupants.

Figure 4.39 also shows that, based on Aggregate Area of CEL, four out of the six apartment types covered in this study were over-occupied in households headed by medium-income earners. The four are: a) Type 1 (2-bedroom) at Abesan, b) Type 2 (2-bedroom) at Dolphin II, c) Type 3 (3-bedroom) at Abesan, d) Type 4 (3-bedroom) at Iba.

The data reveals that all the two bedroom units were unsuitable for medium-income earners, based on this measurement criterion. Again, two out of the three number of three-bedroom apartments covered in this research were over-occupied, meaning that the aggregate area of Cooking, Eating and Living (CEL) was not adequate. Only Type 5 (three-bedroom) and Type 6 (four-bedroom) apartments were under-occupied by this measurement indicator.

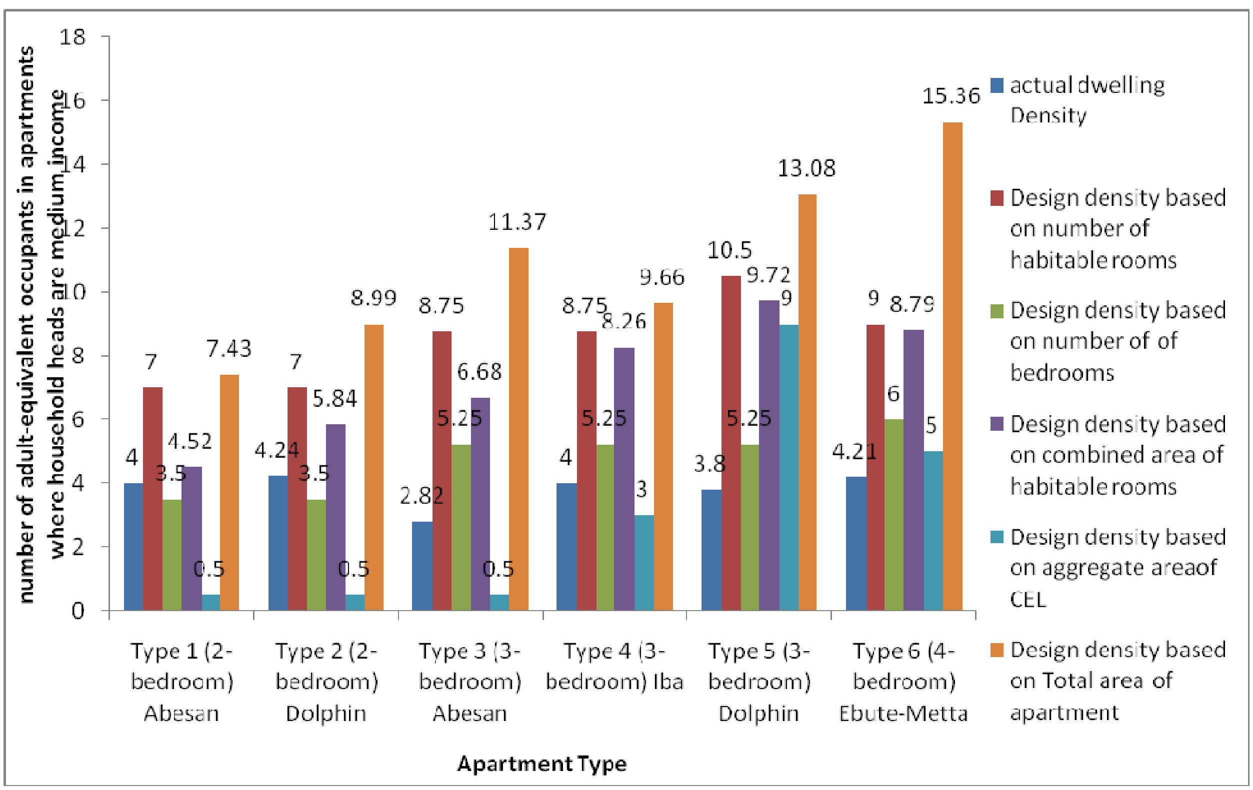


Figure 4.39: Adult Equivalent Occupants in Apartments where Household Heads are Medium-Income

4.13.3 Estimate of Room Deficit or Surplus, Based on Adult Equivalent Number of Persons and Number of Rooms in Apartments where Household Heads are High-Income

Household heads that earn #100,000.00 and above are classified as high income persons. Persons in this category are found in all the apartment types investigated. This reality is contrary to expectation. By concept and nomenclature, all the apartment types covered in this study were designed for low-income and medium-income residents. The fact that high-income persons are now living in these apartments indicates that gentrification has taken place. Figure 4.40 indicates the outcome of dwelling density measurements for the six apartments covered in this research. Five measurement criteria were applied. Figure 4.40 reveals that all the apartment types were under-occupied when four of the five measurement criteria were used. The four criteria that gave results of under-occupancy are: 1) Number of Habitable Rooms, 2) Number of Bedrooms, 3) Combined Area of Habitable Rooms, and 4) Total Area of each Apartment. This result tends to support the generally held perception that the number of persons in high-income households are fewer than in low and medium income households. There is no significant difference in the degree of under-occupancy among the different apartment classifications.

Figure 4.40 further shows that Aggregate Area of Cooking, Eating and Living (CEL) was the only indicator where results recorded over-occupancy in four apartment types. These are: a) Type 1 (2-bedroom) at Abesan, b) Type 2 (2-bedroom) at Dolphin, c) Type 3 (3-bedroom) at Abesan, d) Type 4 (3-bedroom) at Iba. In these apartment types, the available space per square metre of CEL for each adult-equivalent occupant was less than the design density rating. On the contrary, Type 5 (3-bedroom) at Dolphin II and Type 6 (four-bedroom) at Ebute-Metta were under-occupied based on Aggregate Area of CEL

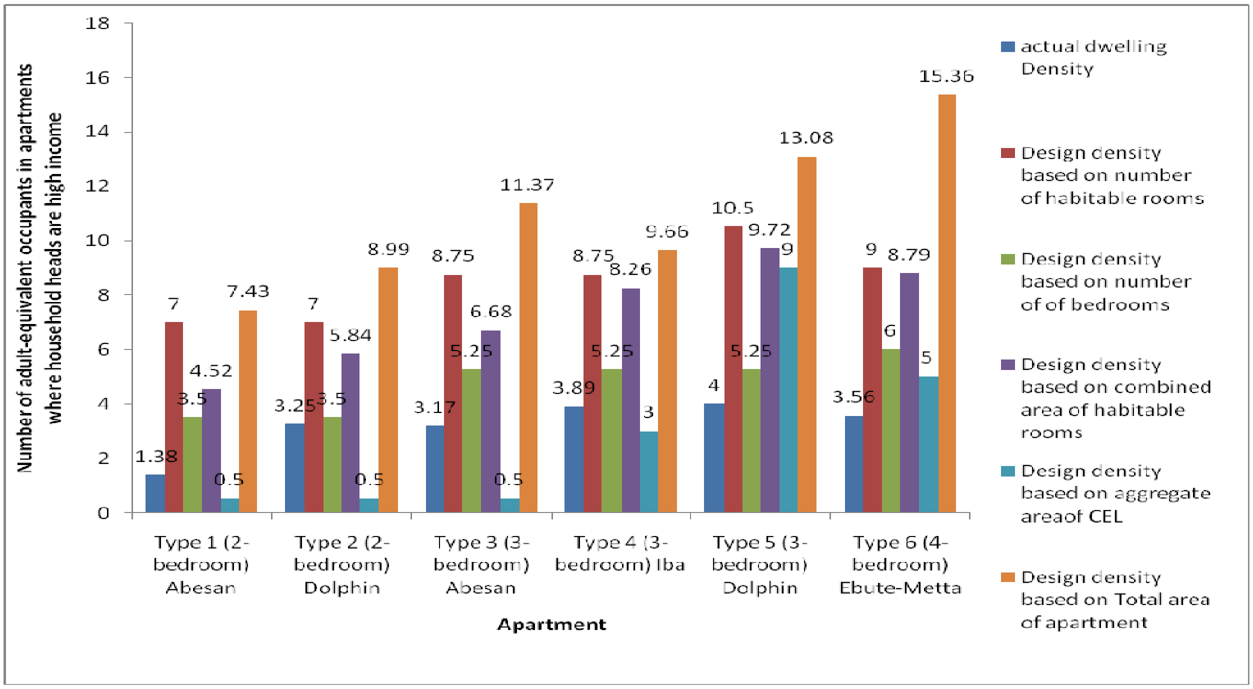


Figure 4.40: Adult Equivalent Occupants in Apartments where Household Heads are High-Income

4.13.4 Statistical Validation of Effect of Socio-Economic Status on Dwelling Density

The data on Table 4.12 shows the results of chi-square test to establish the effect of socio-economic status of respondents on dwelling density. The statistical level of significance for acceptance or rejection was set at 95% confidence interval. Thus P-Value (that is, T tabulated) represents the effect of socio-economic status on dwelling density. The decision rule is that at the same degree of freedom, if the P-Value is less than 0.05, the effect of socio-economic status on dwelling density is classified as "significant". This implies that at the same degree of freedom, if the P-Value is higher than 0.05, the effect of socio-economic status on dwelling density is classified as "not significant". It was observed from Table 4.12 that socio-economic status had no significant effect on dwelling density in all the apartment types investigated, at 95% confidence level.

Table 4.12: Effect of Socio-Economic Status on Dwelling Density

Apartment type	Chi-square Value X^2	P-Value (T- tabulated)	Remark
Type one (two-bedroom), Abesan	4.092	0.394	Income has no Significant effect on dwelling density in all apartment types
Type two (two-bedroom), Dolphin II	4.320	0.364	
Type three (three-bedroom), Abesan;	1.493	0.828	
Type four (three-bedroom), Iba	8.389	0.078	
Type five (three-bedroom), Dolphin	2.831	0.586	
Type six (four-bedroom), Ebute-Metta	3.376	0.497	

Remarks/interpretation

P-Value (that is, T tabulated): effect of socio-economic status on dwelling density. Decision rule: At the same degree of freedom (D.F) if the P-Value is less than 0.05, effect of socio-economic l status on dwelling density is classified as “significant”; if the P-Value is higher than 0.05, effect of socio-economic status on dwelling density is classified as “not significant”.

4.14 DWELLING DENSITY BY ETHNICITY

The total number of respondents for this item was 175. The response categories were the nine biggest ethnic groups in Nigeria that constitute 95% of the languages. Among these, the Yoruba, Hausa-Fulani, and Igbo constitute 68% of the population of the country. At the same time, the Ijaw, Edo, Ibibio, Kanuri, Tiv and Ebira Nupe account for 27%. The other minority groups comprised the rest 5%.

In this study, the distribution of the respondents shows that the Yoruba ethnic race constituted the largest number 59.4% (104) (Table 4.22). The respondents who are of Ibo ethnic extraction (n = 37, 21.1%) and those from Edo (n = 10, 5.7%) were second largest and third largest respectively. Respondents from the rest ethnic groups are Hausa Fulani (n = 9, 5.1%), Ibibio (n = 2, 1.2%), Ijaw (n = 2, 1.2%), Kanuri (n = 2, 1.2%), Tiv (n = 2, 1.2%), Ebira Nupe (n = 1, 0.6%). The large number of Yoruba respondents was understandable, given that the study area was in the South Western Nigeria, where the natives are predominantly Yoruba. Lagos and Ibadan, another major City in South Western Nigeria are regarded as the melting pot of the Yoruba race.

Table 4.13: Ethnic Origin of Occupants of LSDPC's Multifamily Apartments

Ethnic origin	**No of Respondents**	**Percentage (%)**
Yoruba	104	59.4
Hausa Fulani	9	5.1
Igbo	37	21.1
Ijaw	2	1.2
Edo	10	5.7
Ibibio	2	1.2
Kanuri	2	1.2
Tiv	2	1.2
Ebira-Nupe	1	0.6
Others	6	3.3
Total	175	100.0

Note: One of the study participants did not provide data for the variable ethnicity.
Six respondents selected the category "others"and indicated the following responses – "efik" (n = 2), Igara (n=1), Ishan (n = 2), Okrika (n=1)

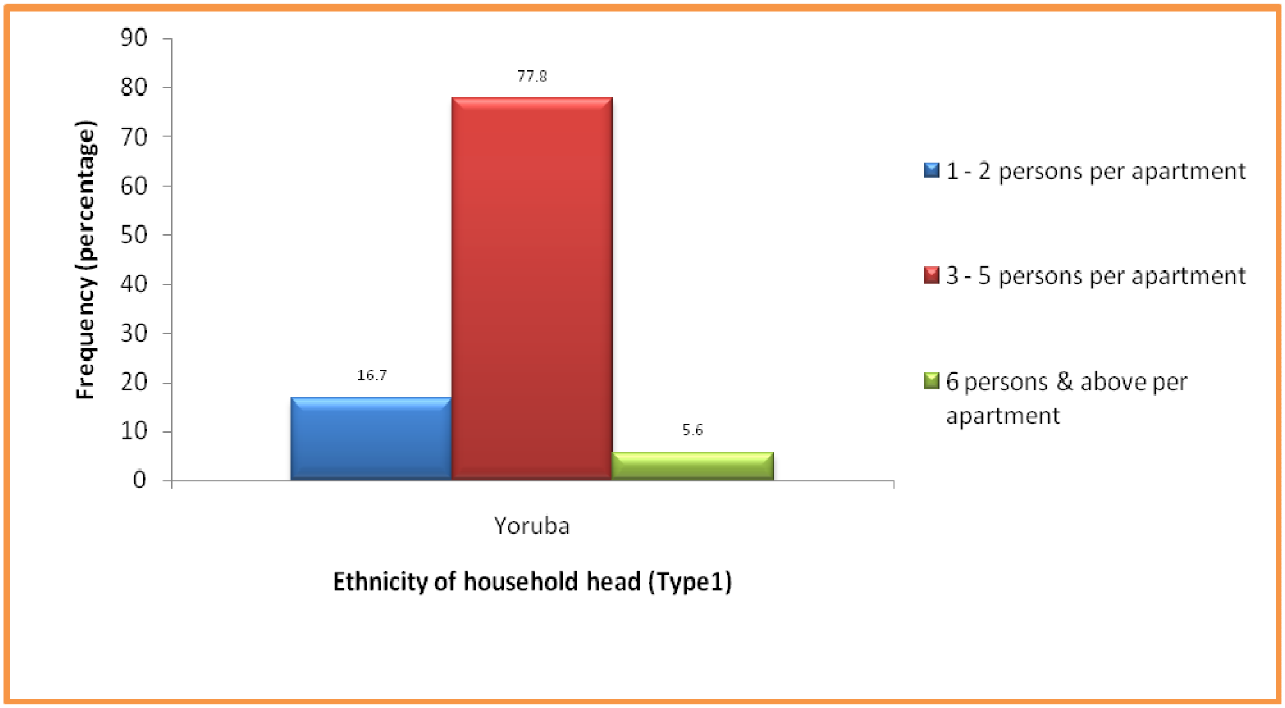


Figure 4.41: Actual Dwelling Density for Apartment Type 1 Based on Ethnicity

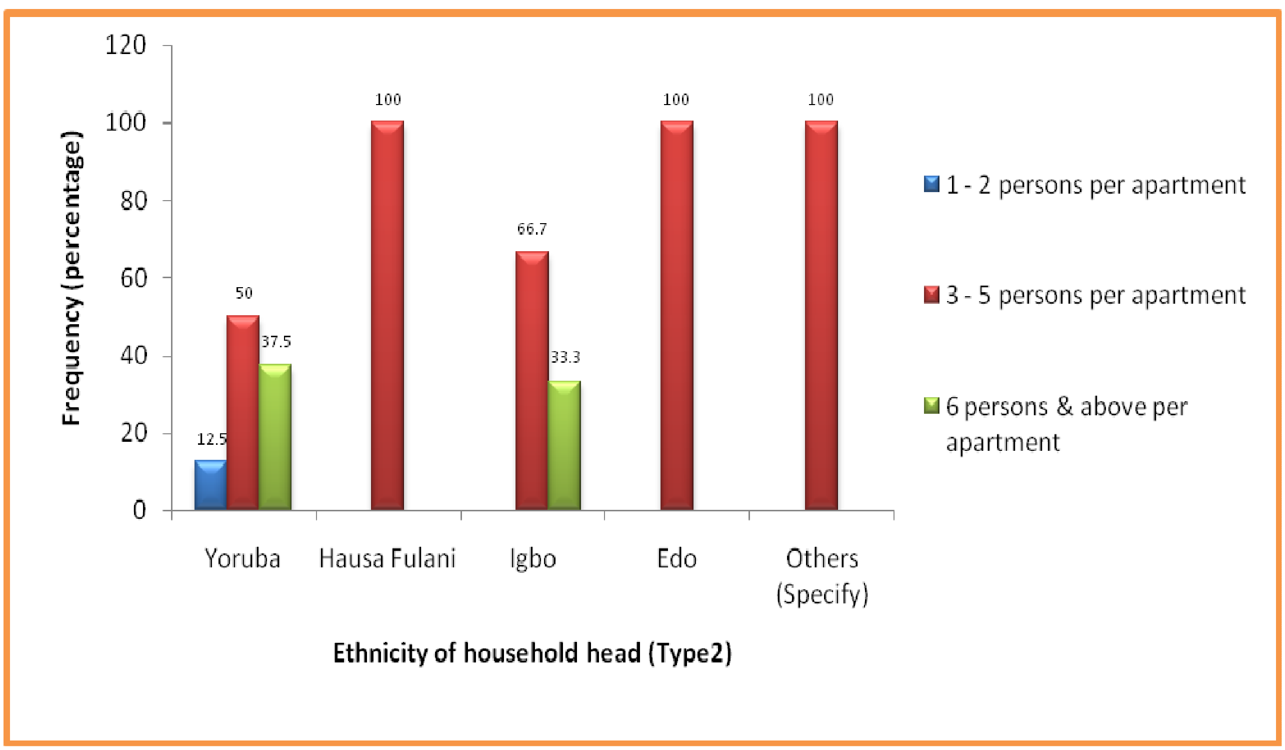


Figure 4.42: Actual Dwelling Density for Apartment Type 2 Based on Ethnicity

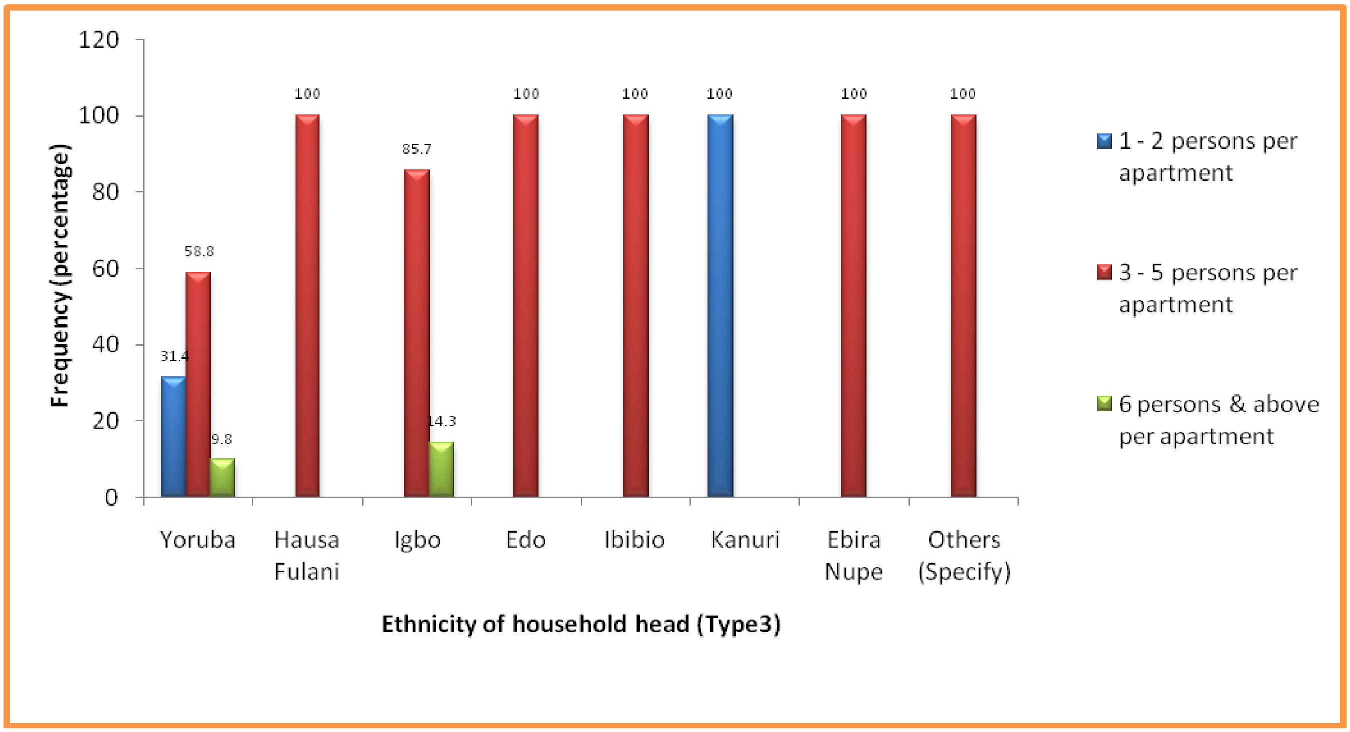


Figure 4.43: Actual Dwelling Density for Apartment Type 3 Based on Ethnicity

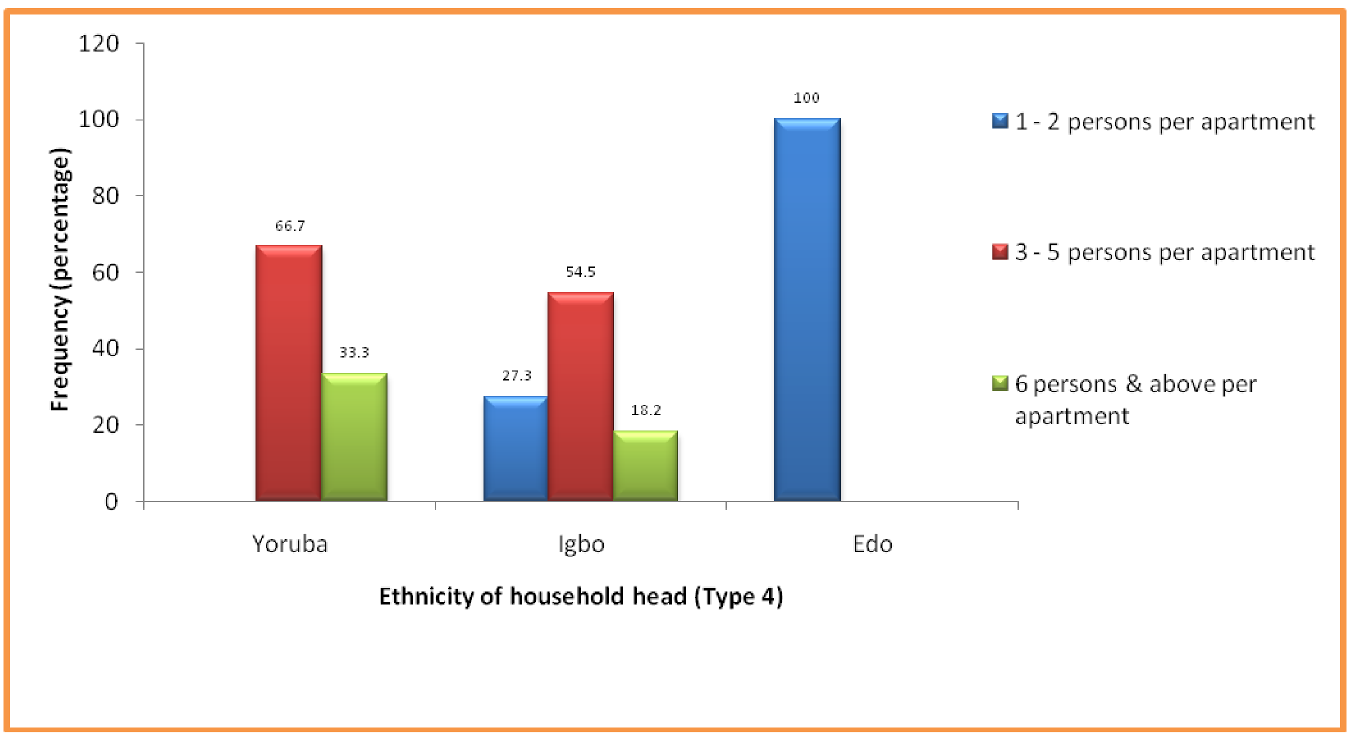


Figure 4.44: Actual Dwelling Density for Apartment Type 4 Based on Ethnicity

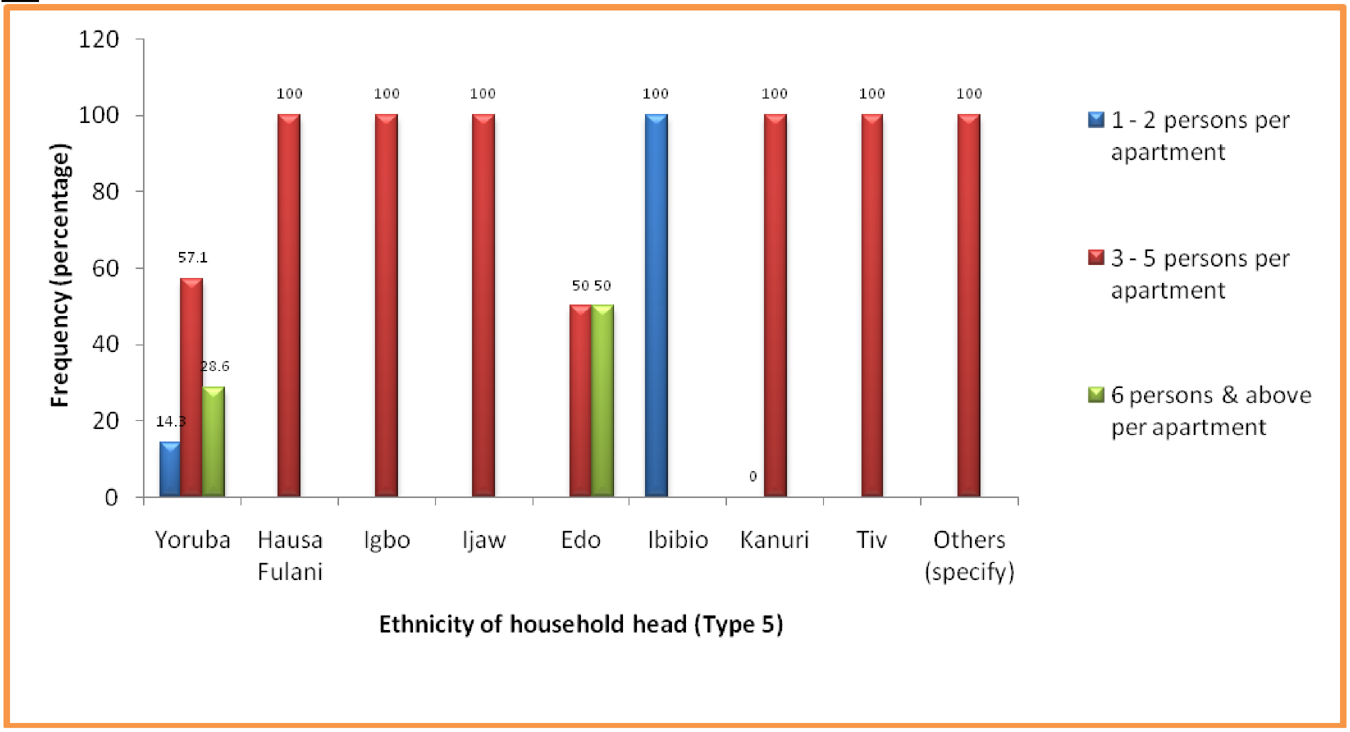


Figure 4.45: Actual Dwelling Density for Apartment Type 5 Based on Ethnicity

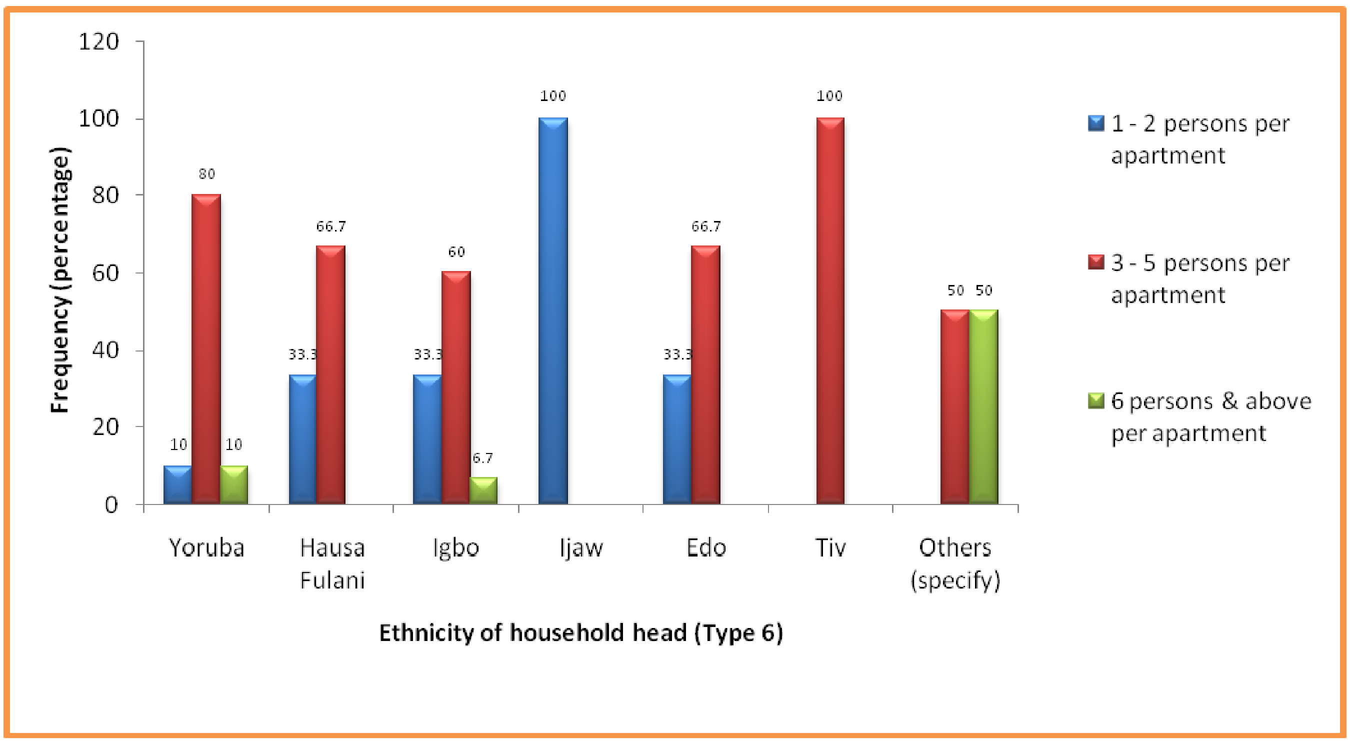


Figure 4.46: Actual Dwelling Density for Apartment Type 6 Based on Ethnicity

Table 4.13 shows that the four ethnic groups of Yoruba, Igbo, Edo and Hausa Fulani constituted 91.4% of the total number of respondents. The policy implication is that housing provision should be targeted at meeting the harmonized needs of these four ethnic groups. The cultural traits and life styles that are common and acceptable to these four dominant groups should capture the attention of public housing providers in Lagos. The widespread speculation that Nigeria is made up of over 250 ethnic nationalities was not supported by the data from this study. Only 14 ethnic groups were represented among the 176 household heads who responded to questionnaire.

4.14.1 Dwelling density in apartments where ethnicity of household head is Yoruba

Figure 4.47 reveals that the Yoruba ethnic group lives in all the six apartment types investigated. The figure further shows the results of dwelling density computation using five different approaches adopted in this study. Three of the measurement indicators reveal that all apartment classifications headed by persons of Yoruba ethnic origin were under-occupied. The three indicators that gave this result are: (1) Number of Habitable Rooms (2) Combined Area of Habitable Rooms (3) Total Area of Each Apartment. Results showing dwelling density based on number of Bedrooms show that Type 2 (two-bedroom) apartment located at Dolphin II Estate was over-occupied by 1.06 adult-equivalent number of adults. All the remaining five apartment types investigated in this research gave results that indicated under-occupancy.

Figure 4.47 further shows that households headed by the Yorubas were over-occupied, based on Aggregate Area of CEL in four apartment types, namely Type 1 (2-bedroom)at Abesan, Type 2 (2-bedroom) at Dolphin II, Type 3 (three-bedroom) at Abesan and Type 4 (three-bedroom) at Iba. The space available for every adult-equivalent occupant in these four apartment types was inadequate. All the four apartment types were therefore unsuitable for persons of Yoruba descent. On the contrary, the use of Aggregate Area of CEL to determine dwelling density as seen in

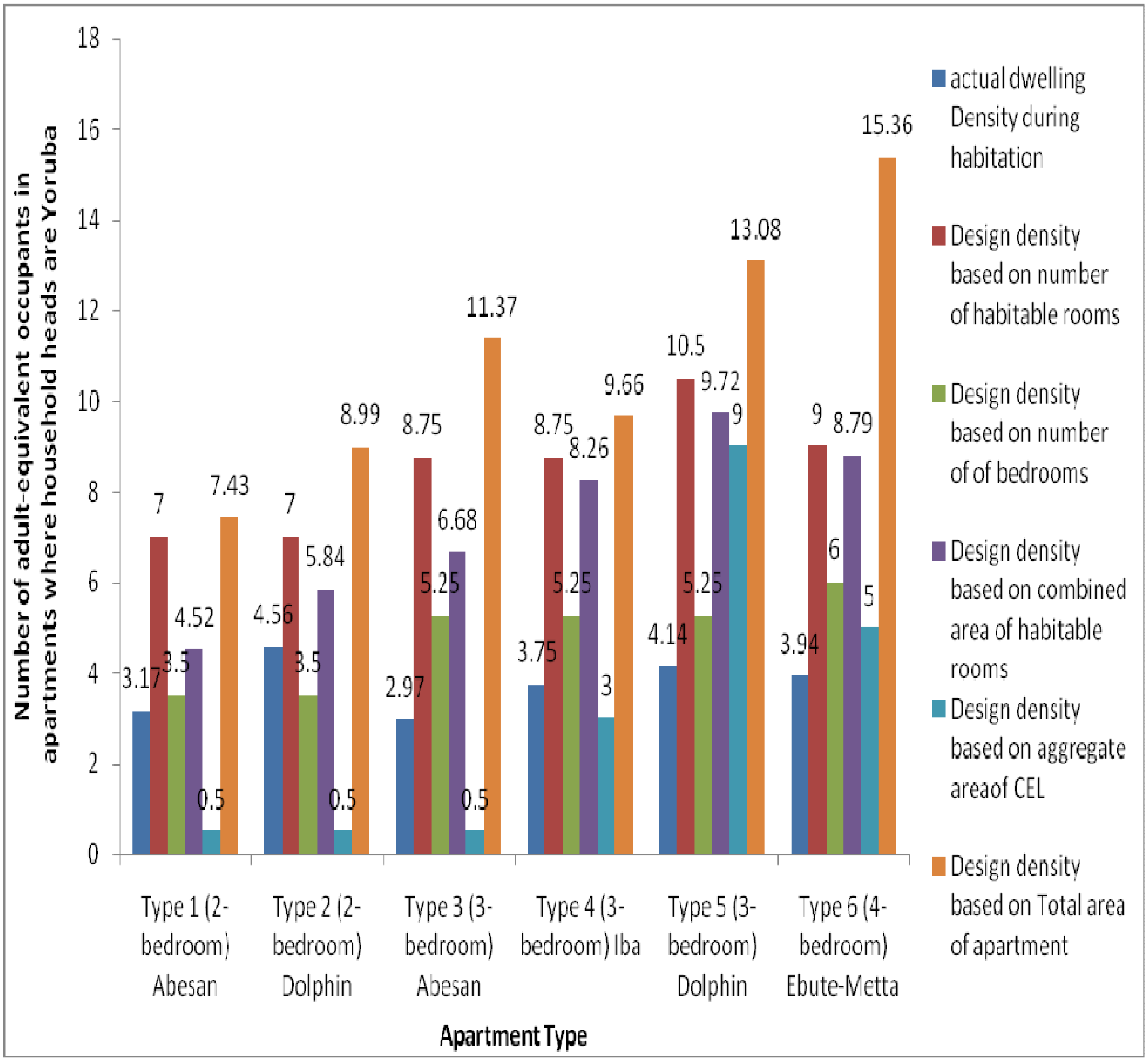


Figure 4.47: Dwelling density in apartments where ethnicity of household head is Yoruba

Figure 4.47 clearly revealed that Type 5 (3-bedroom) at Dolphin II and Type 6 (four-bedroom) at Ebute-Metta were under-occupied. Specifically, Figure 4.47 shows that a record of over-occupancy occured in Type 2 (2-bedroom) apartment at Dolphin II Estate.

For this apartment type, the over-occupancy occured on two occasions, (1) when the number of Bedroom was applied, and (2) when the Aggregate Area of CEL, was applied. On the other hand, the Table shows that Type 5 (3-bedroom) at Dolphin II and Type 6 (four-bedroom) at Ebute-Metta are under-occupied, based on all the five measurement indicators adopted in this study.

4.14.2 Dwelling density in apartments where ethnicity of household head is Hausa-Fulani

Figure 4.48 shows that households headed by persons of Hausa-Fulani origin were less likely to be found in type 1 (two-bedroom) at Abesan and Type 4 (3-bedroom) at Iba. Among the five indicators adopted in the study for assessing dwelling density, three indicators revealed under-occupancy in all apartment types where the household head was of Hausa-Fulani origin. These three indicators are Number of Habitable Rooms, Combined Area of Habitable and Total Area of Each Apartment.

The indicator of Number of Bedrooms shows that Type 2 (two-bedroom) at Dolphin II was over-occupied. The other three types were under-occupied. These are Type 3 (3-bedroom) at Abesan, Type 5 (3-bedroom) at Dolphin II, and Type 6 (four-bedroom) at Ebute-Metta.

Figure 4.48 also shows that Type 2 (2-bedroom) at Dolphin II and Type 3 (three-bedroom) at Abesan were over-occupied, based on Aggregate Area of CEL. On the other hand, the Aggregate Area of CEL indicator revealed that Type 5 (3-bedroom) at Dolphin II and Type 6 (four-bedroom) at Ebute-Metta were under-occupied. The figure also shows that Type 5 (three-bedroom) at Ebute-Metta were under-occupied, when assessed using all the five indicators adopted in this research.

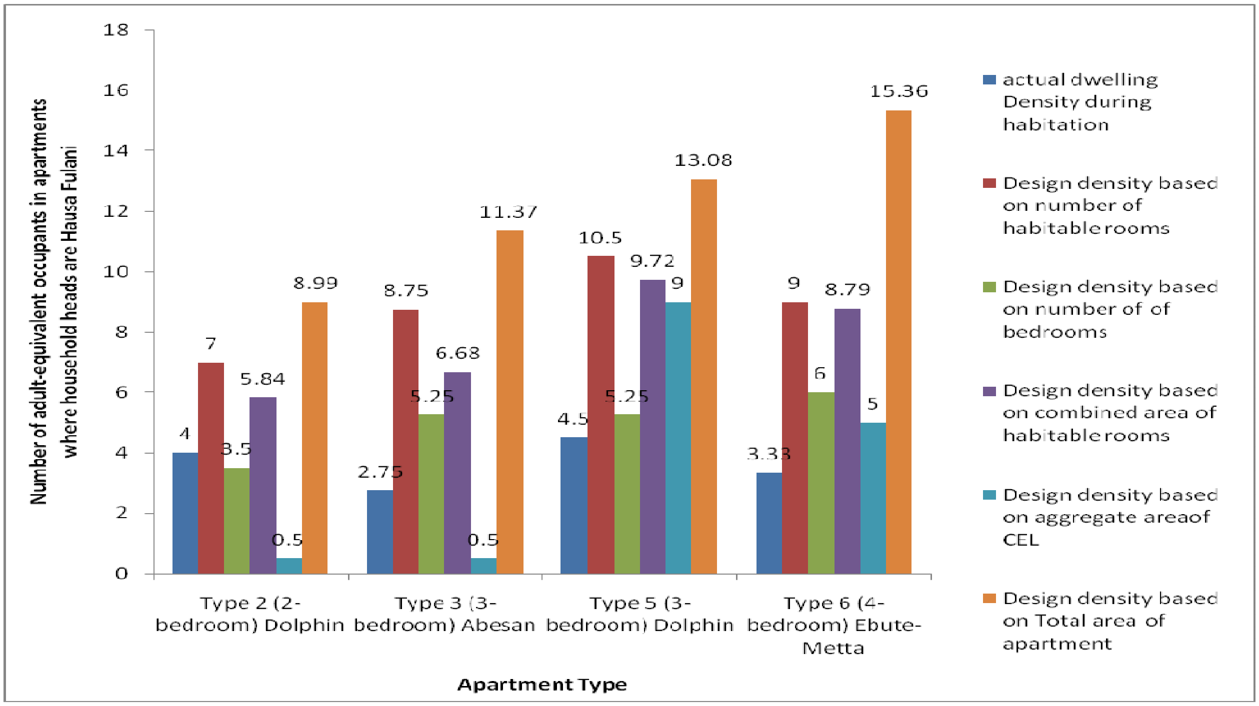


Figure 4.48: Dwelling density in apartments where ethnicity of household head is Hausa-Fulani

4.14.3 Dwelling density in apartments where ethnicity of household head is Igbo

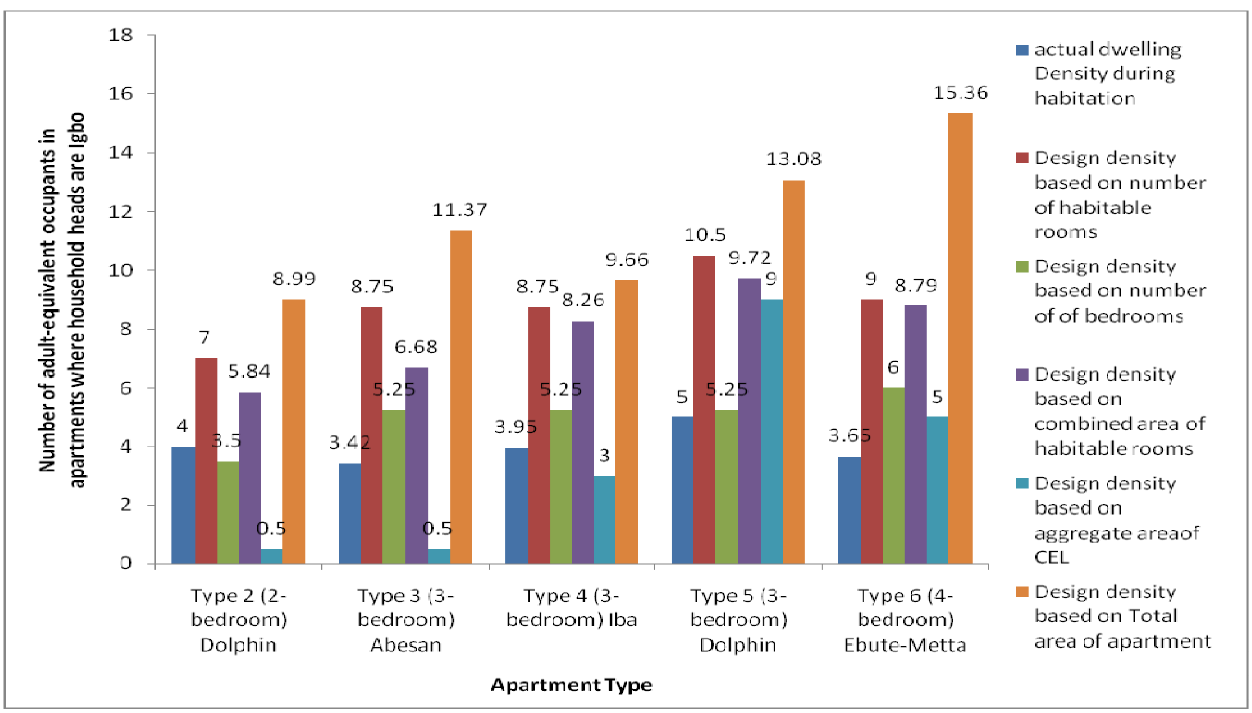


Figure 4.49: Dwelling density in apartments where ethnicity of household head is Igbo

As shown in Figure 4.49, the Igbo ethnic group were less likely to be found in Type 1 (two-bedroom) apartments at Abesan. The Igbos were available in all the other five apartment types investigated in this study. Among the five measurement indicators for determining dwelling density, Type 5 (3-bedroom) at Dolphin II and Type 6 (four-bedroom) at Ebute-Metta revealed under-occupancy in all cases. Also, Type 3 (3-bedroom) at Abesan and type 4 (3-bedroom) at Iba weare under-occupied in all dwelling density measurement indicators except based on Aggregate Area of CEL. These two apartment types are over-occupied when assessed on the basis of Aggregate Area of CEL.

Similarly, Type 2 (two-bedroom) apartments at Dolphin II were over-crowded when two measurement indicators were applied. These are; Number of Habitable Rooms, and Aggregate Area of CEL. The Type 2 (2-bedroom) apartments at Dolphin II were, however, under-occupied based on the other three measurement indicators namely; Number of Habitable Rooms, Combined Area of Habitable Rooms, and Total Area of each Apartment.

4.14.4 Dwelling density in apartments where ethnicity of household head is Ijaw

Figure 4.50 shows the position of apartments in the study area where household heads are of Ijaw ethnic extraction in Nigeria. The Ijaw ethnic group is one of the minority groups, usually found in the Niger Delta region and some other riverine areas.

Data from Figure 4.50 reveals that households belonging to the Ijaw ethnic group could scarcely be found in four out of the six apartment types selected for investigation. These are: (a) Type 1 (2-bedroom) at Abesan, (b) Type 2 (2-bedroom) at Dolphin, (c) Type 3 (three-bedroom), at Abesan, (d) Type 4 (three-bedroom) at Iba.

On the other hand, the figure reveals that households headed by the Ijaws were more likely to be found in Type 5 (3-bedroom) at Dolphin II and Type 6 (four-bedroom) at Ebute-Metta. Figure 4.50 further reveals that when all the five measurement indicators were applied to the households headed by persons of Ijaw origin, the results indicated under-occupancy. This implies that the actual occupancy was less than the design density rating for the two apartment types.

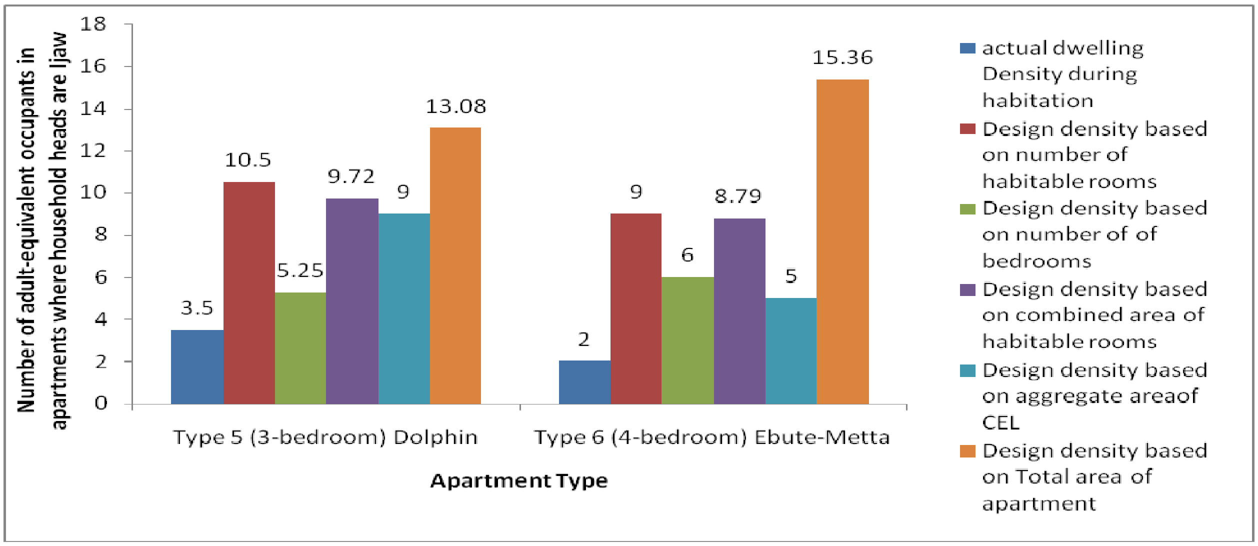


Figure 4.50: Dwelling density in apartments where ethnicity of household head is Ijaw

4.14.5 Dwelling density in apartments where ethnicity of household head is Edo

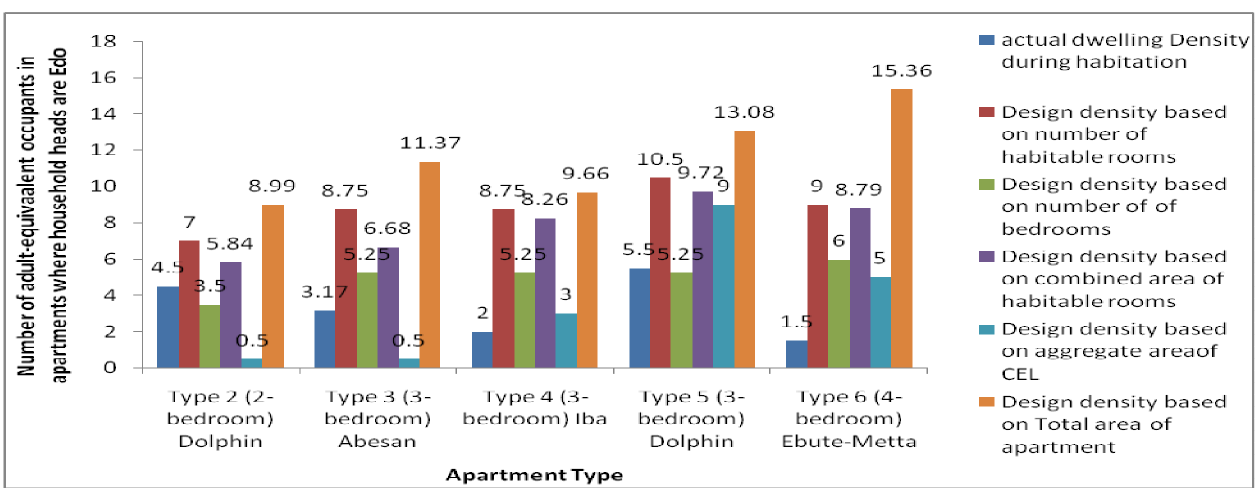


Figure 4.51: Dwelling density in apartments where ethnicity of household head is Edo

Edo is a minority ethnic group in Nigeria. It is the dominant group in Edo State and has historic relevance in Benin City. People of Edo ethnic origin have high connectivity with Lagos in terms of mass transportation. This proximity seems to suggest why the Edos were found in five out of six apartment types. Figure 4.51 shows that Type 1 (2-bedroom) at Abesan was the only type of apartment that was not inhabited by persons from Edo ethnic group. The figure also shows that three apartment types were under-occupied in all the five measurement criteria for dwelling density used in the present research. The three apartments are Type 4 (three-bedroom) at Iba, Type 5 (three-bedroom) at Dolphin II, and Type 6 (four-bedroom) at Ebute-Metta.

A similar result of under-occupancy was recorded for Type 2 (2-bedroom) at Dolphin, and Type 3 (3-bedroom) at Abesan, based on three measurement indicators. The indicators that gave under-occupancy results in these two apartment types are Number of Habitable Rooms, Combined Area of Habitable Rooms, and Total Area of each Apartment.

Viewed totally, Figure 4.51 reveals that all the apartments headed by Edo people in this study were under-occupied on three measurement indicators, namely: Number of Habitable Rooms, Combined Area of Habitable Rooms, and Total Area of each Apartment. Conversely, Figure 4.51 shows that Type 2 (2-bedroom) apartment at Dolphin II was over-occupied based on two measurement indicators. These are Number of Bedrooms and Aggregate Area of CEL. Similarly, Type 3 (3-bedroom) at Abesan shows over-occupancy when an indicator of Aggregate Area of CEL was applied.

4.14.6 Dwelling density in apartments where ethnicity of household head is Ibibio

The Ibibios constitute a minor ethnic group in Nigeria. The research data in Figure 4.52 indicates that households headed by the Ibibios could be found mainly in Type 3 (three-bedroom) at Abesan and Type 5 (three-bedroom) at Dolphin II. All the other four apartment types covered in this study did not harbour persons from Ibibio ethnic background. The four apartment types are: (a) Type 1 (two-bedroom) at Abesan (b) Type 2 (two-bedroom) at Dolphin (c)Type 4 (three-bedroom) at Iba (d) Type 6 (four-bedroom) at Ebute-Metta.

The figure also reveals that persons of Ibibio ethnic origin were not found in two-bedroom and four-bedroom apartment types. Rather, the Ibibios seemed to favour three-bedroom apartments. This argument is supported by the fact that the locations of the three-bedrooms at Abesan and Dolphin II also have some two-bedrooms within them. The two-bedrooms, however, were not occupied by the Ibibios.

Figure 4.52 further shows that when all the five indicators for measuring dwelling density were applied to Type 5 (three-bedroom) at Dolphin II Estate, all the households were under-occupied. On the other hand, Type 3 (three-bedroom) units at Abesan are under-occupied based on four measurement indicators, Number of Habitable Rooms, Number of Bedrooms, Combined Area of Habitable Rooms, and Total Area of Each Apartment. Type 3 (three-bedroom) at Abesan, however, shows over-occupancy when the dwelling density was measured, based on Aggregate Area of CEL. This happens to be the only circumstance where over-occupancy was recorded among households headed by the Ibibios in the study area.

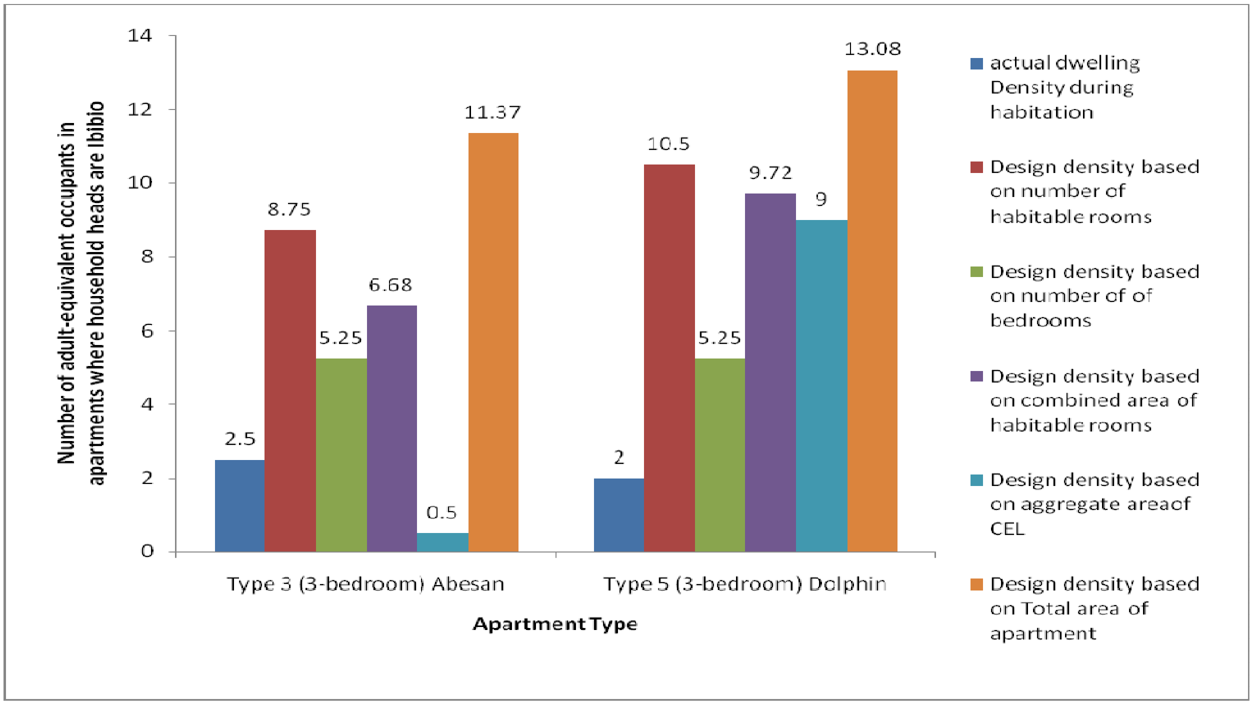


Figure 4.52: Dwelling Density in Apartments where Household Heads are Ibibio Ethnic Origin

4.14.7 Dwelling density in apartments where ethnicity of household head is Kanuri

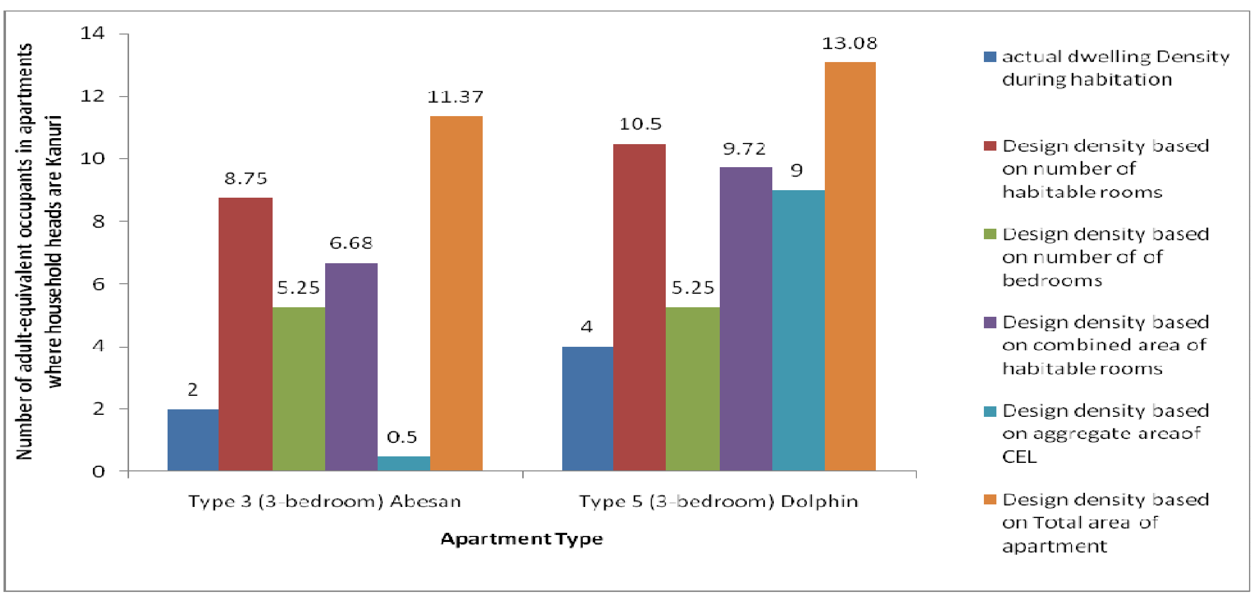


Figure 4.53: Dwelling density in apartments where ethnicity of household head is Kanuri

Figure 4.53 shows that respondents who are of Kanuri ethnic origin were more likely to be found in Type 3 (three-bedroom) and Type 5 (three-bedroom) apartment classifications. Based on the research results, it is evident that household heads who are of kanuri ethnic descent did not live in the other four types of apartment investigated. These are Type 1 (two-bedroom) at Abesan, Type 2 (two-bedroom) at Dolphin II, Type 4 (three-bedroom) at Iba, and Type 6 (four-bedroom) at Ebute-Metta.

The figure reveals the dwelling density for the two apartment types using five indicators adopted in this study.

Figure 4.53 indicates that it is only on the basis of Aggregate Area of CEL that over-occupancy occured in Type 3 (three-bedroom) at Abesan. This suggests that Kanuri people were more likely to exceed the design density rating in Type 3 (three-bedroom) apartment.

On the contrary, all the other indicators for measuring dwelling density show that households headed by persons from Kanuri ethnic background were under-occupied. It is also clear from the figure that all the households in Type 5 (three-bedrooms) were under-occupied, based on all the five indicators adopted in this study for assessing dwelling density.

4.14.8 Dwelling density in apartments where ethnicity of household head is Tiv

Figure 4.54 shows that apartments in the study where household heads are of Tiv ethnic origin could substantially be found in Type 6 (four-bedroom) at Ebute-Metta. Results from the data show that there were no respondents from the other five apartment types investigated in this research. These are: (a) Type 1 (2-bedroom) at Abesan (b) Type 2 (two-bedroom) at Dolphin (c) Type 3 (three-bedroom) at Abesan (d) Type 4 (three-bedroom) at Iba (e) Type 5 (three-bedrooms) at Dolphin II.

The research data from Figure 4.54 further suggests that household heads from Tiv ethnic background could not be found in apartments that are two-bedrooms or three-bedrooms. This probably means that people from that area have penchant for big apartments; hence, the disdain for two-bedroom and three-bedroom types. It is also likely that the location of the medium income big apartment at Ebute-Metta is a factor that encouraged this preference.

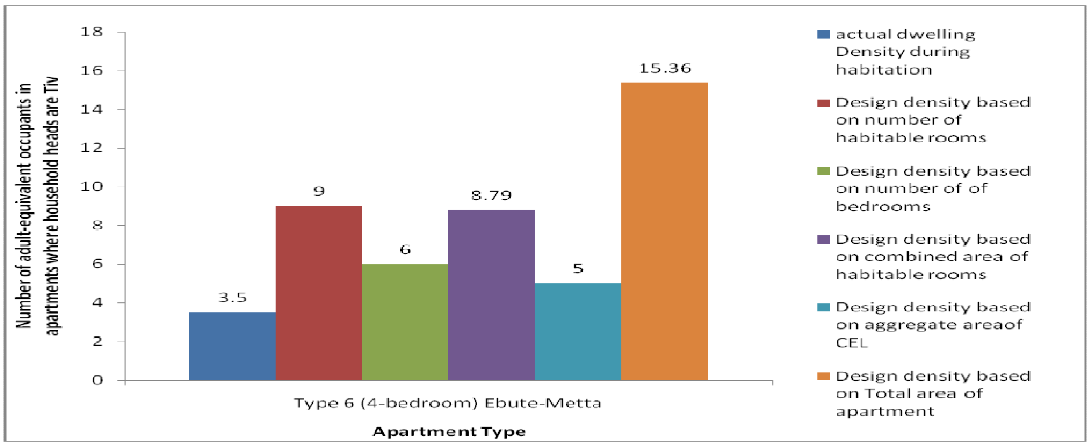


Figure 4.54: Dwelling density in apartments where ethnicity of household head is Tiv

4.14.9 Dwelling density in apartments where ethnicity of household head is Ebira-Nupe

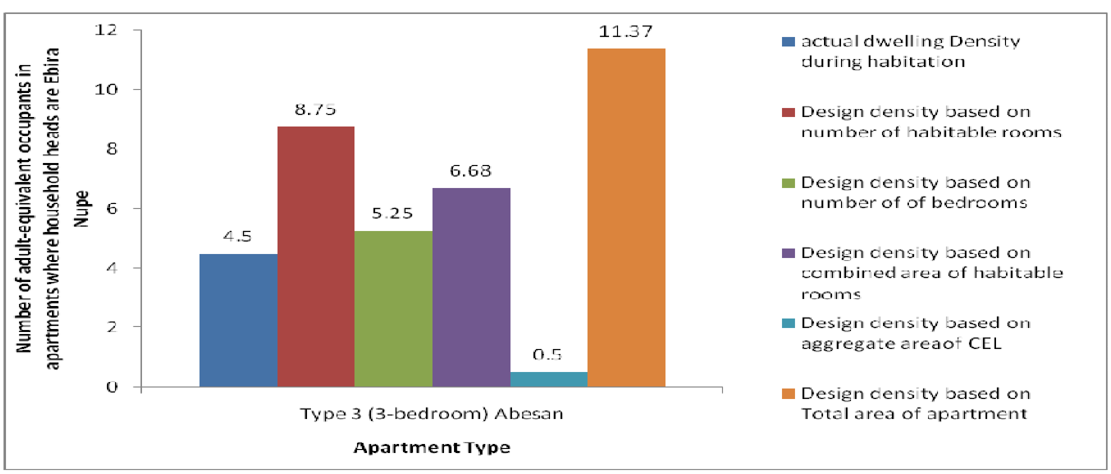


Figure 4.55: Dwelling density in apartments where ethnicity of household head is Ebira-Nupe

Ebira-Nupe is one of the recognised minority ethnic groups selected in this study for investigation in relation to dwelling density in LSDPC's multifamily apartments. Respondents who are from Ebira-Nupe ethnic group were not found in five of the apartment types under investigation. These are: (1) Type 1 (two-bedroom) at Abesan (2) Type 2 (two-bedroom) at Dolphin II (3) Type 4 (three-bedroom) at Iba (4) Type 5 (three-bedroom) at Dolphin II (5) Type 6 (four-bedroom) at Ebute-Metta.

Figure 4.55 hence reveals that in the study area, persons from Ebira-Nupe who are household heads were most likely to be found only in Type 3 (three-bedroom) apartments located at Abesan. The five measurement indicators adopted in the present study were applied to the residents of Type 3 (three-bedroom) apartments in Abesan. Results in Figure 4.55 show that based on Aggregate Area of CEL, Type 3 (three-bedroom) apartments headed by persons of Ebira-Nupe origin were over-occupied. This means that the spaces available per square metre for each adult equivalent occupant was less than what was rated based on the design.

On the contrary, the dwelling density outcome based on the other four measurement indicators adopted in this research revealed under-occupancy. The four indicators that gave under-occupancy result are Number of Habitable Rooms, Number of Bedrooms, Combined Area of Habitable Rooms, Aggregate Area of CEL, and Total Area of Each Apartment.

4.14.10 Statistical Validation of Effect of Ethnicity on Dwelling Density

The effect of ethnicity on dwelling density among residents of the six apartments investigated was tested using chi-square technique. The results are shown in Table 4.14 The statistical level of significance for acceptance or rejection was set at 95% confidence interval. Thus P-Value (that is, T tabulated) represents the effect of ethnicity on dwelling density. The decision rule is that at the same degree of freedom, if the P-Value is less than 0.05, the effect of ethnicity on dwelling density is classified as "significant". This implies that at the same degree of freedom, if the P-Value is higher than 0.05, the effect of ethnicity on dwelling density is classified as “not significant”. The table reveals that ethnicity had no significant effect on dwelling density, at 95% confidence level.

Table 4.14: Effect of Ethnicity on Dwelling Density

Apartment type	Chi-square Value X^2	D.F.	P-Value (T- tabulated)	Remark
Type one (two-bedroom), Abesan	Constant			Ethnicity has No significant effect on dwelling density in all apartment types
Type two (two-bedroom), Dolphin II	3.344	8	0.911	
Type three (three-bedroom), Abesan;	10.678	14	0.711	
Type four (three-bedroom), Iba	3.939	4	0.414	
Type five (three-bedroom), Dolphin	13.151	16	0.662	
Type six (four-bedroom), Ebute-Metta	10.427	12	0.579	

Remarks/interpretation
P-Value (that is, T tabulated): effect of ethnicity on dwelling density. Decision rule: At the same degree of freedom (D.F.) if the P-Value is less than 0.05, effect of ethnicity on dwelling density is classified as “significant”; if the P-Value is higher than 0.05, effect ethnicity on dwelling density is classified as “not significant”.

4.15 DWELLING DENSITY BY AGE OF HOUSEHOLD HEAD

Table 4.15: Dwelling Density Outcome for Respondents According to Age Distribution

Age group of household head	Number of Respondents	Percentage (%)
Less than 18 years	3	1.7
18-30 years	29	16.4
31-40 years	50	28.4
41-50 years	48	27.3
51-65 years	36	20.5
Above 65 years	10	5.7
Total	**176**	**100.0**

One variable on which subjects were described was current age. Survey respondents were requested to "please indicate your age as of your last birth day". The following six age groups were provided as response options: "less than 18 years", "18-30 years", "31-40 years", "41-50 years", "51-65 years", and "above 65 years". Table 4.15 depicts the age distribution of respondents. The age category that was selected by the largest number of respondents 28.4% (50) was 31 – 40 years. The age group that was reported by the fewest number of respondents 1.7% (9) was below 18 years. The result on age distribution of respondents indicates that persons in the productive age bracket 31 – 65 years account for 76.2% (134). On the other hand respondents who could be regarded as youthful and those regarded as senior citizens jointly constitute only 23.8% (42).

This difference could be useful for policy and planning purposes particularly in regard to family life-cycle and household size considerations in public housing delivery. The result also clearly reveals the presence of child-headed households among the respondents, a phenomenon that characterizes areas ravaged by war and HIV/AIDS.

Figures 4.56 to 4.61 show the actual dwelling density outcome during habitation for different age categories in various apartment types, presented in three groupings of 1-2 occupants, 3-5 occupants, and 6 & above occupants. The figures show a preponderance of household sizes of 3-5 occupants.

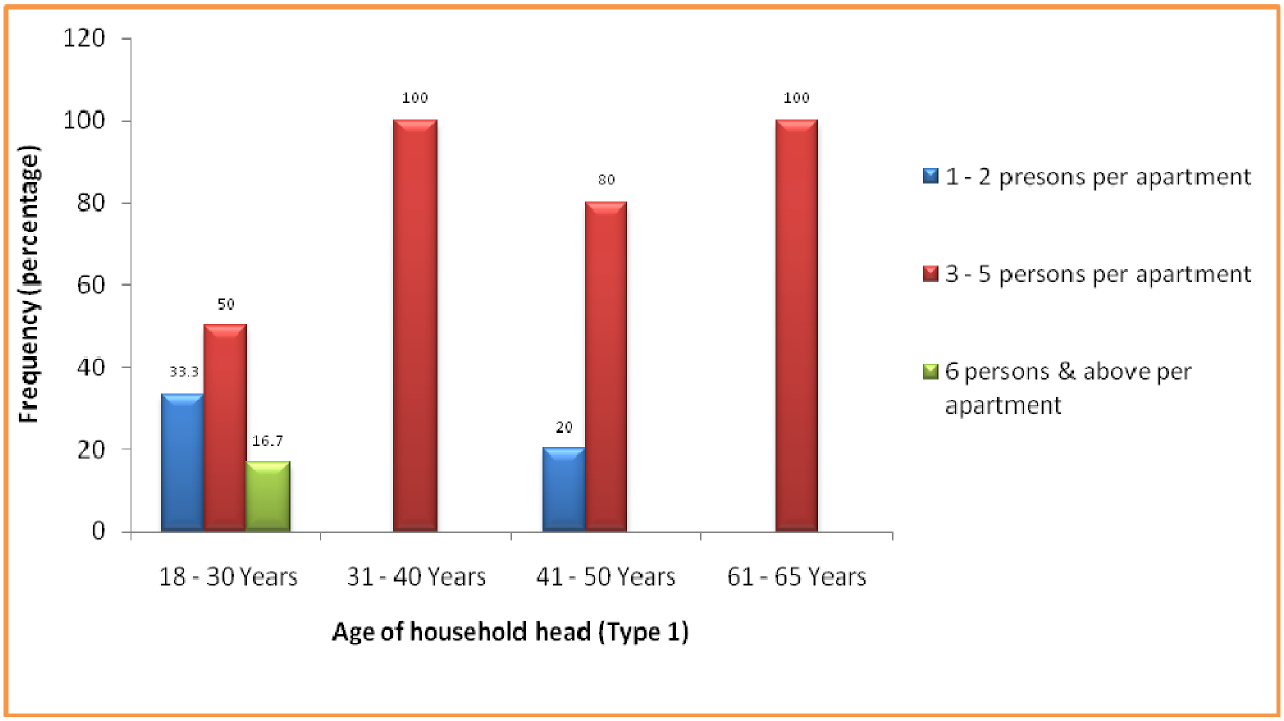


Figure 4.56: Actual Dwelling Density for Apartment Type 1 Based on Age of Household Head

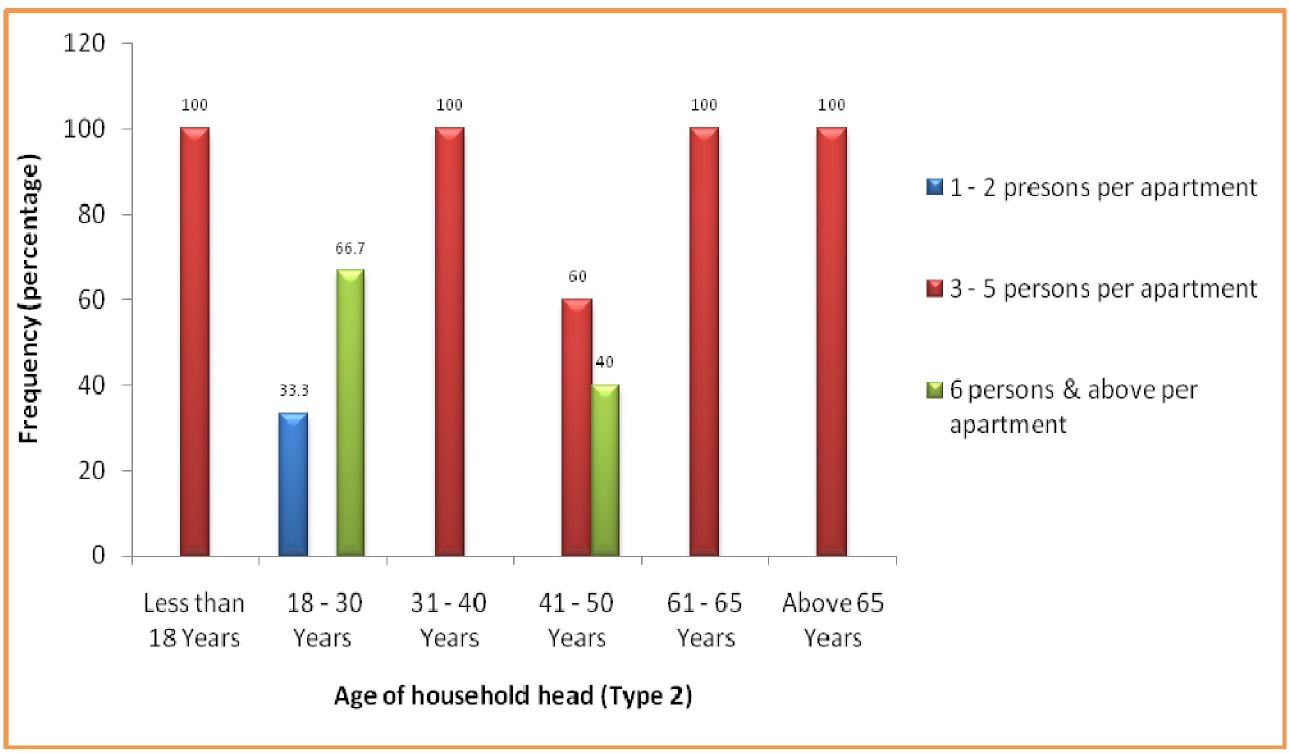


Figure 4.57: Actual Dwelling Density for Apartment Type 2 Based on Age of Household Head

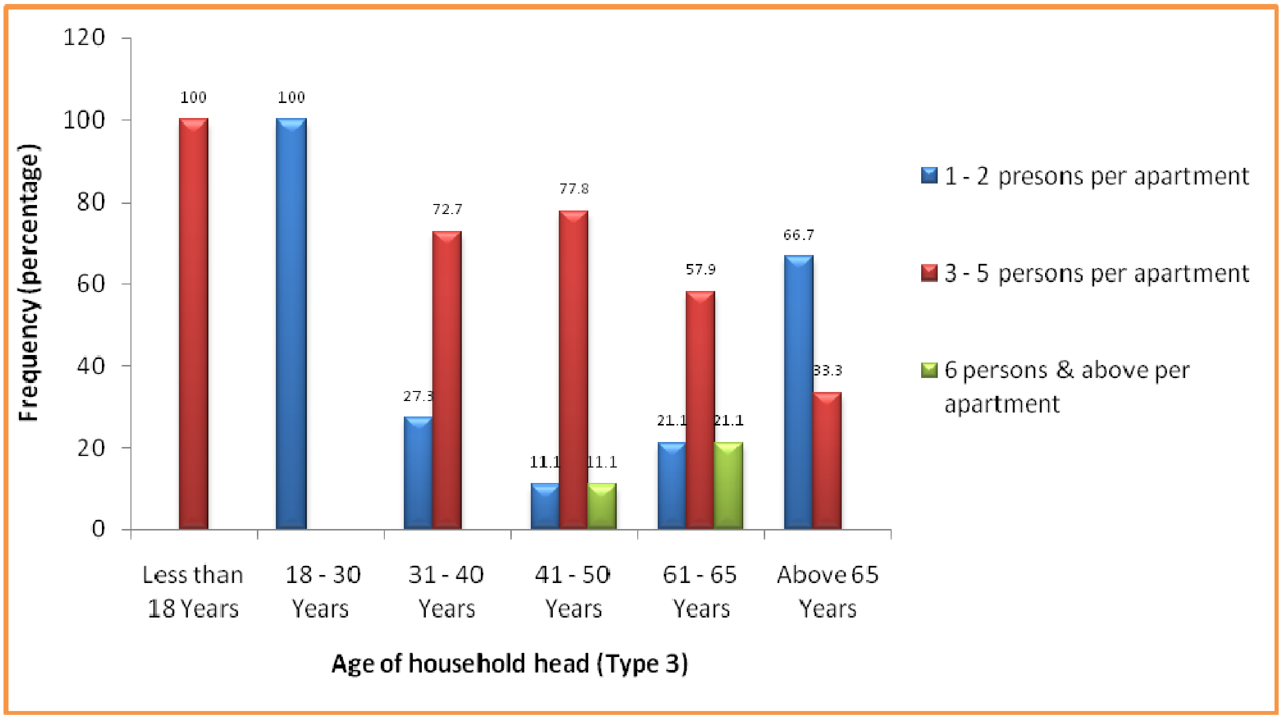


Figure 4.58: Actual Dwelling Density for Apartment Type 3 Based on Age of Household Head

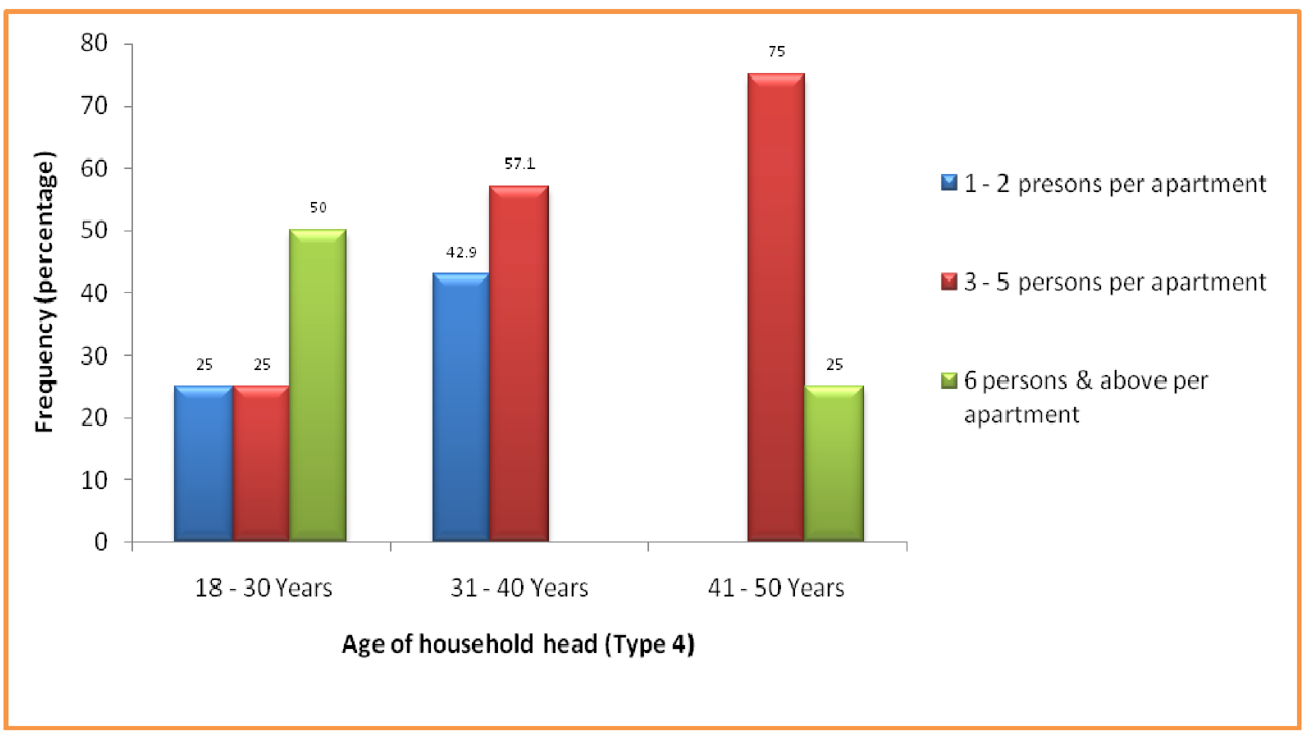


Figure 4.59: Actual Dwelling Density for Apartment Type 4 Based on Age of Household Head

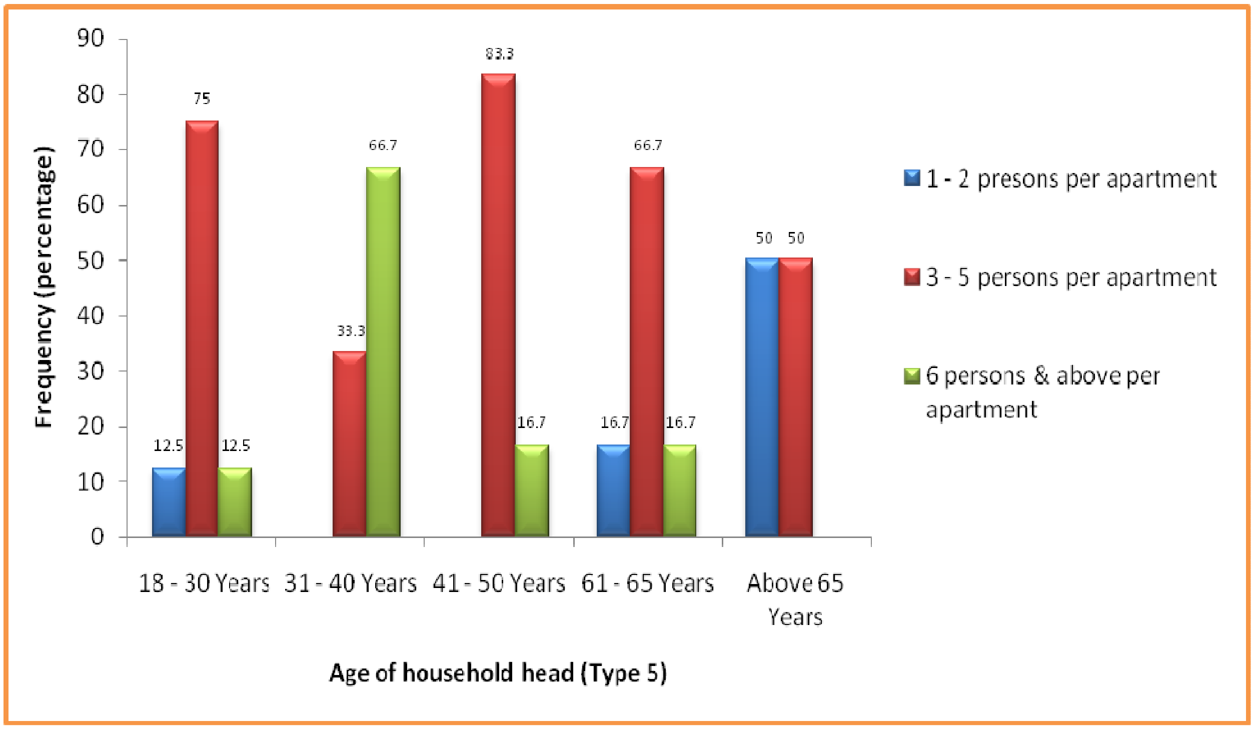


Figure 4.60: Actual Dwelling Density for Apartment Type 5 Based on Age of Household Head

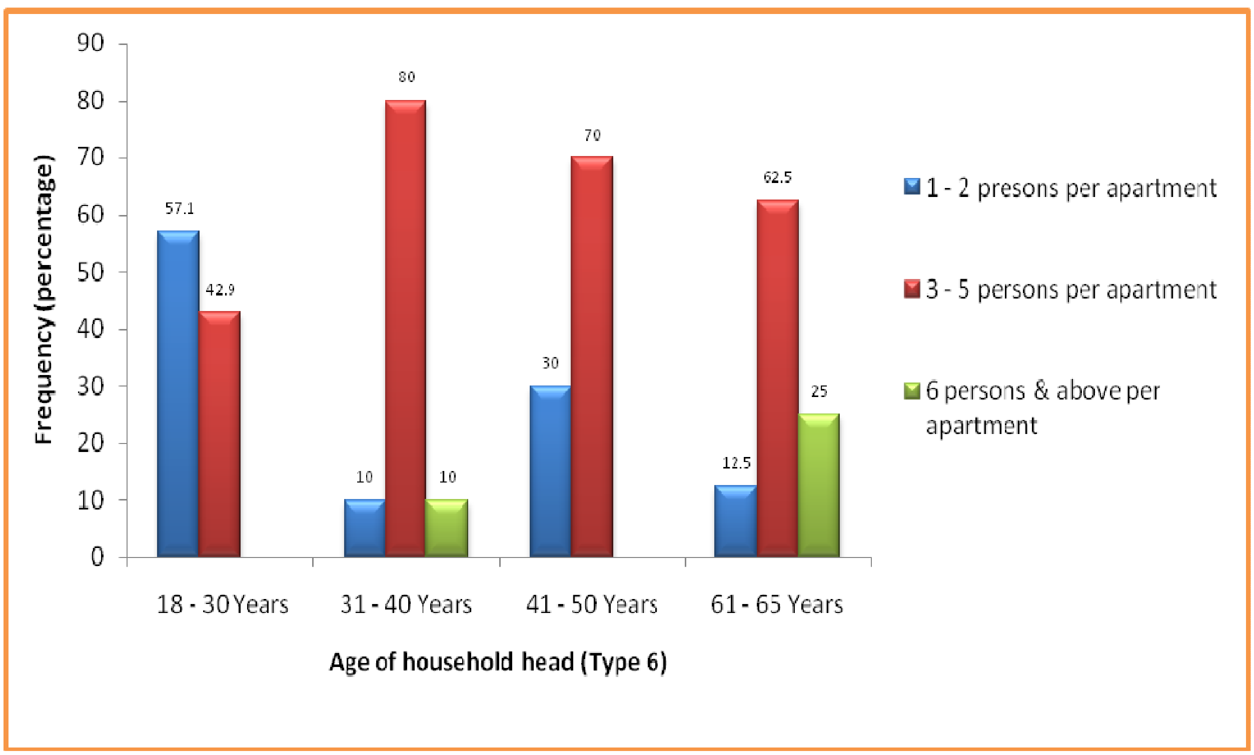


Figure 4.61: Actual Dwelling Density for Apartment Type 6 Based on Age of Household Head

4.15.1 Dwelling density in apartments where age range of household head is 18 – 30 Years

Figure 4.62 shows the results of dwelling density outcome for respondents in the age range 18 – 30 years. As could be observed from the figure, five criteria were employed in the measurement of dwelling density rating for each of the six apartment types selected for in-depth investigation. Three of the measurement indicators reveal that all apartments, regardless of type, were under-occupied. The three criteria that gave this result are: Number of habitable Rooms, Combined Area of Habitable Rooms, and Total Area of Each Apartment. Results of dwelling density based on Number of Bedrooms indicate that over-occupancy occurred in Type 2 (Two-bedroom) apartment for households headed by persons in the age range 18-30 years. A surplus of 1.17 adult-equivalent occupants were accommodated in the apartment.

All the other five apartment types in this study were under-occupied based on Number of Bedroom measurement indicator. The apartment types that were under-occupied are: (a) Type 1 (two-bedroom) at Abesan (b) Type 3 (three-bedroom) at Abesan (c) Type 4 (three-bedroom) at Iba (d) Type 5 (three-bedroom) at Dolphin II (e) Type 6 (four-bedroom) at Ebute-Metta. Among all these, Type 3 apartment recorded the highest difference between design density and actual density in terms of under-occupancy. Figure 4.62 further shows that households headed by persons in the age range 18-30 years were over-occupied in five out of six apartment types selected for this study.

The apartments where over-occupancy occurs, based on Aggregate Area of CEL are: (1) Type 1 (two-bedroom) at Abesan, (2) Type 2 (two-bedroom) at Dolphin II, (3) Type 3 (three-bedroom) at Abesan, and (4) Type 4 (three-bedroom) at Iba (5). Conversely, Type 5 (three-bedroom) apartment at Dolphin II, and Type 6 (four-bedroom) at Ebute-Metta recorded under-occupancy, based on Aggregate Area of CEL.

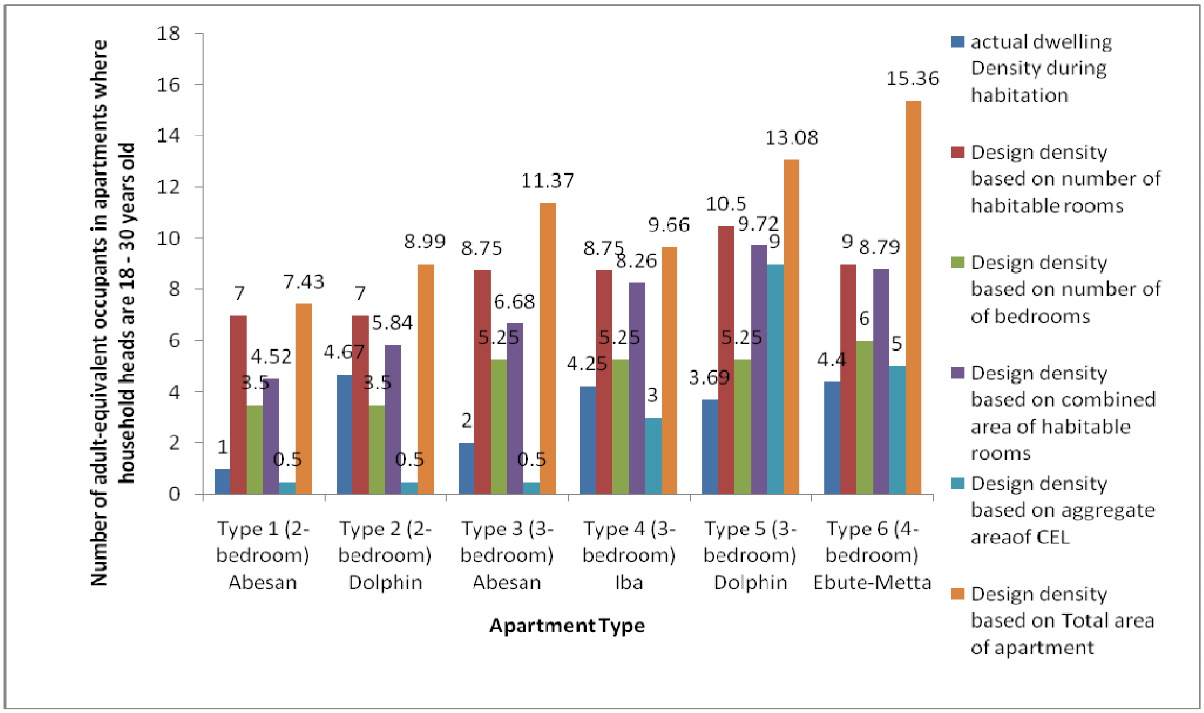


Figure 4.62: Dwelling density in apartments where age range of household head is 18 – 30 Years

4.15.2 Dwelling density in apartments where age range of household head is 31 – 40 Years

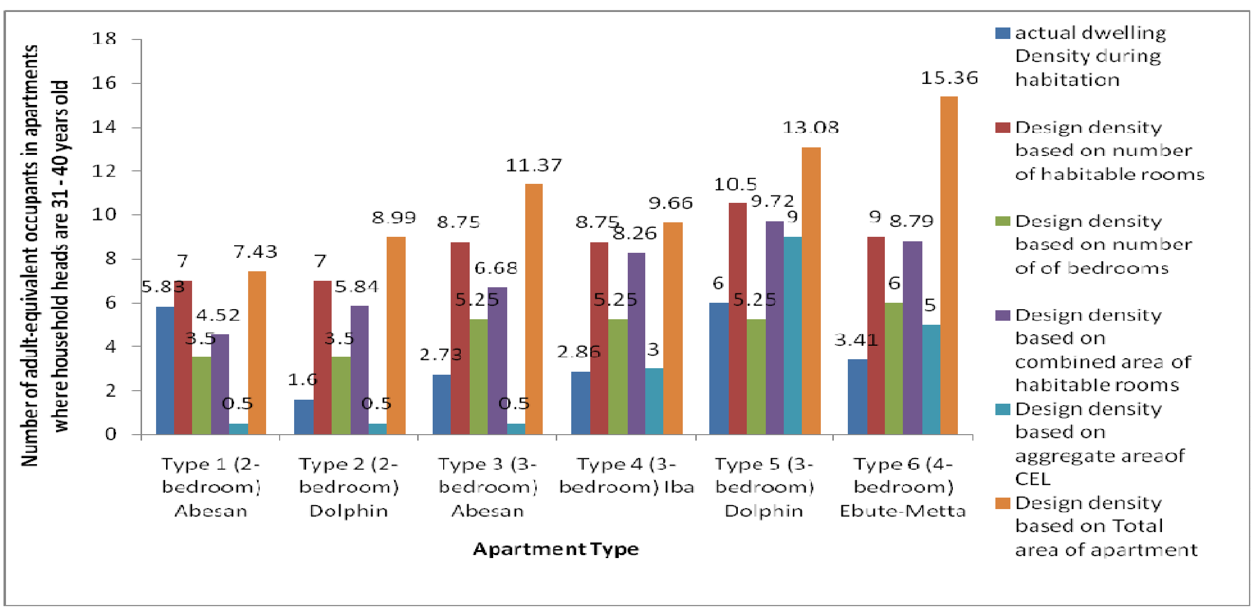


Figure 4.63: Dwelling density in apartments where age range of household head is 31 – 40 Years

The dwelling density in apartments where the age group of household heads is 31 – 40 years is depicted in Figure 4.63. The figure reveals that all the apartments covered in the study were under-occupied when assessment methods of Number of Habitable Rooms and Total Area of Apartment were used.

When the Number of Bedrooms was used as the measuring indicator, the figure shows that Type 1 (2-bedroom) and Type 5 (3-bedroom) recorded over-occupancy. However, all the other four apartment types indicated under-occupancy, based on this measurement indicator. The four types that recorded under-occupancy based on Number of Bedroom are: (1) Type 2 (two-bedroom) at Dolphin (2) Type 3 (three-bedroom) at Abesan (3) Type 4 (three-bedroom) at Iba (4) Type 6 (four-bedroom) at Ebute-Metta.

Figure 4.63 equally reveals the result of dwelling density computation based on Combined Area of Habitable Rooms. When this indicator was applied, only Type 1 (two-bedroom) apartment at Abesan recorded over-occupancy. Conversely, all the other five apartment types investigated showed under-occupancy are Type 4 (three-bedroom) at Iba, Type 5 (three-bedroom) at Dolphin II and Type 6 (four-bedroom) at Ebute-Metta.

Generally, among this age group, Type 1 (two-bedroom) apartment at Abesan showed the highest level of over-occupancy, based on three measurement indicators, while two apartment types recorded under-occupancy in all the five measurement indicators. Theses are; Type 4 (3-bedroom) at Iba and Type 6 (4-bedroom) at Ebute-Metta.

The results in Figure 4.63 therefore suggest that Type 1 (two-bedroom) at Abesan was unsuitable for household heads in the age range 31- 40. On the other hand, Type 4 (three-bedroom) at Iba and Type

6 (four-bedroom) at Ebute-Metta seemed to be the most appropriate types, based on the results of the present study.

4.15.3 Dwelling density in apartments where age range of household head is 41 – 50 Years

Figure 4.64 shows that persons who belong to the age category 41-50 years were spread among the six apartment types investigated in this research. As could be observed from the figure, five criteria were employed in the computation of household dwelling density rating for each apartment classification. Three of the measurement indicators revealed that all apartments regardless of type were under-occupied. The three criteria that gave this result are: Number of Habitable Rooms, Combined Area of Habitable Rooms, and Total Area of Each Apartment.

A slightly different result was obtained when an indicator of Number of Bedrooms was applied in the measurement of dwelling density. The figure shows that Type 2 (2-bedroom) at Dolphin II and Type 4 (three-bedroom) at Iba recorded over-occupancy. This indicator of Number of Bedrooms, however, gave under-occupancy in the other four types of apartments headed by persons within the age bracket 41-50 years. The four apartment types in this category include: (1) Type 1 (two-bedroom) at Abesan (2) Type 3 (three-bedroom) at Abesan (3) Type 5 (three-bedroom) at Dolphin II (4) Type 6 (four-bedroom) at Ebute-Metta.

Again, it could be observed from the figure that all the apartments in Abesan estate and Ebute-Metta estate were under-occupied when this indicator of number of bedrooms is used for dwelling density assessment.

The data from Figure 4.64 further shows that when a measurement indicator of Aggregate Area of CEL was applied, four apartment types were over-occupied. These include all the two-bedroom apartment types covered in this study. It also includes the three-bedroom apartment types at Abesan and Iba estates. Four apartment types were hence over-occupied, based on Aggregate Area of CEL. In these apartments, the amount of space available for every adult-equivalent occupant per square metre of CEL was less than what was provided at the design stage. The four apartments had obviously exceeded their optimum design density rating. A contrary result was, however, obtained in Type 5 (3-bedroom) and Type 6 (four-bedroom) apartments. In these two apartment types, households headed by persons belonging to the age category 41-50 years were largely under-occupied, based on Aggregate Area of CEL indicator.

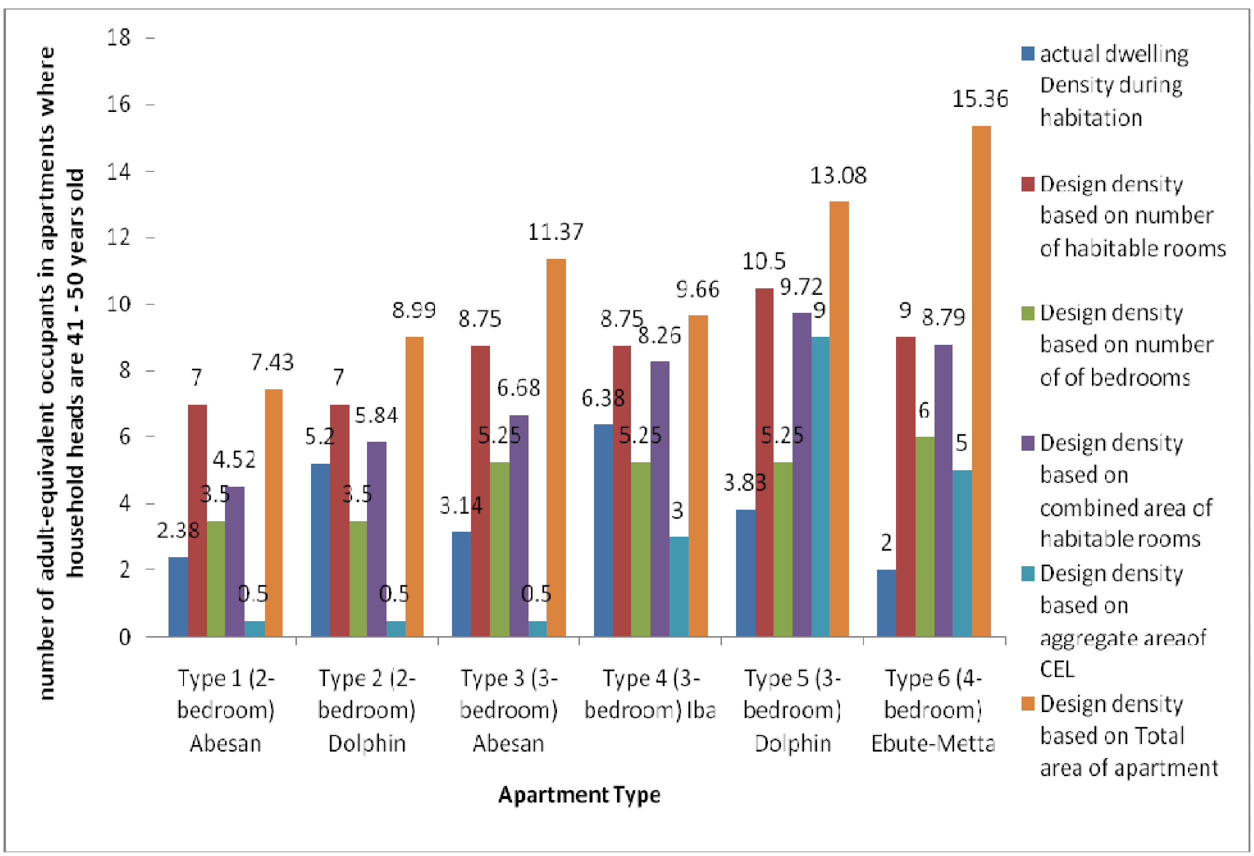


Figure 4.64: Dwelling density in apartments where age range of household head is 41 – 50 Years

4.15.4 Dwelling density in apartments where age range of household head is 51 - 65 Years

Figure 4.65 shows that respondents whose ages are from 51 years to 65 years were less likely to be found in Type 1 (two-bedroom) at Abesan and Type 4 (three-bedroom) at Iba. Among the five indicators adopted in the present research for determining dwelling density, three indicators revealed under-occupancy in all apartment types where household head was aged 51-65 years. These three indicators are Number of Habitable Rooms, Combined Area of Habitable Rooms and Total Area of Each Apartment.

The application of an indicator of Number of Bedrooms shows that Type 2 (two-bedroom) at Dolphin II estate was over-occupied. There were more adult-equivalent persons (0.5) than the estimated dwelling density by design. On the other hand, this indicator of Number of Habitable Rooms reveals that three apartment types were under-occupied. These under-occupied apartments could be found in Type 3 (three-bedroom) at Abesan, Type 5 (three-bedroom) at Dolphin II, and Type 6 (four-bedroom) at Ebute-Metta.

Figure 4.65 also indicates that Type 2 (two-bedroom) at Dolphin II, and Type 3 (three-bedroom) at Abesan were over-occupied based on Aggregate Area of CEL. On the other hand, the Aggregate Area of CEL indicator reveals that Type 5 (3-bedroom) at Dolphin II and Type 6 (four-bedroom) at Ebute-Metta were under-occupied. The figure equally shows that Type 5 (three-bedroom) at Dolphin and Type 6 (four-bedroom) at Ebute-Metta were under-occupied, irrespective of the five indicators used to assess the dwelling density for respondents in the age range 51-65 years.

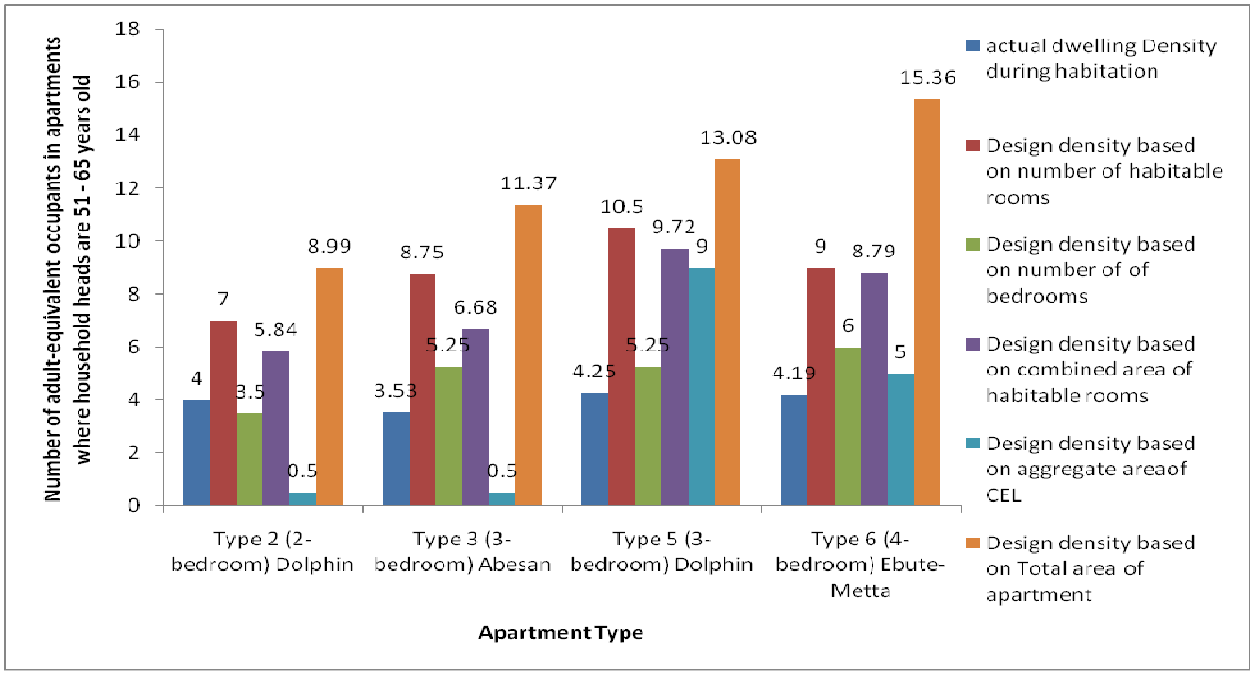


Figure 4.65: Dwelling density in apartments where age range of household head is 51 - 65 Years

4.15.5 Dwelling density in apartments where age range of household head is above 65 Years

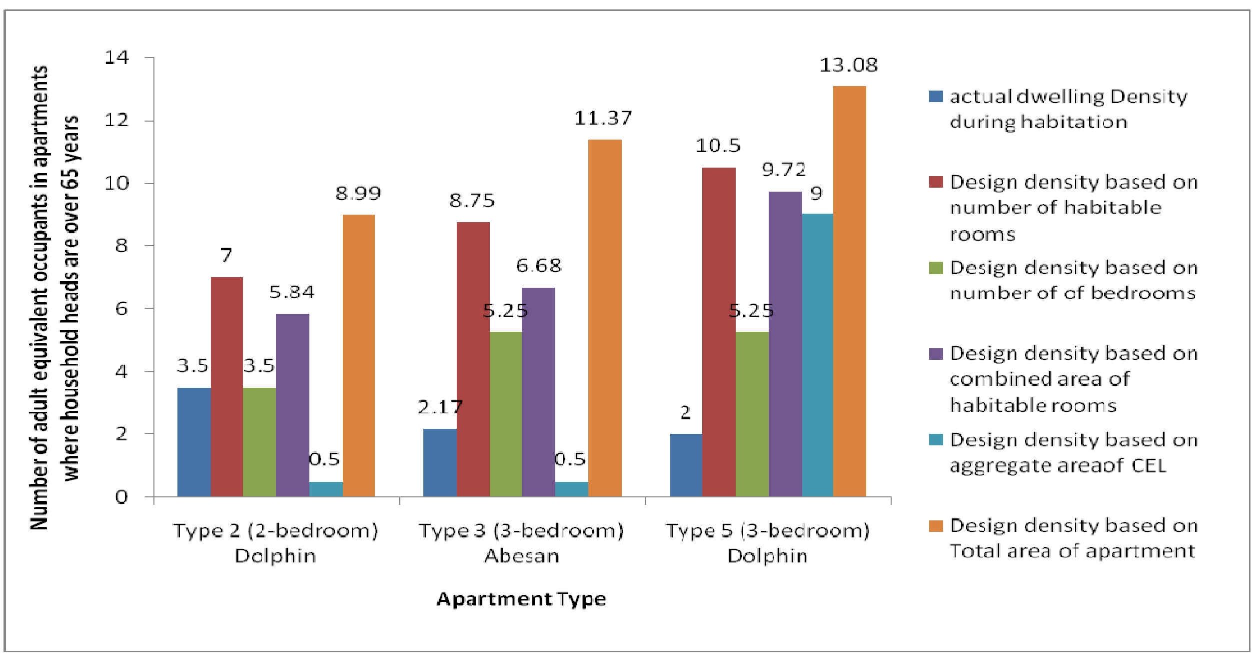


Figure 4.66: Dwelling density in apartments where age range of household head is above 65 Years

Data from Figure 4.66 shows that household heads whose ages are above sixty-five years were not found among residents of three apartment types in the study area. These are: Type 1 (two-bedroom) at Abesan, Type 4 (three-bedroom) at Iba and Type 6 (four-bedroom) at Ebute-Metta. Instead, respondents in this age category were seen in Type 2 (two-bedroom) at Dolphin II, Type 3 (three-bedroom) at Abesan and Type 5 (three-bedroom) at Dolphin II.

The data shows that among the three apartment types where respondents in this age reside, only Type 5 (three-bedroom) at Dolphin estate was completely under-occupied irrespective of the measuring indicator applied. Type 3 (three-bedroom) at Abesan was only under-occupied when four indicators were applied. These four indicators are Number of Habitable Rooms, Number of Bedrooms, Combined Area of Habitable Rooms and Total Area of Each Apartment. However, this Type 3 (three-bedroom) apartment at Abesan recorded over-occupancy when assessed on the basis of Aggregate Area of CEL.

With regards to Type 2 (two-bedroom) at Dolphin II, the households were under-occupied using three indicators. The three indicators that recorded under-occupancy are Number of Habitable Rooms, Combined Area of Habitable Rooms and Total Area of Apartment.

Figure 4.66, however, reveals that this Type 2 (two-bedroom) at Dolphin was over-occupied, based on Aggregate Area of CEL. A significant result was recorded when the Number of Bedrooms was used to assess dwelling density in this apartment type for respondents above 65 years. This was one of the few instances where the apartment was occupied as designed. The actual dwelling density was equal to the design density rating.

4.15.6 Statistical Validation Of Effect Of Age Of Household Head On Dwelling Density

Table 4.16 shows the result of a chi-square test to determine the effect of age of respondents on dwelling density among the six apartment categories investigated. The statistical level of significance for acceptance or rejection was set at 95% confidence interval. Thus P-Value (that is, T-tabulated) represents the effect of age of respondents on dwelling density. The decision rule is that at the same degree of freedom, if the P-Value is less than 0.05, the effect of age of respondents on dwelling density is classified as “significant”. This implies that at the same degree of freedom, if the P-Value is higher than 0.05, the effect of age of respondents on dwelling density is classified as “not significant”. It was observed from Table 4.16 that age of household head had no significant effect on dwelling density in all the apartment types investigated, at 95% confidence level.

Table 4.16: Effect of age of household head on Dwelling Density

Apartment type	Chi-square Value X^2	D.F.	P-Value T-tabulated	Remark
Type one (two-bedroom), Abesan	5.243	6	0.513	Age of household head has no significant effect on dwelling density in all apartment types
Type two (two-bedroom), Dolphin II	11.200	10	0.342	
Type three (three-bedroom), Abesan;	17.223	10	0.070	
Type four (three-bedroom), Iba	5.982	4	0.200	
Type five (three-bedroom), Dolphin	8.448	8	0.391	
Type six (four-bedroom), Ebute-Metta	9.171	6	0.164	

Remarks/interpretation

P-Value (that is, T tabulated): effect of age of respondents on dwelling density. Decision rule: At the same degree of freedom (D.F.) if the P-Value is less than 0.05, effect of age of respondents on dwelling density is classified as “significant”; if the P-Value is higher than 0.05, effect of age of respondents on dwelling density is classified as “not significant”.

4.16 DWELLING DENSITY BY EDUCATION LEVEL OF HOUSEHOLD HEAD

Respondents were asked "which of these best describes the education level of the head of household"? The following educational attainments were provided as response options: "below primary school", "primary school", "secondary school", "college of education", "polytechnic", "university", "others (specify)".

The study (Table 4.17) shows the preponderance of people with university education (n = 103, 58.9%), or its equivalent, the polytechnic education (n = 35, 20.0%). The third highest number of respondents are those who attended colleges of education and persons with secondary education (n = 16, 9.1% for each). Only 2.9% of the respondents have primary school education or less. The high educational attainment among respondent household heads was an important personal asset that increases opportunities in life. This high literacy level could help LSDPC's planners know how best to reach its tenants with their messages.

Table 4.17: Education Level of Household Head

Education level of household head	**Number of Respondents**	**Percentage (%)**
Below primary school	1	0.6
Primary school	4	2.3
Secondary school	16	9.1
College of education	16	9.1
Polytechnic	35	20.0
University	103	58.9
Total	**175**	**100.0**

Note: One respondent did not answer the question on education level of household head.

Figures 4.67 to 4.72 illustrate the actual occupancy during habitation, based in education level of household head. Three groupings were used, 1-2 occupants, 3-5 occupants, and 6 & above occupants. The figures reveal that households containing 3-5 persons were the most dominant.

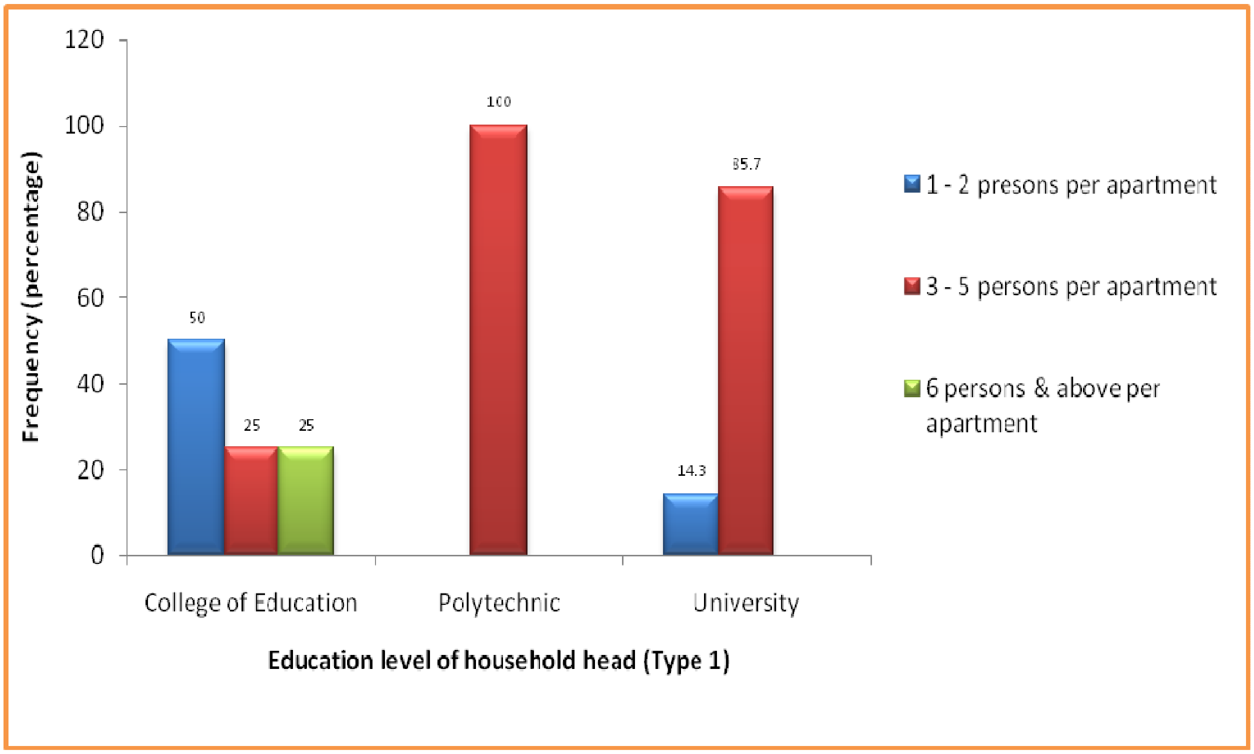


Figure 4.67: Actual Dwelling Density for Apartment Type 1Based on Education Level of Household Head

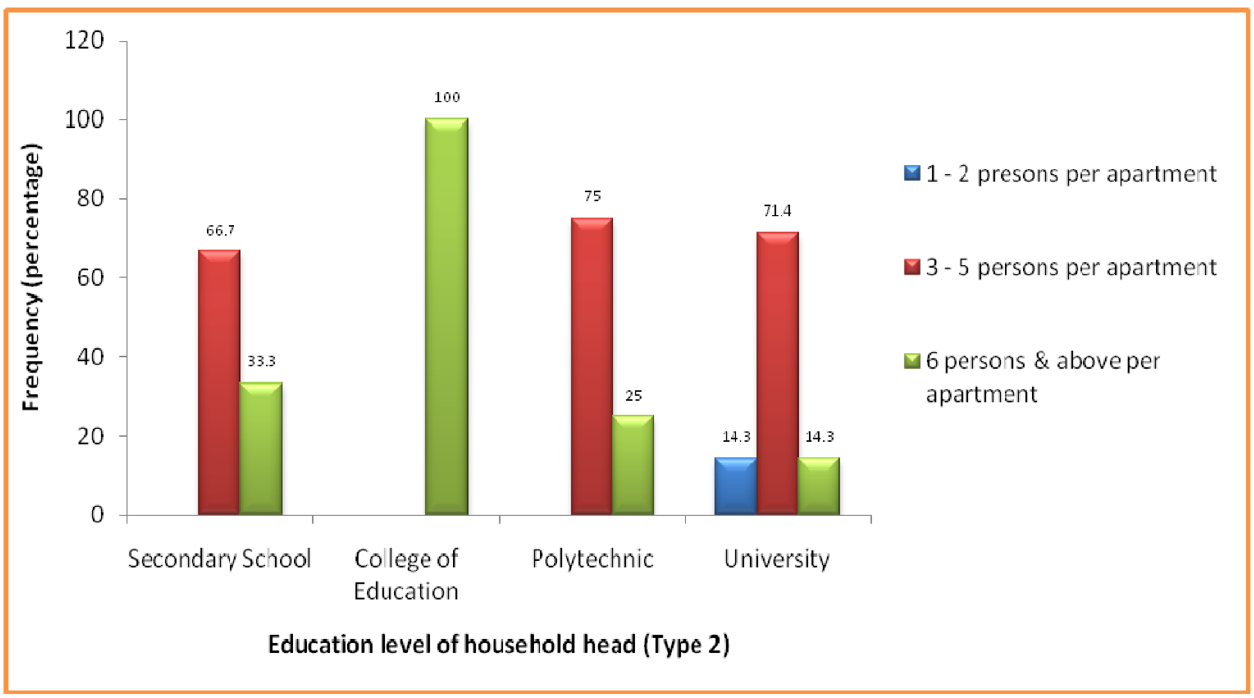


Figure 4.68: Actual Dwelling Density for Apartment Type 2 Based on Education Level of Household Head

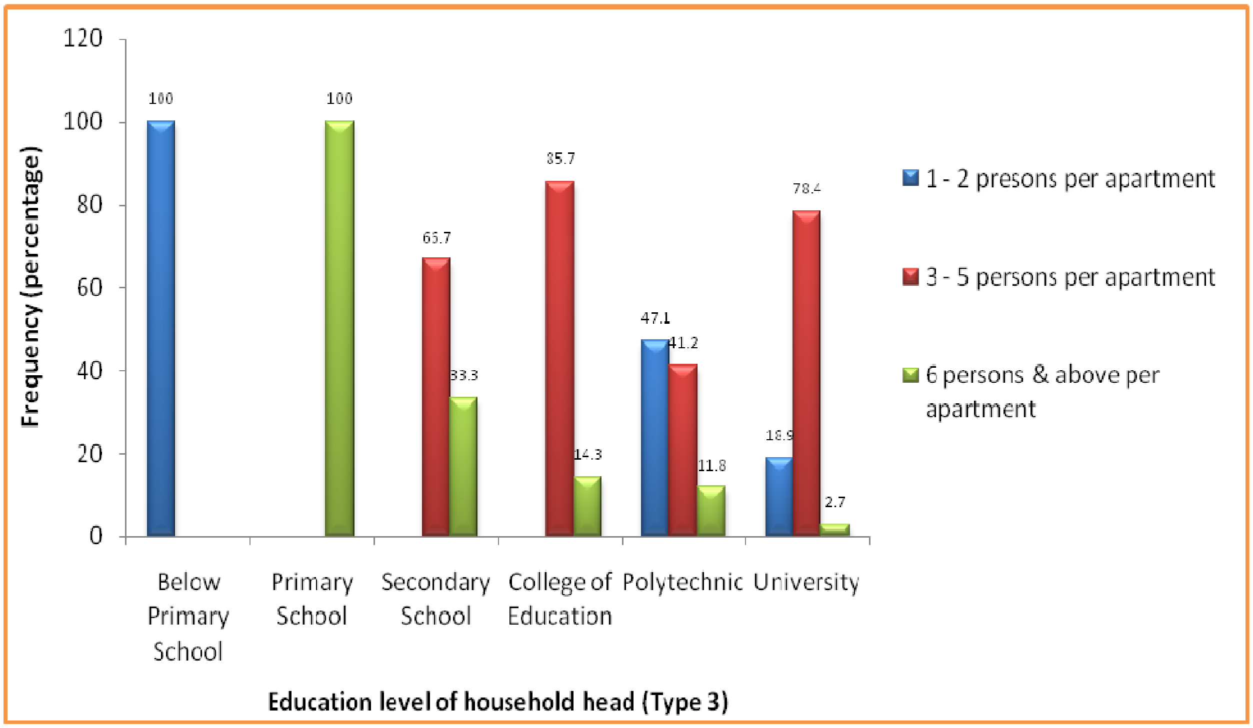


Figure 4.69: Actual Dwelling Density for Apartment Type 3 Based on Education Level of Household Head

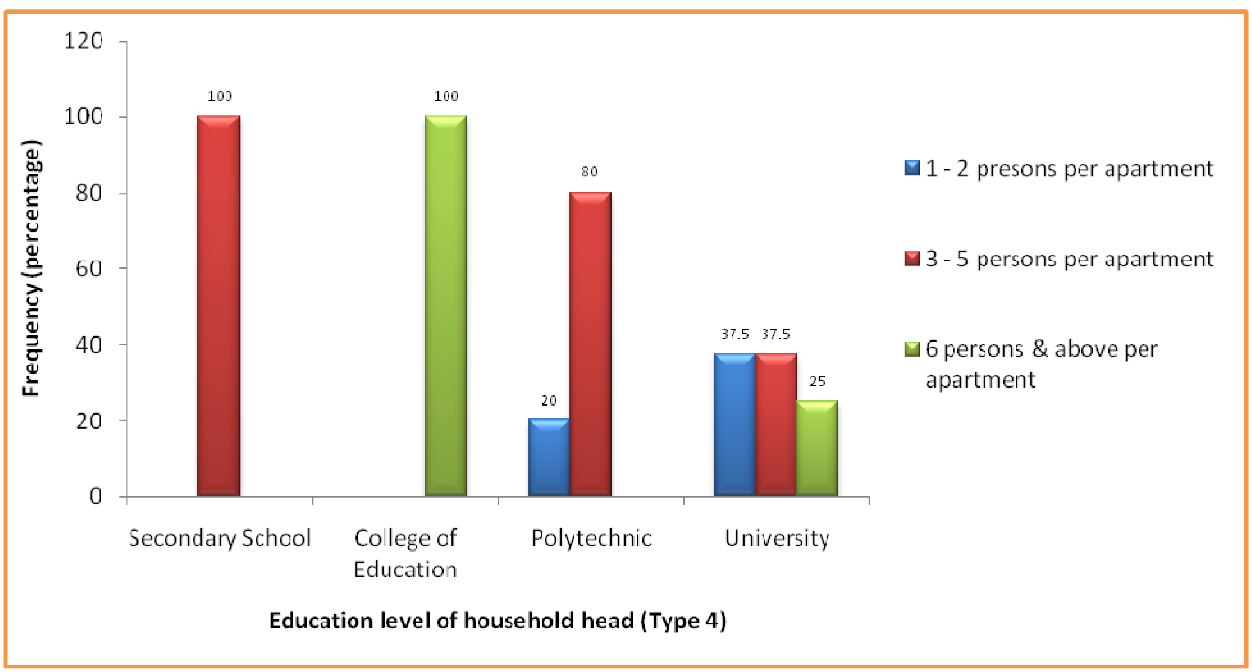


Figure 4.70: Actual Dwelling Density for Apartment Type 4 Based on Education Level of Household Head

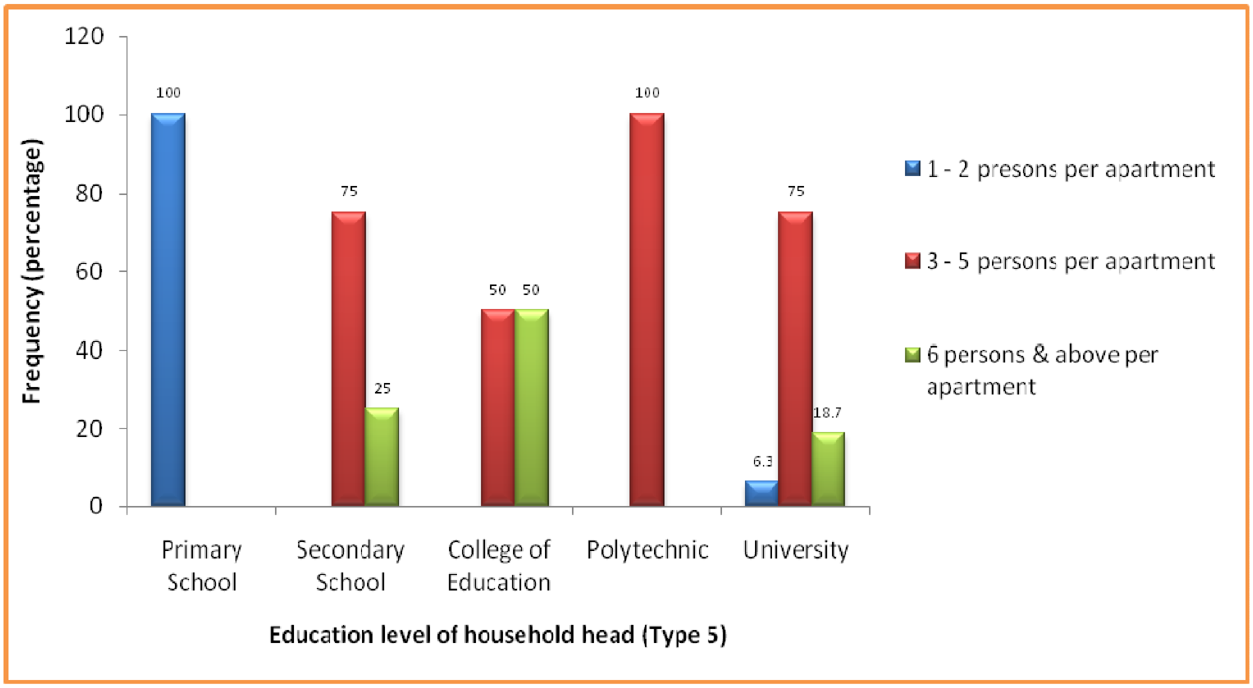


Figure 4.71: Actual Dwelling Density for Apartment Type 5 Based on Education Level of Household Head

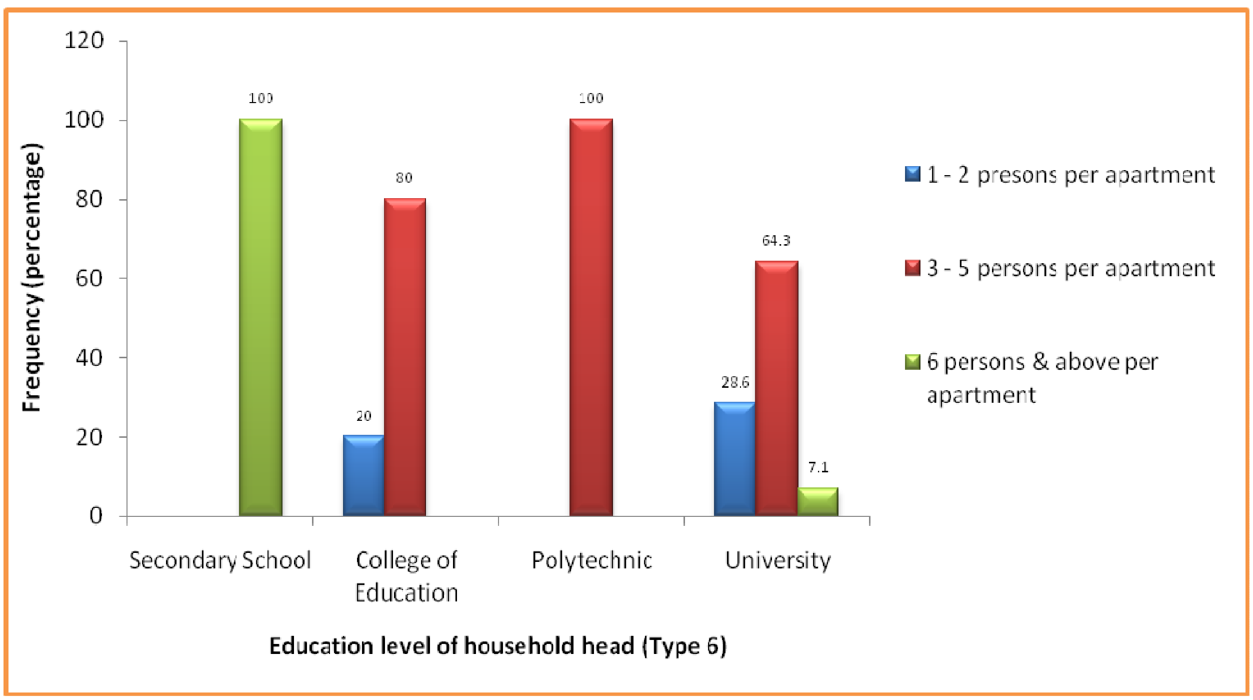


Figure 4.72: Actual Dwelling Density for Apartment Type 6 Based on Education Level of Household Head

4.16.1 Dwelling density in apartments where Education Level of household head is Below Primary School

The research data in Figure 4.73 indicates that respondents whose educational attainment wais below Primary school level could be found mainly in Type 3 (three-bedroom) at Abesan. All the other five apartment types covered in this study did not harbour persons below primary school level. The figure therefore reveals that household heads who did not possess primary school leaving certificate were not likely to be found in: (1) Type 1 (two-bedroom) at Abesan (2) Type 2 (two-bedroom) at Dolphin II (3) Type 4 (three-bedroom) at Iba (4) Type 5 (three-bedroom) at Dolphin II (5) Type 6 (four-bedroom) at Ebute-Metta.

Figure 4.73 hence reveals that in the study area, household heads who did not go beyond Primary education level were most likely to be found only in Type 3 (three-bedroom) at Abesan.

In this study, five different measurement criteria for dwelling density were adopted. These are: (a) Number of Habitable Rooms (b) Number of Bedrooms (c) Combined Area of Habitable Rooms (d) Aggregate Area of CEL (e) Total Area of Each Apartment.

Results in Figure 4.73 show that based on Aggregate Area of CEL Type 3 (three-bedroom) apartment headed by persons below Primary school level were over-occupied. This means that the spaces available per square metre for each adult-equivalent occupant was less than what was rated based on the design. On the contrary, the dwelling density outcome based on the other four measurement indicators adopted in this research revealed under-occupancy.

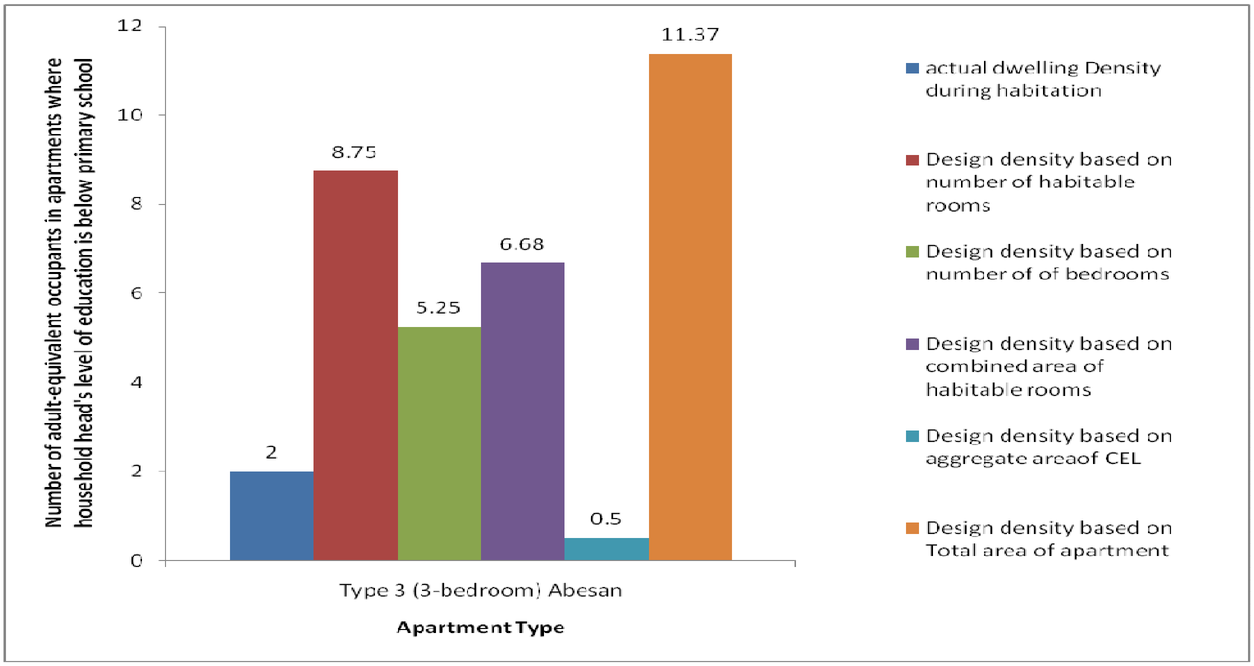


Figure 4.73: Dwelling density in apartments where Education Level of household head is Below Primary School

4.16.2 Dwelling density in apartments where Education Level of household head is Primary School

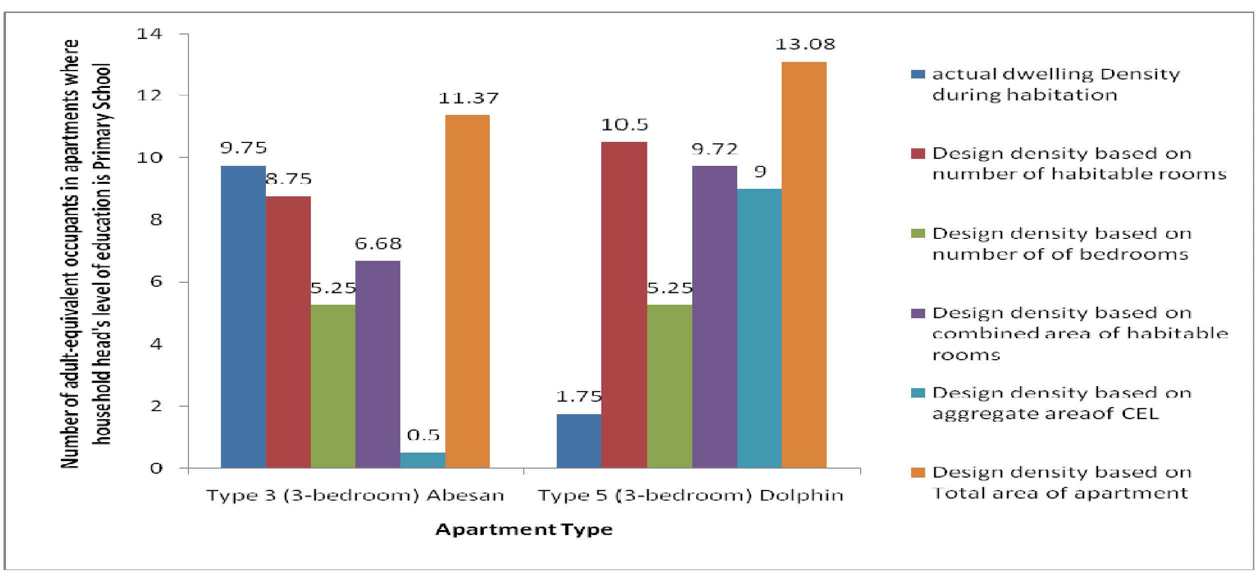


Figure 4.74: Dwelling density in apartments where Education Level of household head is Primary School

Figure 4.74 shows apartments in the study area where the highest level of education of household heads was Primary school. The data shows that persons in this category of educational attainment can substantially be found in Type 3 (three-bedroom) at Abesan, and Type 5 (three-bedroom) at Dolphin II. On the contrary, all the other four apartment types investigated in this study did not indicate any likelihood of harbouring household heads in this educational category.

The four apartment types are: (a) Type 1 (two-bedroom) at Abesan (b) Type 2 (two-bedroom) at Dolphin II (c) Type 4 (three-bedroom) at Iba (d) Type 6 (four-bedroom) at Ebute-Metta.

Figure 4.74 therefore tends to suggest that persons with Primary school as their highest educational level were not found in two-bedroom apartments covered in this study.

The result for four-bedroom was expected and understandable, because the social rating of Primary school holders suggests that they are incapable of affording and maintaining such an apartment. However, the case of two-bedroom apartments appeared to be counter-intuitive. The ordinary expectation wass that persons with primary school education are in the lower rum of society and therefore should dominate the two-bedroom apartments. The result therefore suggests that persons with primary school education seemed to favour three-bedroom apartments by choice rather than by compulsion. This argument was supported by the fact that the three-bedrooms where these respondents reside at Abesan and Dolphin II also have some two-bedrooms within them. The two-bedrooms were however, not occupied by respondents with primary school as their highest educational attainment in this study.

4.16.3 Dwelling density in apartments where Education Level of household head is Secondary School

As shown in Figure 4.75, persons with secondary school as their highest level of educational attainment were less likely to be found in Type 1 (two-bedroom) apartments at Abesan. These group of persons were, however, available in all the other five apartment types investigated in the study.

Among the five measurement indicators for determining dwelling density in this research only Type 5 (three-bedroom) at Dolphin II revealed under-occupancy in all cases. Also, Type 6 (four-bedroom) apartment at Ebute-Metta indicated under-occupancy in all dwelling density measurement indicators except based on Number of Bedrooms. In this circumstance, the apartment was occupied as designed.

Type 3 (three-bedroom) at Abesan and Type 4 (three-bedroom) at Iba were under-occupied in all dwelling density measurement indicators, except based on Aggregate Area of CEL. These two apartment types were over-occupied when assessed on the basis of Aggregate Area of CEL. Similarly, Type 2 (two-bedroom) apartments at Dolphin were over-occupied when two measurement indicators were applied. These are; Number of Bedrooms and Aggregate Area of CEL. The Type 2 (two-bedroom) apartments at Dolphin II were, however, under-occupied based on the other three measurement indicators namely, Number of Habitable Rooms, Combined Area of Habitable Rooms and Total Area of Each Apartment.

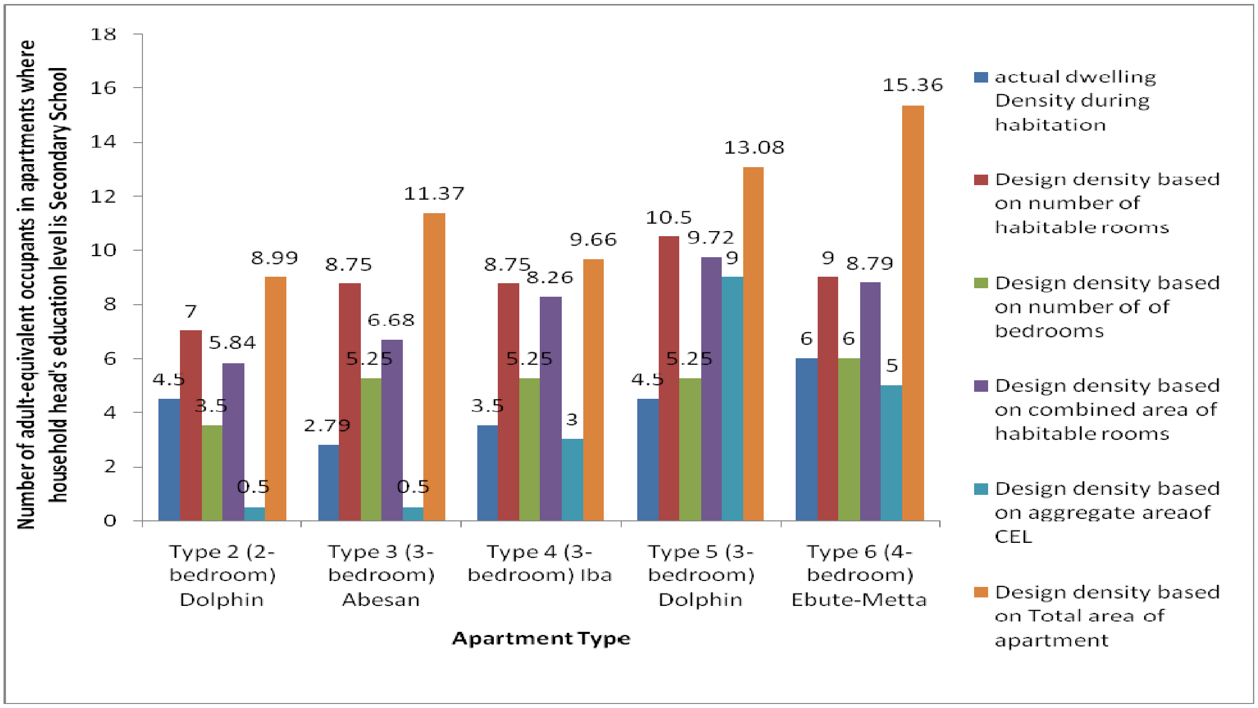


Figure 4.75: Dwelling density in apartments where Education Level of household head is Secondary School

4.16.4 Dwelling density in apartments where Education Level of household head is College of Education

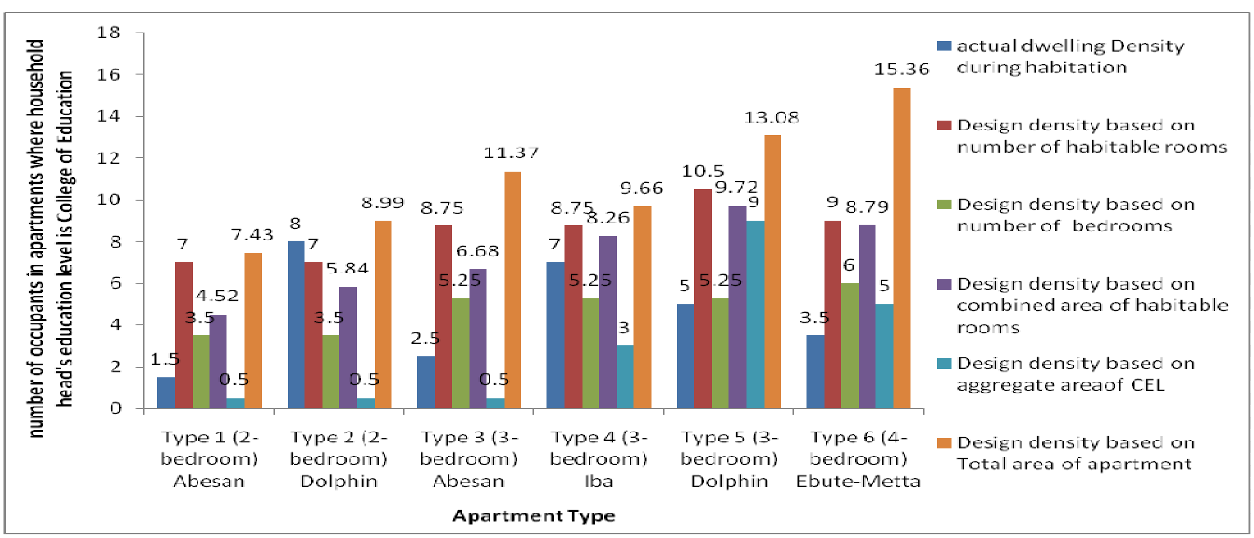


Figure 4.76: Dwelling density in apartments where Education Level of household head is College of Education

Figure 4.76 shows the dwelling density in apartments where respondent's highest education level is College of Education. All the six apartment types investigated in this study harbour individuals that belong to this educational classification. All the five indicators used to assess dwelling density in this study clearly indicated that Type 5 (3-bedroom) at Dolphin II and Type 6 (four-bedroom) at Ebute-Metta were generally under-occupied. Three other apartment types were under-occupied based on four indicators but over-occupied only on the basis of Aggregate Area of CEL. The four indicators that recorded over-occupancy for these three apartment types are: (a)Number of Habitable Rooms (b) Number of Bedrooms (c) Combined Area of Habitable Rooms (d) Total Area of Each Apartment.

The results for dwelling density in Type 2 (two-bedroom) at Dolphin II were significantly different from other apartment types. In Type 2 (two-bedroom) at Dolphin II, the apartment was over-occupied based on four out of five assessment criteria adopted in this study. The four criteria are Number of Habitable Rooms, Number of Bedrooms, Combined Area of Habitable Rooms and Aggregate Area of CEL. This apartment type, however, remained under-occupied, based on Total Area of Apartment. There appears to be no discernable explanation to justify the high level of disparity between the results from Type 2 (two-bedroom) at Dolphin II and the rest of the apartments covered in this study. One other unique revelation from Figure 4.76 is that all the six apartment types recorded under-occupancy in only one assessment indicator – Total Area of Each Apartment.

4.16.5 Dwelling density in apartments where Education Level of household head is Polytechnic

Figure 4.77 shows the dwelling density variability among the six apartment types investigated for households where the head possesses polytechnic degree. As shown, two apartment types were completely under-occupied, based on all the five measurement indicators applied in this research. These apartments are Type 5 (three-bedroom) at Dolphin II, and Type 6 (four-bedroom) at Ebute-Metta. Type 1 (two-bedroom) at Abesan and Type 3 (three-bedroom) at Abesan were over-occupied, when assessed based on aggregate area of CEL. Both apartment classifications were, however, under-occupied, based on the four other indicators namely Number of Habitable Rooms, Number of Bedrooms, Combined area of Habitable Rooms, and Total Area of Each Apartment.

The highest record of over-occupancy occured in Type 2 (two-bedroom) at Dolphin II. This apartment type was over-occupied when assessed based on Combined Area of Habitable Rooms and Aggregate Area of CEL.

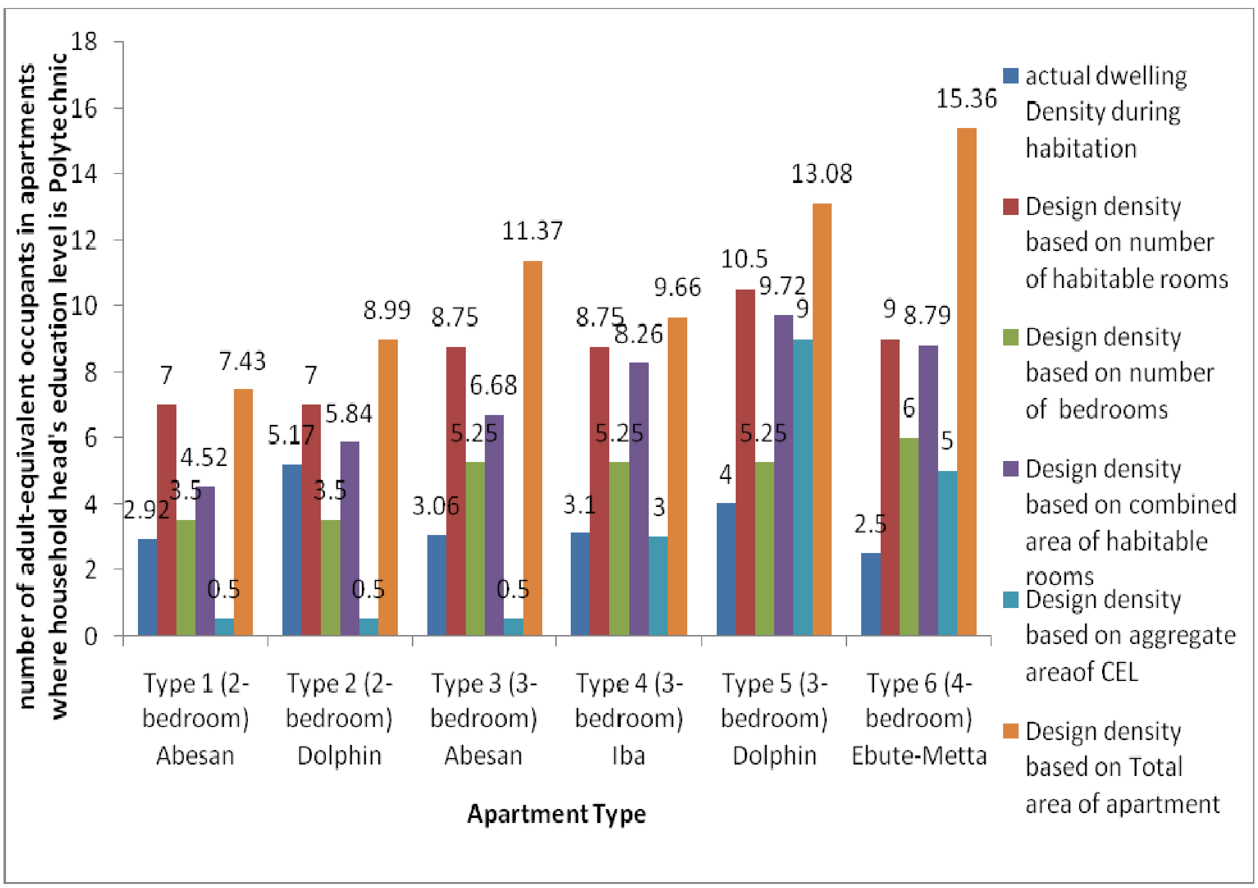


Figure 4.77: Dwelling density in apartments where Education Level of household head is Polytechnic

4.16.6 Dwelling density in apartments where Education Level of household head is University

Figure 4.78 indicates the outcome of dwelling density measurement for the six apartments covered in this research, for respondents who possess university degree. Persons in this category were found in all the apartment types investigated. Five measurement indicators were used in the study. Figure 4.78 shows that all the apartment types were under-occupied when four of the five measurement indicators were applied. The four indicators that gave results of under-occupancy are Number of Habitable Rooms, Number of Bedrooms, Combined Area of Habitable Rooms, and Total Area of Each Apartment. This result tends to support the general notion that apartments where the head of household possesses university education tend to be less occupied than apartments where household heads have lower educational attainment.

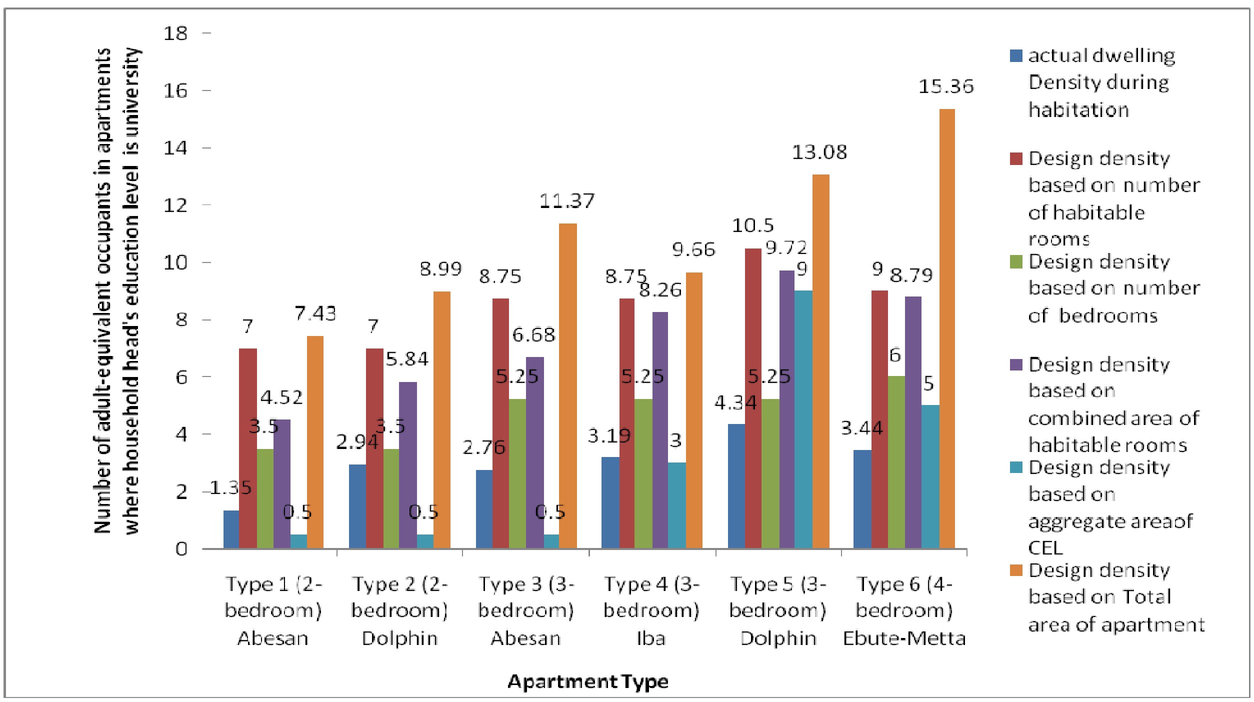


Figure 4.78: Dwelling density in apartments where Education Level of household head is University

Figure 4.78 further shows that Aggregate Area of CEL was the only indicator where results recorded that four apartment types were over-occupied. The apartments in this category are: (a) Type 1 (two-bedroom) at Abesan (b) Type 2 (two-bedroom) at Dolphin II (c) Type 3 (three-bedroom) at Anesan (d) Type 4 (three-bedroom) at Iba. In these four apartment types, the available space per square metre of CEL for each adult-equivalent occupant was less than the design density rating. On the contrary, Type 5 (3-bedroom) at Dolphin II and Type 6 (four-bedroom) at Ebute-Metta were under-occupied, based on Aggregate Area of CEL.

4.16.7 Statistical Validation of Effect of Education Level of Household Head on Dwelling Density

The effect of education level of household head on dwelling density among residents of various apartment types was tested using chi-square technique. The results are shown in table 4.18. The statistical level of significance for acceptance or rejection was set at 95% confidence interval. Thus P-Value (that is, T-tabulated) represents the effect of education level of household head on dwelling density. The decision rule is that at the same degree of freedom, if the P-Value is less than 0.05, the effect of education level of household head on dwelling density is classified as "significant". This implies that at the same degree of freedom, if the P-Value is higher than 0.05, the effect of education level of household head on dwelling density is classified as "not significant".

At 95% confidence interval, it was observed that education level of household head had significant effect on dwelling density in Type 3 (three-bedroom) at Abesan, and Type 5 (three-bedroom) at Dolphin II. On the contrary, the effect of education level of household head on dwelling density was not significant, at 95% confidence level for the remaining four apartment types namely, Type 1 (two-bedroom) at Abesan, Type 2 (two-bedroom) at Dolphin II, Type 4 (three-bedroom) at Iba and Type 6 (four-bedroom) at Ebute-Metta.

Table 4.18: Effect of Education Level of Household Head on Dwelling Density

Apartment type	Chi-square Value X^2	D.F.	P-Value (T- tabulated)	Remark
Type one (two-bedroom), Abesan	9.291	4	0.054	Education level has no significant effect on dwelling density in apartment Types 1 &2
Type two (two-bedroom), Dolphin II	4.348	6	0.630	
Type three (three-bedroom), Abesan;	34.031	10	0.000	Education level has significant effect on dwelling density in apartment Type 3
Type four (three-bedroom), Iba	7.453	6	0.281	Education level has no significant effect on dwelling density in apartment Types 4
Type five (three-bedroom), Dolphin	17.500	8	0.025	Education level has significant effect on dwelling density in apartment Type 5
Type six (four-bedroom), Ebute-Metta	12.000	6	0.062	Education level has no significant effect on dwelling density in apartment Types 6

Remarks/interpretation
P-Value (that is, T tabulated): effect of education level of household head on dwelling density. Decision rule: At the same degree of freedom (D.F.) if the P-Value is less than 0.05, effect of education level of household head on dwelling density is classified as "significant"; if the P-Value is higher than 0.05, effect of education level of household head on dwelling density is classified as "not significant".

4.17 DWELLING DENSITY BY EMPLOYMENT STATUS OF HOUSEHOLD HEAD

The heads of household who responded to the research questionnaire were grouped according to their employment status. Seven criteria were used to measure this variable. These include: self-employed, private firm employee, daily paid casual worker, unemployed, retired/pensioner, government employee, and unpaid family work. The data (Table 4.19) shows that persons who work in private firms represent 34.3% (60) of the respondents. Also, household heads that were self-employed constitute 32.0% (56). This is contrary to expectation that majority of the respondents ought to be persons who work in government establishments. However, it could be postulated that many of the respondents currently in self employment or private firm employees may have been disengaged from government service and took up another vocation before the statutory retirement age. This thinking is supported by the fact that majority of the respondents fall within the age bracket 31 – 50 years.

Another possible explanation is the impact of gentrification, whereby persons in private business bought over the apartments from original allottees. None of the respondents belongs to the category “daily paid casual worker”. The two other lowest group of respondents are unemployed 1.1% (2), and unpaid family work 1.1% (2). The few number of respondents belonging to these three categories seem to suggest that affordability is a basis for ownership and occupation of LSDPC apartments in the study area. Contrary to expectation, persons who are currently in government employment 14.9% (26) and those who are retired 16.6% (29) rank fourth and third respectively. It is likely that government workers who were allocated the apartments sold them out or put them to rent.

Table 4.19: Employment Level of Household Head

Employment level of household head	**No of Respondents**	**Percentage**
Self employed	56	32
Retired/Pensioner	29	16.6
Private firm employee	60	34.3
Government employee	26	14.9
Daily-paid Casual worker	0	0
Unpaid family work	2	1.1
unemployed	2	1.1
Total	**175**	**100.0**

Note: 1 respondent did not answer the question on education level.

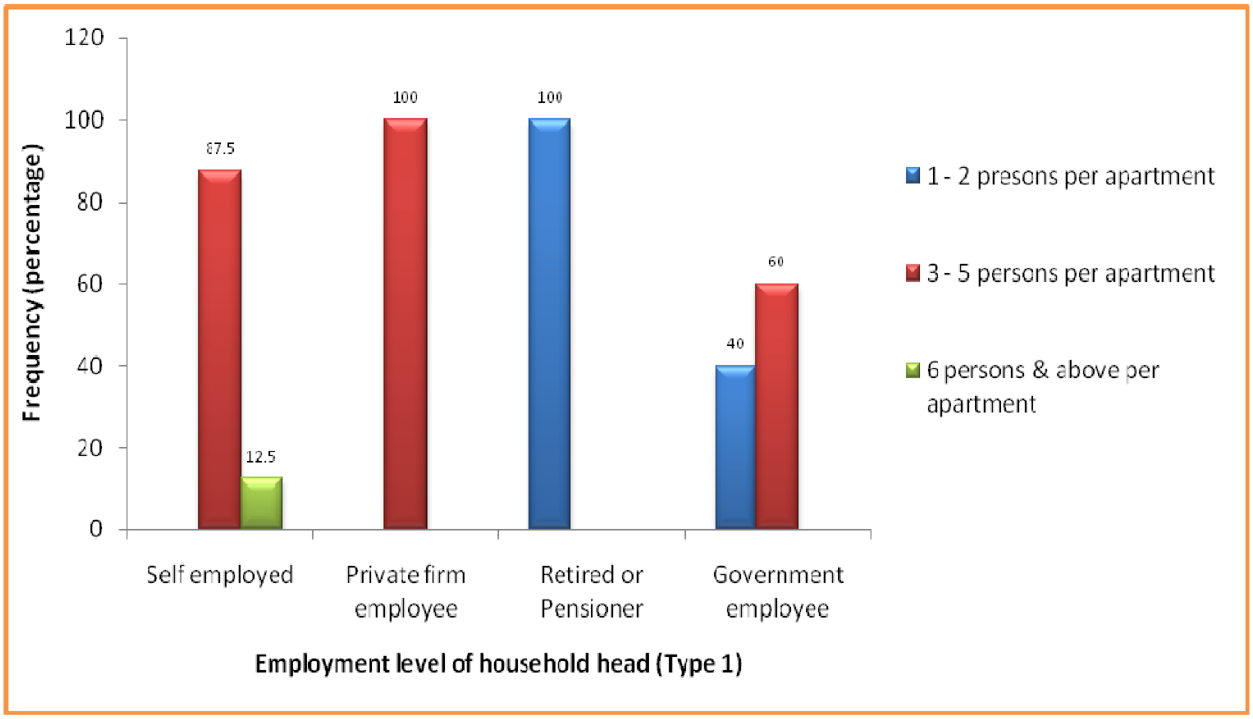


Figure 4.79: Actual Dwelling Density for Apartment Type 1 Based on Employment Level of Household Head

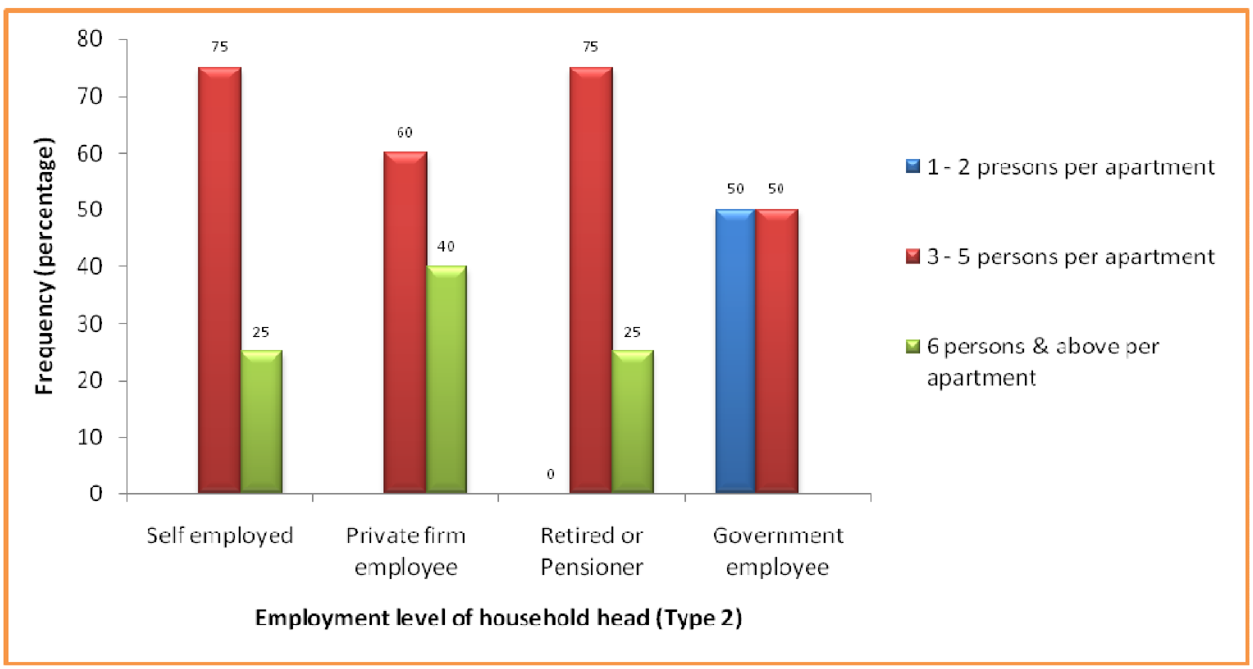


Figure 4.80: Actual Dwelling Density for Apartment Type 2 Based on Employment Level of Household Head

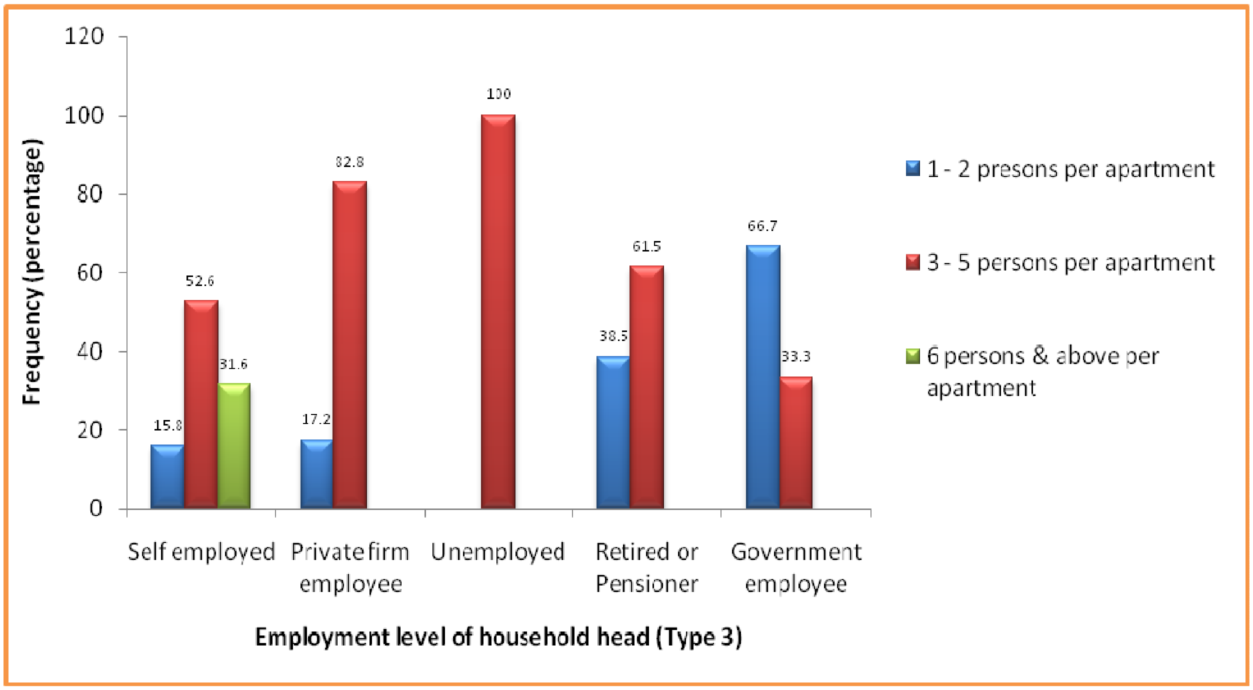


Figure 4.81: Actual Dwelling Density for Apartment Type 3 Based on Employment Level of Household Head

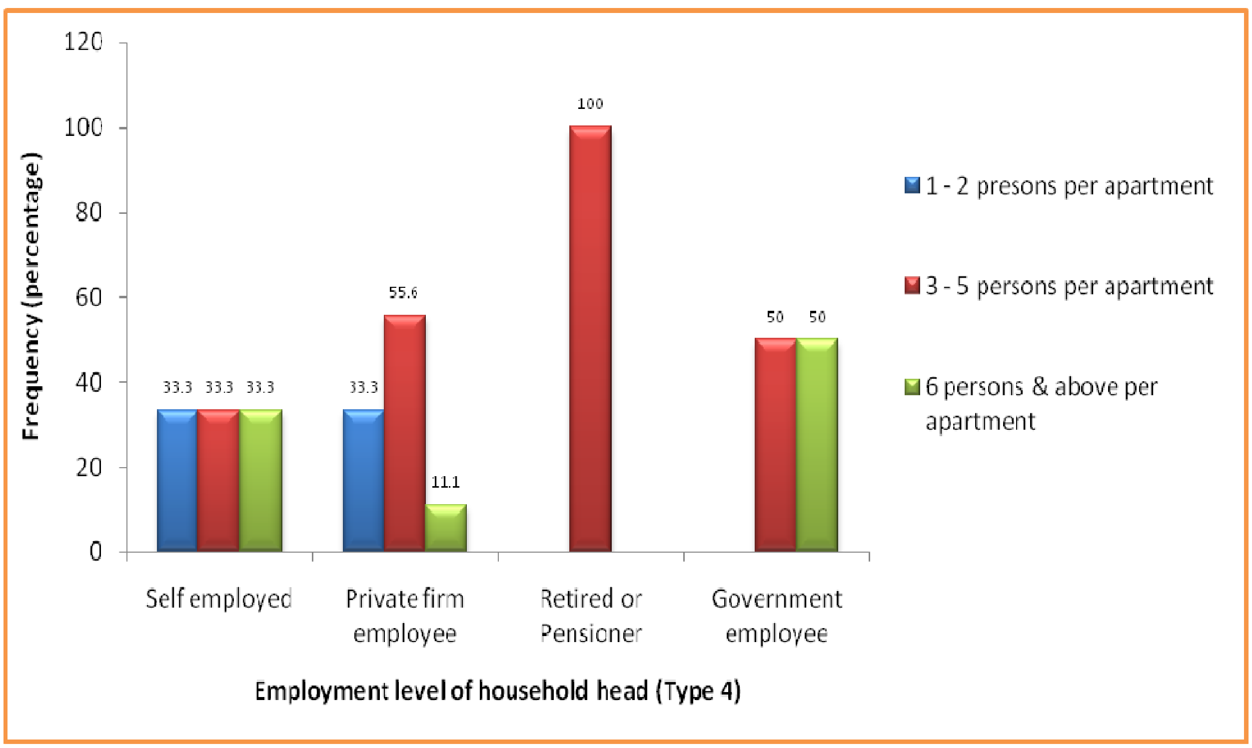


Figure 4.82: Actual Dwelling Density for Apartment Type 4 Based on Employment Level of Household Head

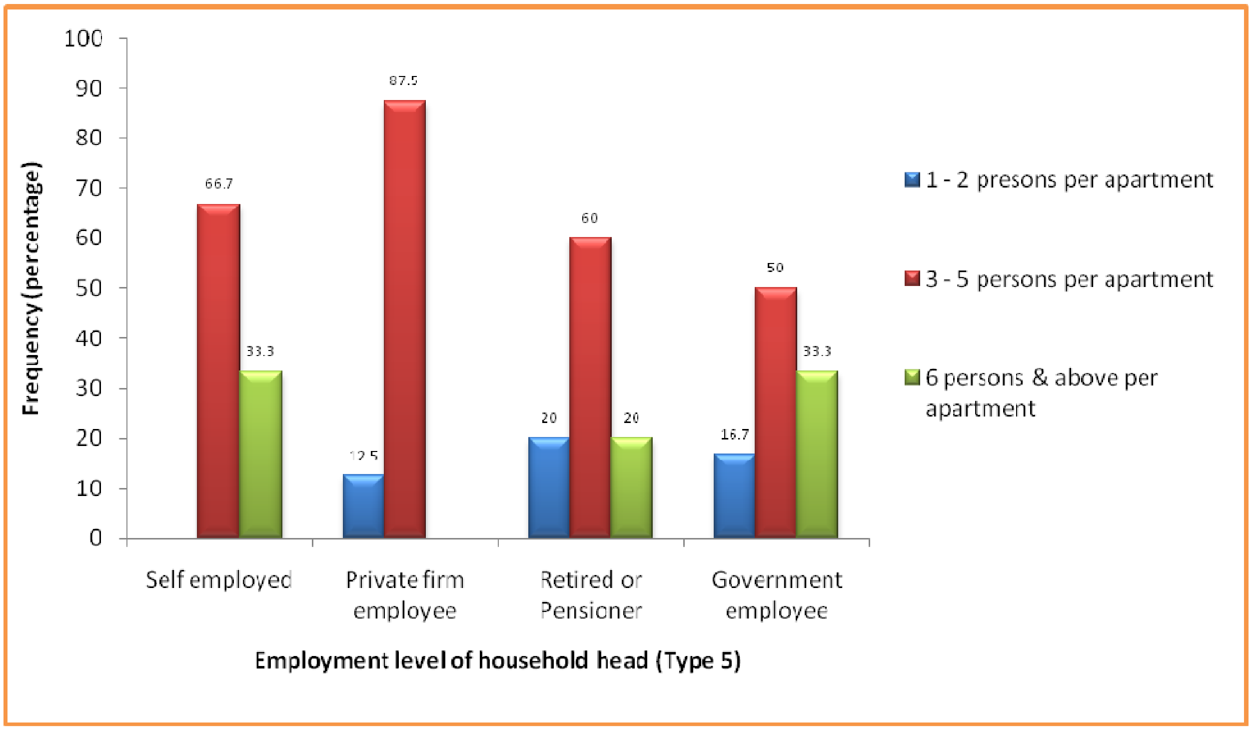


Figure 4.83: Actual Dwelling Density for Apartment Type 5 Based on Employment Level of Household Head

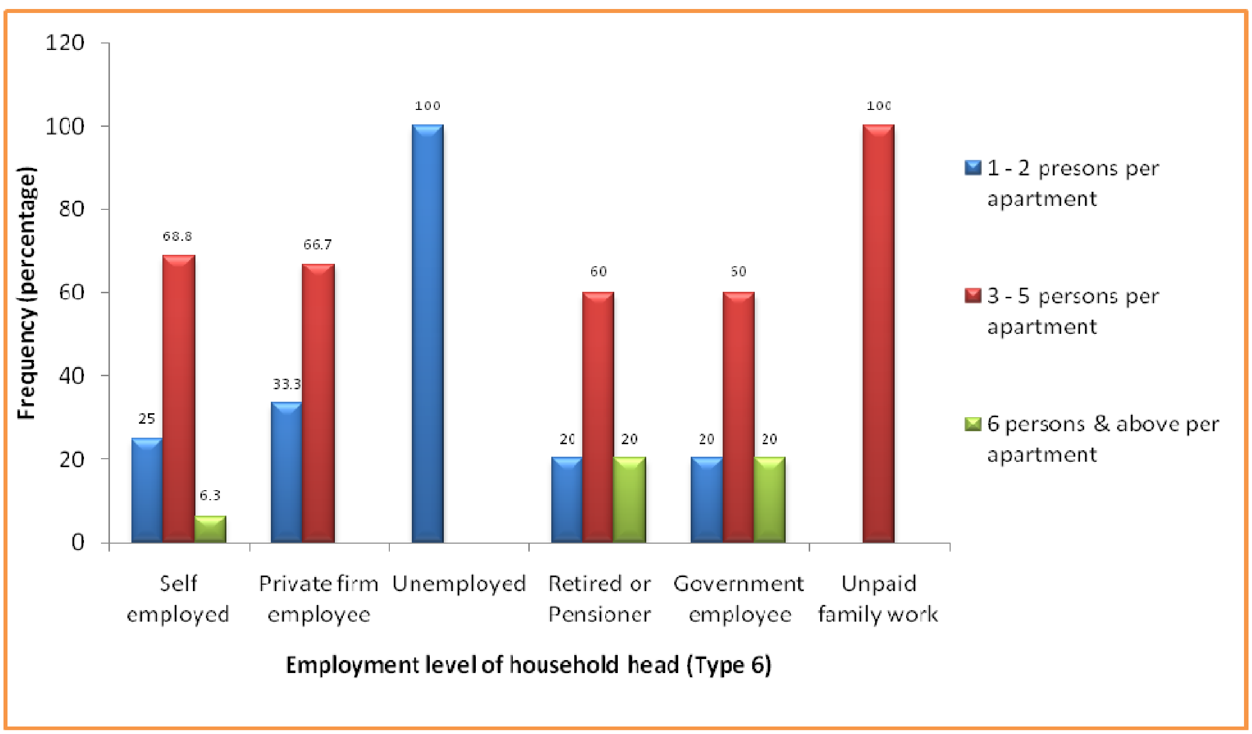


Figure 4.84: Actual Dwelling Density for Apartment Type 6 Based on Employment Level of Household Head

4.17.1 Dwelling density in apartments where household heads are Self-Employed

Figure 4.85 shows that respondents who are self-employed can be found in all the six apartment types investigated in this research. As revealed in the Table, five criteria were employed in the measurement of dwelling density rating for each of the six selected apartments. Three of the measurement criteria show that all apartment classifications headed by self-employed persons were under-occupied. The three indicators that gave this result are: (1) Number of Habitable Rooms (2) Combined Area of Habitable Rooms (3) Total Area of Each Apartment. Results showing dwelling density based on Number of Bedrooms indicate that Type 2 (two-bedroom) apartment located at Dolphin II is over-occupied by 0.5 adult-equivalent occupants. All the remaining five apartment types investigated in this research gave results that indicated under-occupancy.

Figure 4.85 further shows that households headed by self-employed persons were over-occupied, based on Aggregate Area of CEL in four apartment types, namely Type 1 (two-bedroom) at Abesan, Type 2 (two-bedroom) at Dolphin II and Type 3 (three-bedroom) at Abesan and Type 4 (three-bedroom) at Iba.

Based on Aggregate Area of CEL, these four apartment types that were over-occupied were unsuitable for households headed by self-employed persons. Similarly, based on Number of Bedrooms indicator, Type 2 (2-bedroom) at Dolphin II estate was unsuitable for accommodating self-employed individuals in the study area.

Data from the figure equally reveals that Type 5 (3-bedroom) at Dolphin II and Type 6 (four-bedroom) at Ebute-Metta were under-occupied, based on all the five measurement criteria adopted in this study.

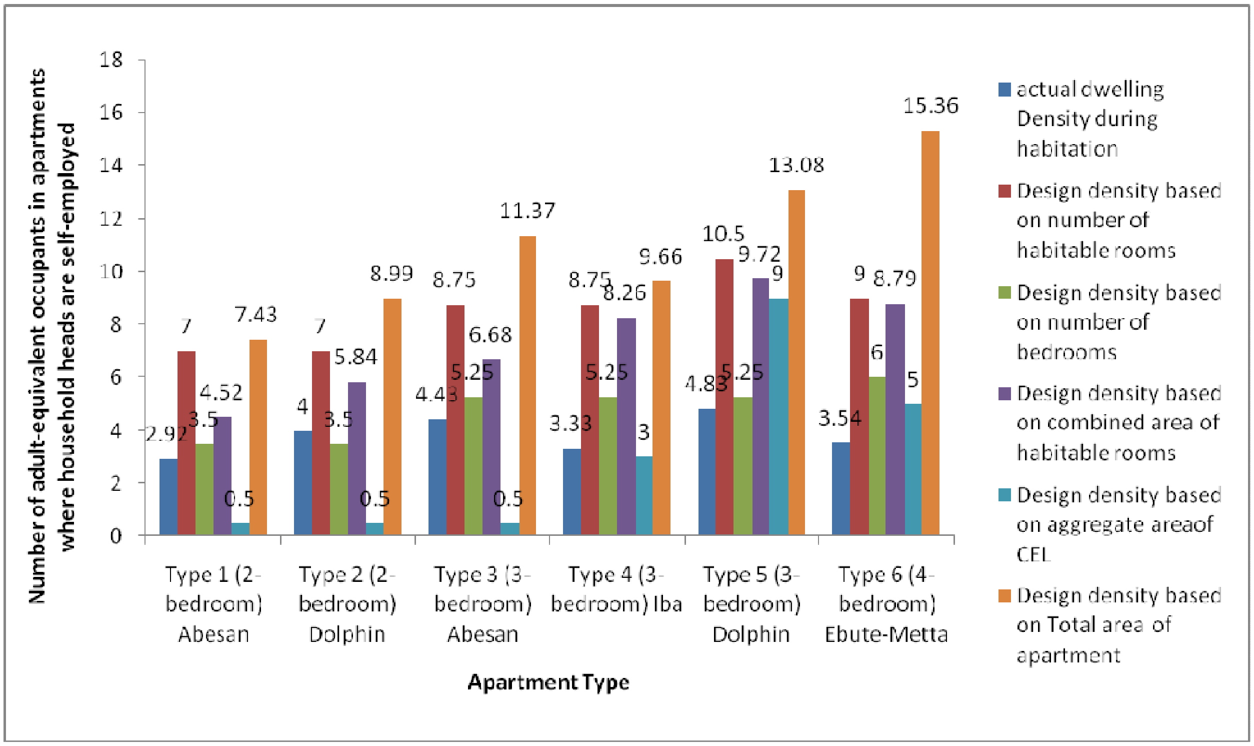


Figure 4.85: Dwelling density in apartments where household heads are Self-Employed

4.17.2 Dwelling density in apartments where household heads are Private Firm Employees

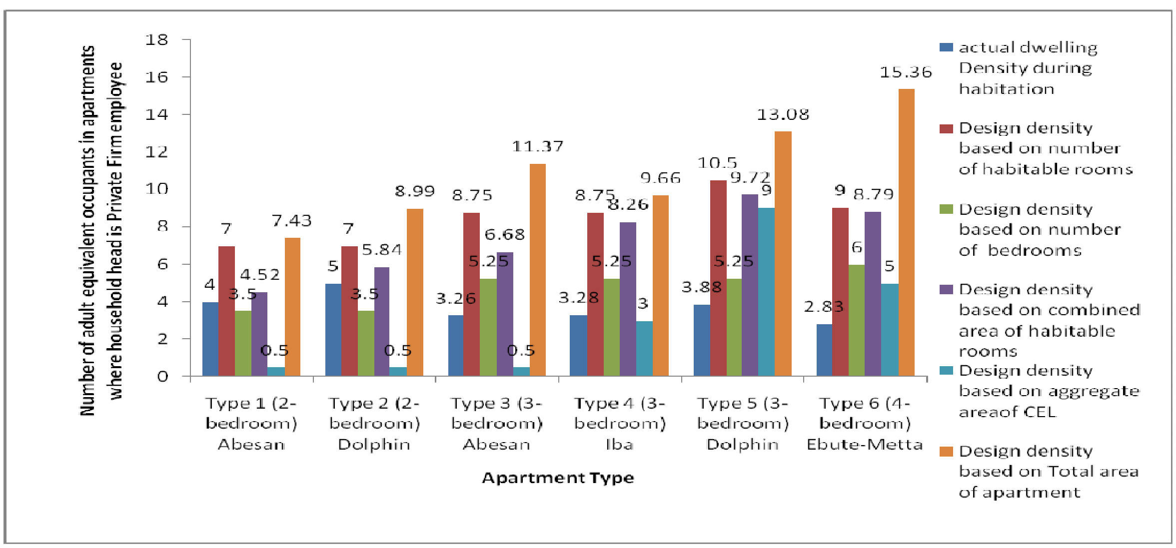


Figure 4.86: Dwelling density in apartments where household heads are Private Firm Employees

The dwelling density in apartments where the respondents are employees of private firms is depicted in Figure 4.86. As shown in the table, all apartments covered in this research are under-occupied when assessment methods of Number of Habitable Rooms and Total Area of Apartment are used.

When the number of Bedrooms was applied as the measurement indicator, the table shows that Type 1 (two-bedroom) at Abesan and Type 2 (two-bedroom) at Dolphin II recorded over-occupancy. However, all the other four apartment types indicated under-occupancy, based on Number of Bedrooms are: Type 3 (three-bedroom) at Abesan, Type 4 (three-bedroom) at Iba, Type 5 (three-bedroom) at Dolphin II and Type 6 (four-bedroom) at Ebute-Metta. Figure 4.86 equally reveals the result of dwelling density computation, based on Combined Area of Habitable Rooms. When this indicator was applied, only Type 5 (three-bedroom) at Dolphin II recorded over-occupancy. Conversely, all the other five apartment types investigated showed under-occupancy. In the case of Aggregate Area of CEL indicator, four apartment categories are over-occupied.

The apartment types that recorded over-occupancy are Type 1 (two-bedroom) at Abesan, Type 2 (two-bedroom) at Dolphin II, Type 3 (three-bedroom) at Abesan and Type 4 (three-bedroom) at Iba. On the other hand, the two apartments that recorded under-occupancy are Type 5 (three-bedroom) at Dolphin II and Type 6 (four-bedroom) at Ebute-Metta. Generally, among respondents who are employees of private firms, the highest level of under-occupancy based on all the five measurement indicators was recorded in Type 6 (four-bedroom) apartment.

4.17.3 Dwelling density in apartments where household heads are Unemployed

Figure 4.87 shows the absence of unemployed household heads among five, out of six apartment types covered in this study. The data from the figure indicates that the few respondents in this employment category were found in Type 6 (four-bedroom) at Ebute-Metta. This result raises some curiosity, because Type 6 (four-bedroom) is the highest grade among the apartments covered in this research. Unemployed persons were hence expected to be found in the other categories rather than Type 6.

A possible explanation is that the respondents were not the bread-winners of their respective households. Another possibility, however, was that the loss of job may be a recent experience, in which case the tenancy still subsists. It is also possible that if the respondent was the bona-fide owner of the apartment, he might be justified in staying put in his apartment, despite being unemployed.

The general trend in the six apartment types show that LSDPC's multifamily apartments did not provide safe haven for unemployed household heads. Therefore, all unemployed persons in these apartments were likely to be under the care of employed household heads.

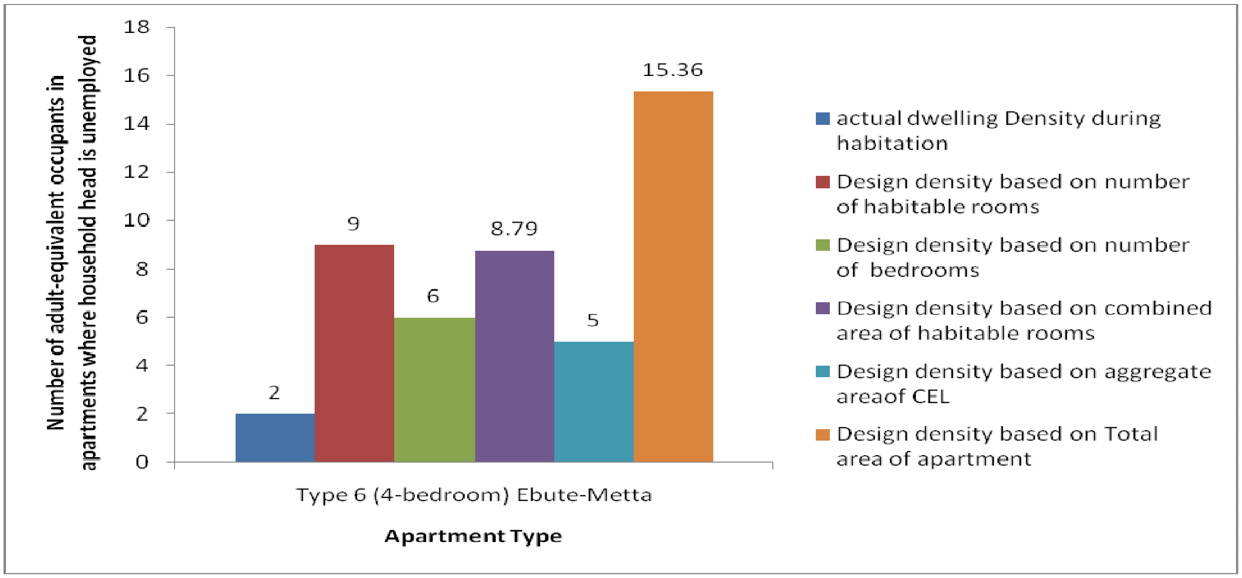


Figure 4.87: Dwelling density in apartments where household heads are Unemployed

4.17.4 Dwelling density in apartments where household heads are Retired/ Pensioner

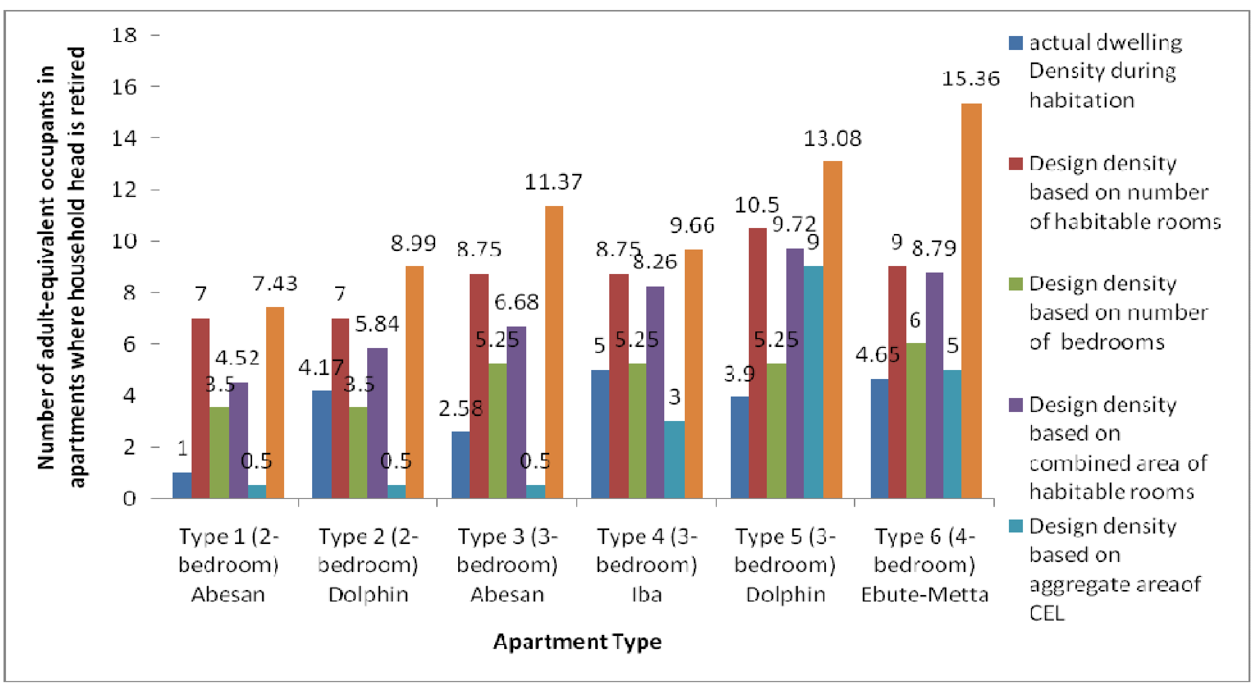


Figure 4.88: Dwelling density in apartments where household heads are Retired/ Pensioner

The data in Figure 4.88 reveals that household heads who are retired were available in all the six apartment types investigated in this study. The figure also shows the results of dwelling density computation using five different indicators adopted in this research. Three of the measurement indicators reveal that all apartment classifications headed by retired persons were under-occupied. The three indicators that gave this result are: (1) Number of Habitable Rooms, (2) Combined Area of Habitable Rooms (3) Total Area of Each Apartment.

When the dwelling density was assessed on the basis of Number of Bedrooms, the result shows that Type 2 (two-bedroom) at Dolphin II estate is over-occupied by 0.67 adult-equivalent occupants. All other five apartment types investigated in this study gave results that indicated under-occupancy.

When the dwelling density was assessed on the basis of Aggregate Area of CEL, Figure 4.88 shows that apartments headed by retired persons were over-occupied in four classifications. These are: Type 1 (two-bedroom) at Abesan, Type 2 (two-bedroom) at Dolphin II, Type 3 (three-bedroom) at Abesan, and Type 4 (three-bedroom) at Iba. In these four apartment types, the spaces available for every adult-equivalent occupant per square metre of CEL were inadequate. The four apartment types were therefore regarded as unsuitable for households headed by retired persons in the study area. On the other hand, the use of Aggregate Area of CEL to determine dwelling density as seen in Figure 4.88 clearly shows that Type 5 (three-bedroom) at Dolphin II and Type 6 (four-bedroom) at Ebute-Metta were under-occupied, irrespective of the measurement indicator applied. The highest record of over-occupancy on the other hand was experienced in Type 2 (two-bedroom) apartment at Dolphin II. This indicates that it was the most unsuitable for retired persons.

4.17.5 Dwelling density in apartments where household heads are Government Employees

Data from Figure 4.89 shows that respondents who are government employees reside in all the six apartment categories covered in this study. Five measurement criteria were adopted. The figure shows that all the six apartment types were under-occupied when four out of the five measurement criteria were applied. The four criteria that gave results of under-occupancy are: (a) Number of Habitable Rooms (b) Number of Bedrooms (c) Combined Area of Habitable Rooms (d) Total Area of Each Apartment. The research data tends to suggest that apartments occupied by government employees were likely to be under-occupied. No plausible explanation can be readily deduced. It is, however, likely that government employees may have had the privilege of being tutored on the deleterious effects of over-crowding.

Figure 4.89 further indicates that Aggregate Area of CEL is the only indicator where results of dwelling density report that four apartment types were over-occupied. The apartments in this category are: (1) Type 1 (two-bedroom) at Abesan (2) Type 2 (two-bedroom) at Dolphin II (3) Type 3 (three-bedroom) at Abesan (4) Type 4 (three-bedroom) at Iba. In these four apartment groups, the available space per square metre of CEL for each adult-equivalent occupant was less than the design density rating. On the contrary, Type 5 (three-bedroom) at Dolphin II estate and Type 6 (four-bedroom) at Ebute-Metta estate were under-occupied, based on Aggregate Area of CEL.

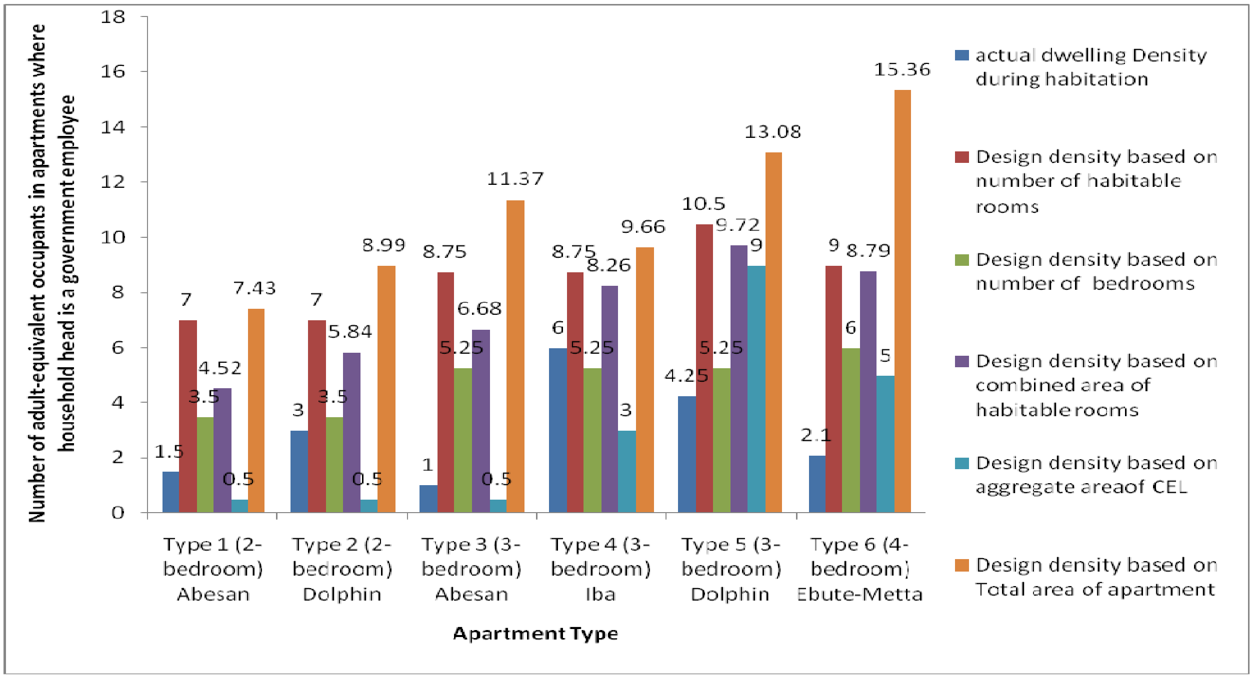


Figure 4.89: Dwelling density in apartments where household heads are Government Employees

4.17.6 Dwelling density in apartments where household heads are engaged in Unpaid Family Work

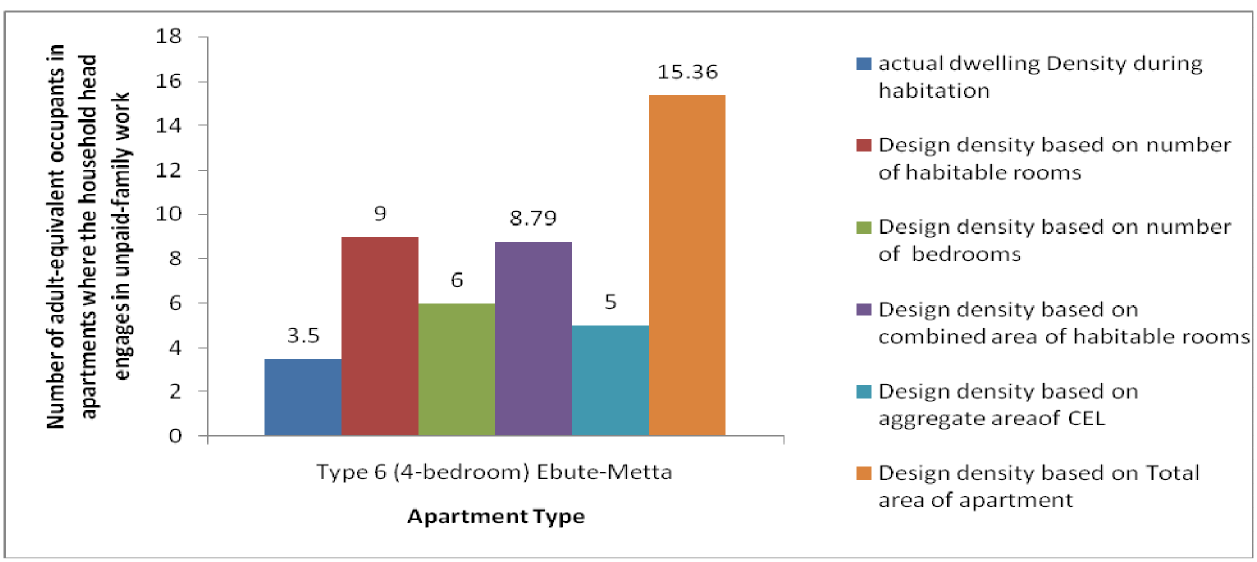


Figure 4.90: Dwelling density in apartments where household heads are engaged in Unpaid Family Work

Figure 4.90 indicates that respondents who were solely engaged in unpaid family work were few in the selected apartment types for this study. As can be inferred, household heads belonging to this group of workers were not among responds in five out of the six apartments that were investigated in the present research. These are: (a) Type 1 (two-bedroom) at Abesan, (b) Type 2 (two-bedroom) at Dolphin II, (c) Type 3 (three-bedroom) at Abesan, (d) Type 4 (three-bedroom) at Iba, and (e) Type 5 (three-bedroom) at Dolphin II.

On the other hand, respondents who indicated that they are engaged in unpaid family work as their major employment were found only in Type 6 (four-bedroom) at Ebute-Metta.

This result tends to suggest that unpaid family work was largely unpopular in the study area. It is probably regarded as exploitative and socially reprehensive. There is in fact, no such reality as something for nothing in this circumstance. Nevertheless, the data points out that unpaid family work household type were not totally absent in LSDPC's multifamily apartments.

An application of all the five measurement indicators adopted in this study shows that apartments headed by persons belonging to this employment category were under-occupied. This implies that apartments in this category were capable of accommodating more adult equivalent occupants than originally programmed by design.

4.17.7 Statistical Validation of Effect of Employment Level of Household Head on Dwelling Density

The chi-square statistical tool was used to validate whether household heads' level of employment has any significant effect on the incidence of dwelling density among the respondents. The results are shown in Table 4.20. The statistical level of significance for acceptance or rejection was set at 95% confidence interval. Thus P-Value (that is, T-tabulated) represents the effect of employment level of household head on dwelling density. The decision rule is that at the same degree of freedom, if the P-Value is less than 0.05, the effect of employment level of household head on dwelling density is classified as “significant”. This implies that at the same degree of freedom, if the P-Value is higher than 0.05, the effect of employment level of household head on dwelling density is classified as “not significant”.

At 95% confidence interval, the data from the table reveals that employment level of household head had significant effect on dwelling density in Type 3 (three-bedroom) apartment at Abesan. On the other hand, the effect of household head’s employment level on dwelling density was not significant on five other apartment classifications. These are Type 2 (two-bedroom) at Dolphin, Type 4 (three-bedroom) at Iba, Type 5 (three-bedroom) at Dolphin II, and Type 6 (four-bedroom) at Ebute-Metta.

Table 4.20: Effect of employment level of household head on dwelling density

Apartment type	Chi-square Value	D. F.	P-Value	Remark
Type one (two-bedroom), Abesan	9.612	6	0.142	Employment status has no significant effect on dwelling density in these 2 apartment types
Type two (two-bedroom), Dolphin II	7.575	6	0.271	
Type three (three-bedroom), Abesan	25.101	8	0.001	Employment status has significant effect on dwelling density
Type four (three-bedroom), Iba	3.368	6	0.761	Employment status has no significant effect on dwelling density in these 3 apartment types
Type five (three-bedroom), Dolphin	4.546	6	0.603	
Type six (four-bedroom), Ebute-Metta	6.410	10	0.780	

Remarks/interpretation

P-Value (that is, T tabulated): effect of employment level of household head on dwelling density. Decision rule: At the same degree of freedom (D.F.) if the P-Value is less than 0.05, effect of employment level of household head on dwelling density is classified as “significant”; if the P-Value is higher than 0.05, effect of employment level of household head on dwelling density is classified as “not significant”.

4.18 DWELLING DENSITY BY LENGTH OF RESIDENCY OF HOUSEHOLD

Table 4.21 indicates the number of years the respondents have lived in the housing estates selected for this study. The highest number of respondents (n = 77, 43.7%) who have lived in the estates for five years or less. Respondents who have lived in the selected estates from six to ten years constituted the second largest number (n = 37, 21.0%). The third largest number of respondents were persons who have lived in the estates for sixteen to twenty years (n = 30, 17.0%). Among persons who answered the questionnaire, the smallest number (n = 15, 8.7%) indicated that they have lived in the study area for twenty-one years and above. Table 4.21 clearly shows that just about one-quarter of the respondents have spent more than sixteen years in LSDPC estates, while about 75% have lived there for sixteen years or less.

Table 4.21: Length of Residency of Household

Length of residency of household	No of Respondents	Percentage
0-5 years	77	43.7
6-10 years	37	21.0
11-15 years	17	9.6
16-20 years	30	17.0
21-25 years	14	8.0
26-30years	1	0.7
Above 30 years	0	0
Total	**176**	**100.0**

The data from the Table suggests that housing mobility could be rampant within the first ten to fifteen years of occupancy. It is most likely that LSDPC apartments serve as first accommodation for households in early stages of family life-cycle. The tendency to move therefore increased as the length of stay increased, if the wherewithal was available. When more than 75% of the respondents did not stay for more than 16 years, it probably meant that a high level of housing stress was being experienced in the apartments.

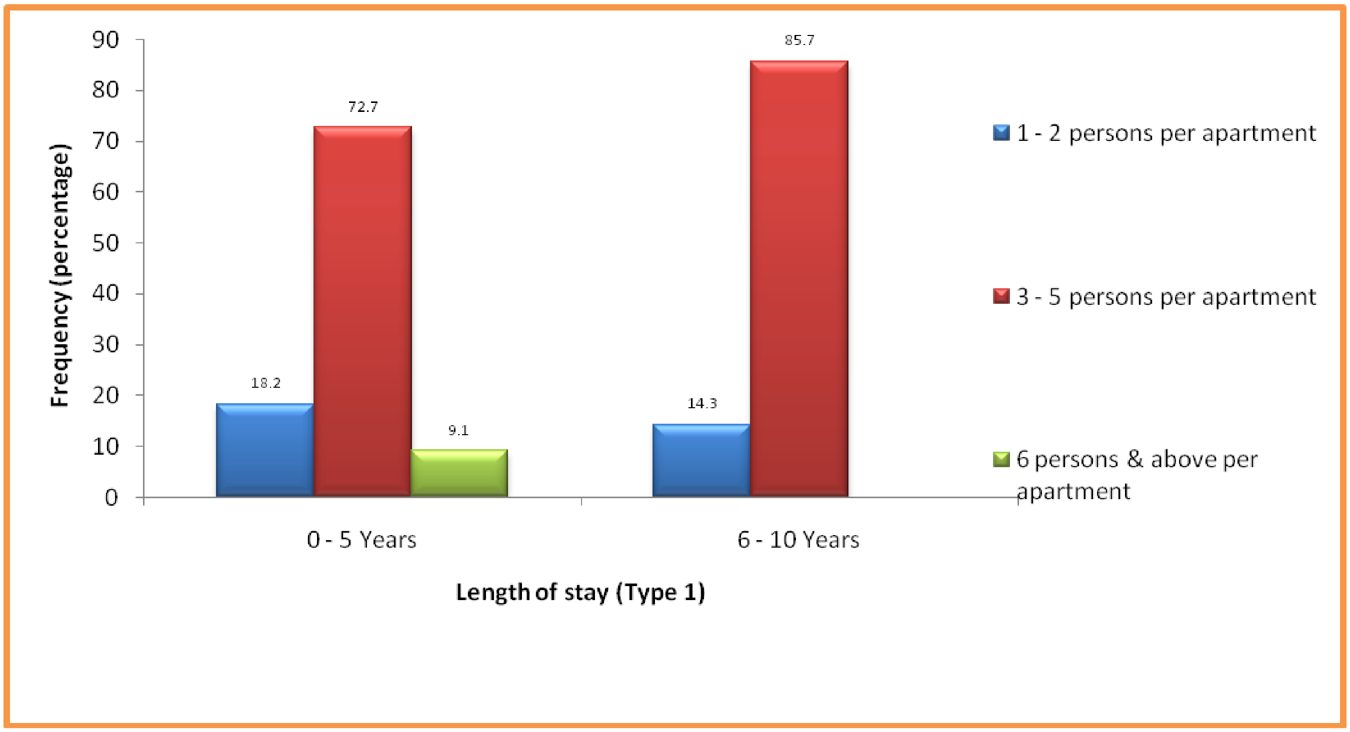


Figure 4.91: Actual Dwelling Density for Apartment Type 1 Based on Length of Stay

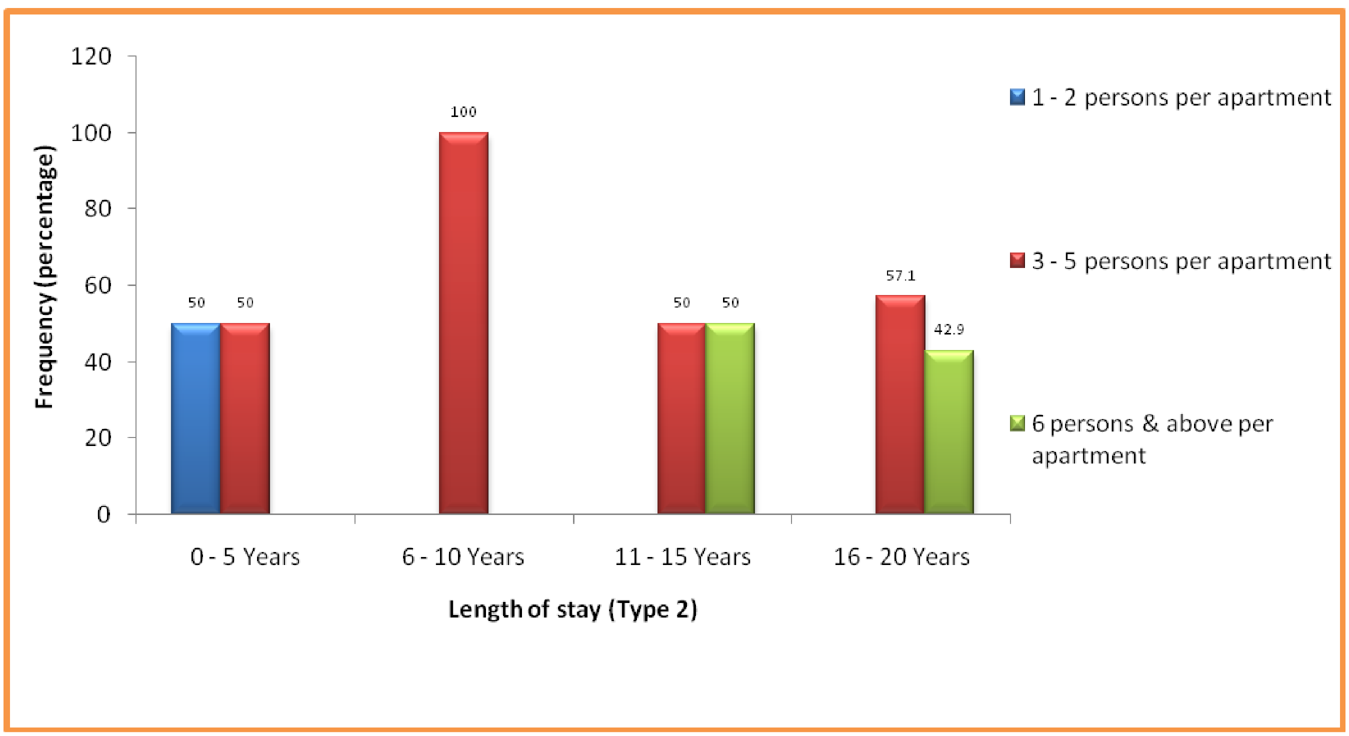


Figure 4.92: Actual Dwelling Density for Apartment Type 2 Based on Length of Stay

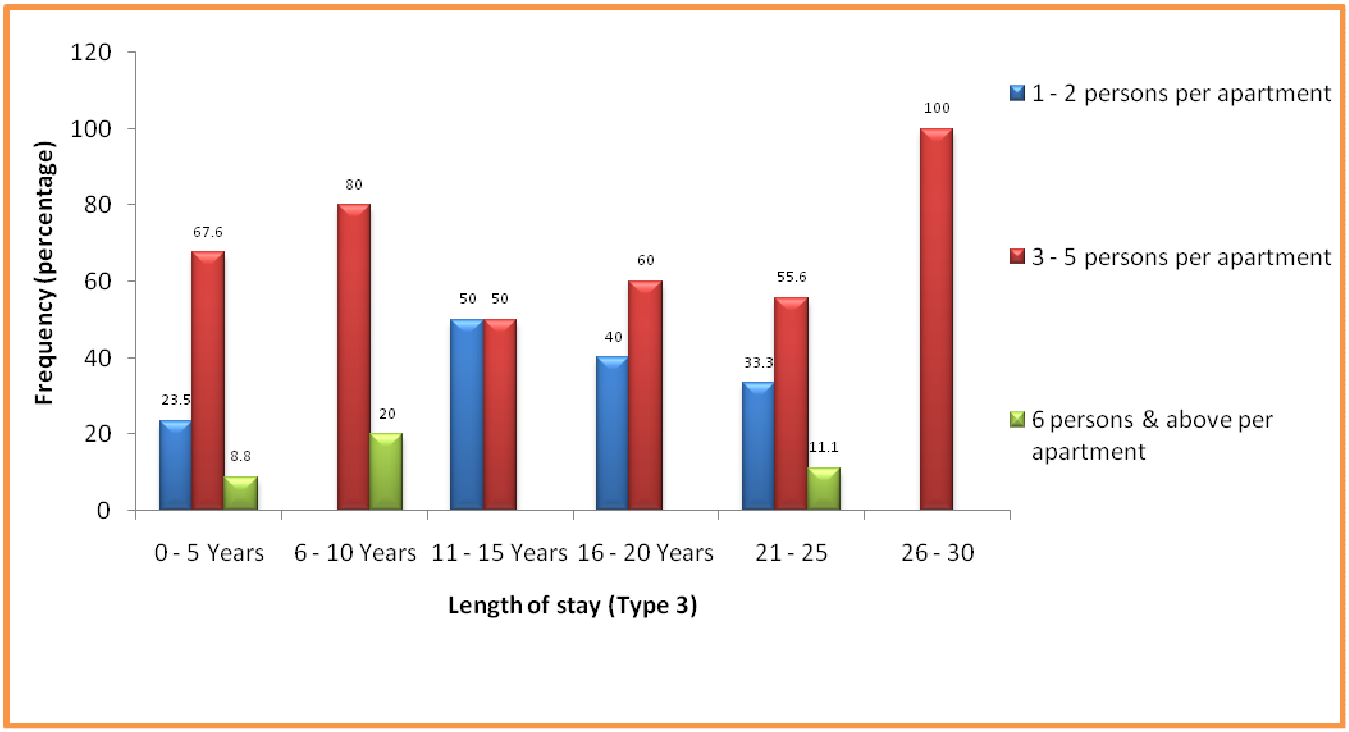


Figure 4.93: Actual Dwelling Density for Apartment Type 3 Based on Length of Stay

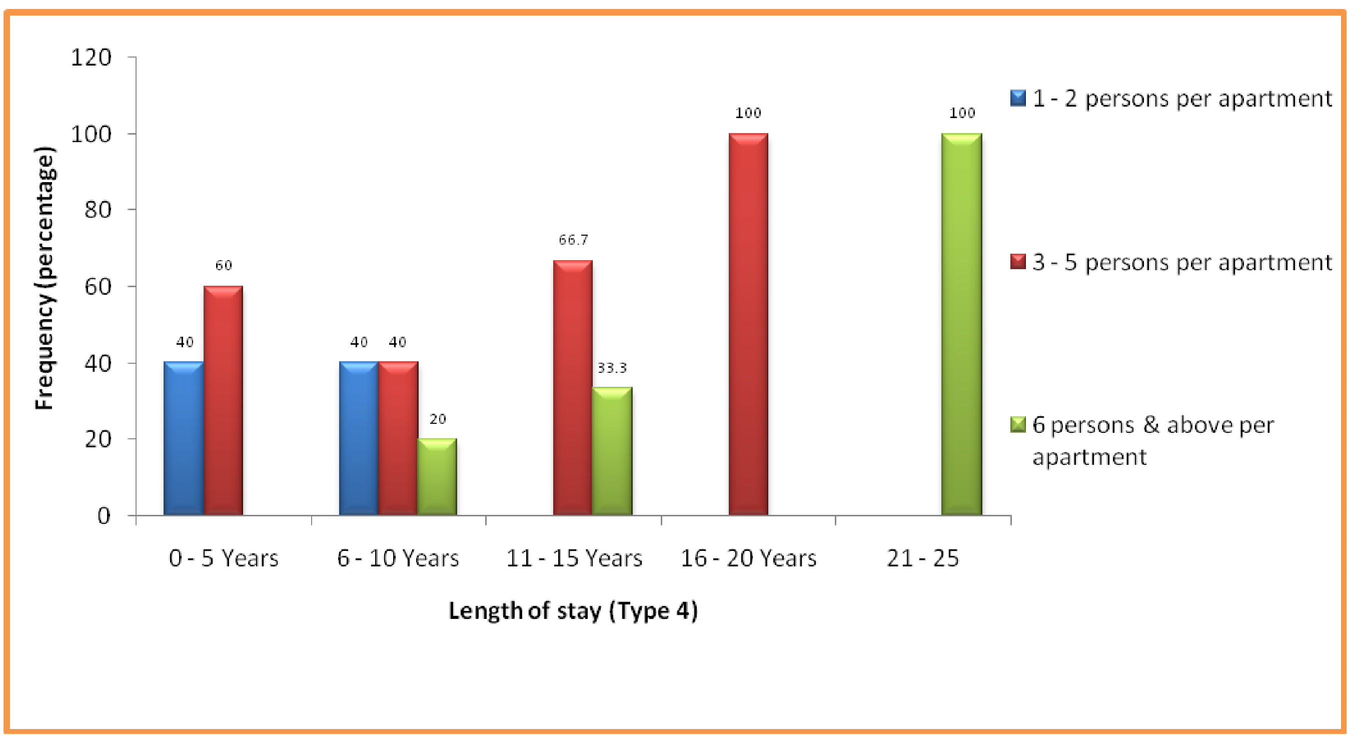


Figure 4.94: Actual for Apartment Type 4 Based on Length of Stay

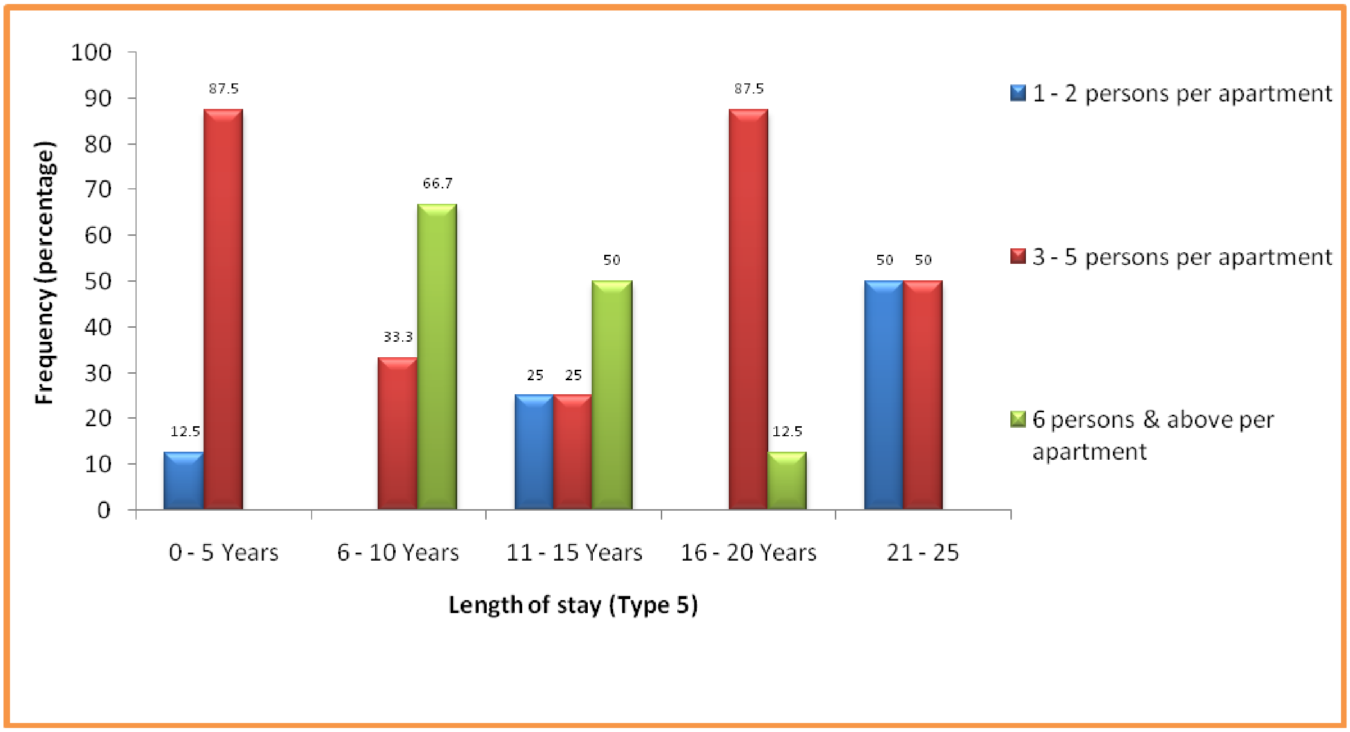


Figure 4.95: Actual Dwelling Density for Apartment Type 5 Based on Length of Stay

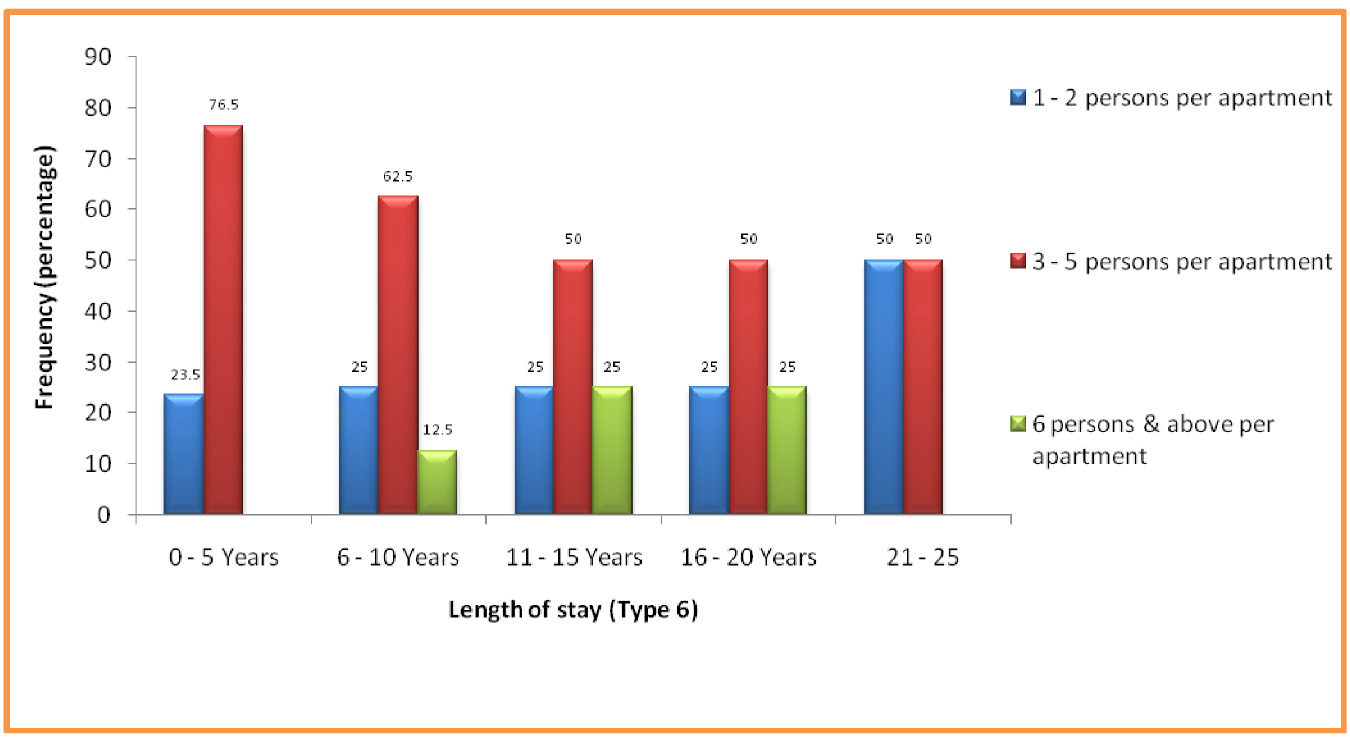


Figure 4.96: Actual Dwelling Density for Apartment Type 6 Based on Length of Stay

4.18.1 Dwelling density in apartments where households have lived for 0 – 5 Years

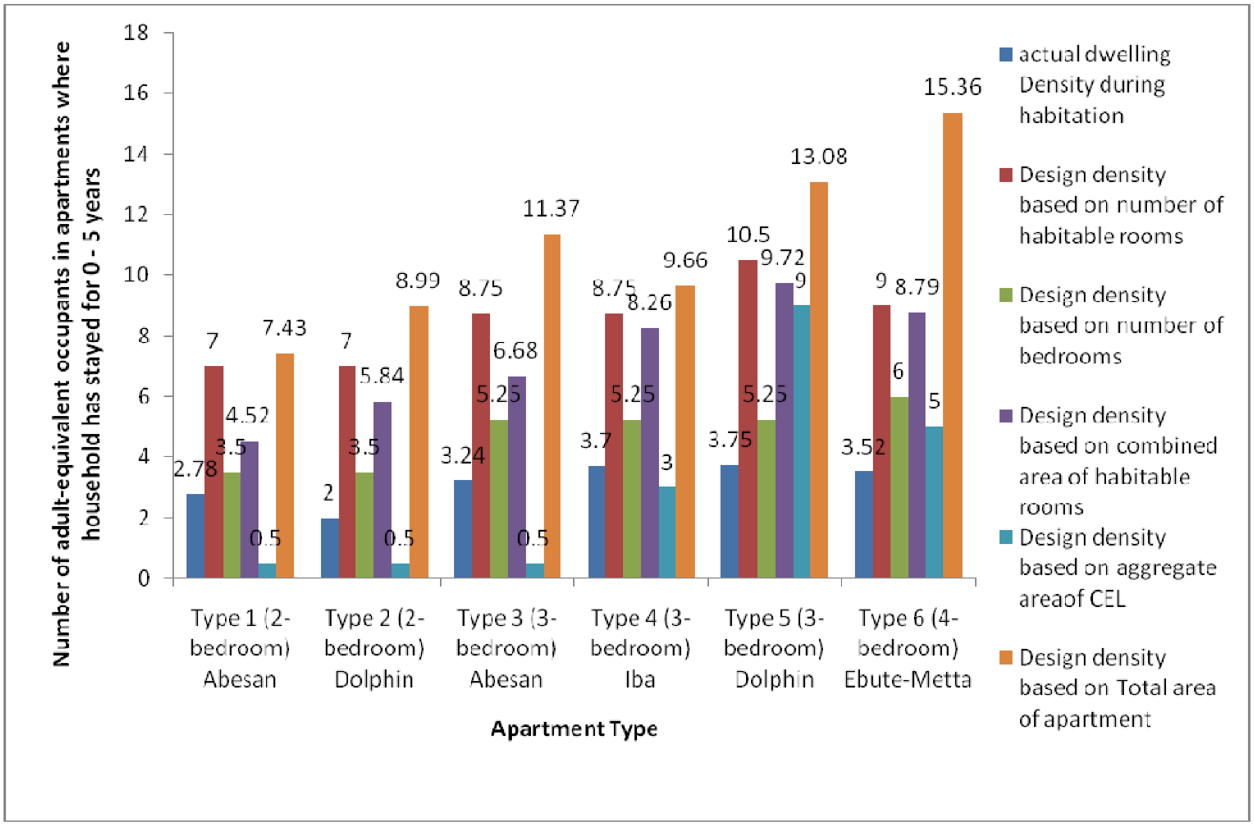


Figure 4.97: Dwelling density in apartments where households have lived for 0 – 5 Years

Figure 4.97 shows the dwelling density computation for the six apartments covered in this research regarding respondents who have lived in their apartments for a period 0-5 years. Five measurement criteria were applied. As can be inferred from the figure, all the apartment types were under-occupied when four of the five measurement criteria that gave results of under-occupancy are: (1) Number of Habitable Bedrooms, (2) Number of Bedrooms, (3) Combined Area of Habitable Rooms, (4) Total Area of Each Apartment.

Figure 4.97 further reveals that Aggregate Area of CEL is the only indicator where results point out that four apartment categories were over-occupied. The apartments that were over-occupied include: Type 1 (two-bedroom) at Abesan, Type 2 (two-bedroom) at Dolphin II, Type 3 (three-bedroom) at Abesan, and Type 4 (three-bedroom) at Iba. In these four apartment types, the space available per square metre of CEL for each adult-equivalent occupant was less than the design density rating.

On the contrary, Type 5 (three-bedroom) at Dolphin II and Type 6 (four-bedroom) at Ebute-Metta estates were under-occupied, based on Aggregate Area of CEL.

4.18.2 Dwelling density in apartments where households have lived for 6 – 10 Years

The dwelling for respondents who have lived in the study area for 6-10 years is represented in the data in Figure 4.98. As shown in the figure, Type 6 (four-bedroom) apartments were the only ones with a record of under-occupancy in all the five measurement indicators adopted in the present study for assessing dwelling density.

Again, the figure reveals that all the six apartments were completely under-occupied, based on three measurement indicators. The three indicators are Number of Habitable Rooms, Combined Area of Habitable Rooms and Total Area of Each Apartment. In these circumstances, the selected apartments were occupied below the design density rating. On the other hand, five apartment types were under-occupied when an indicator of Number of Bedrooms was applied, while only one apartment type showed over-occupancy. The only apartment that was over-occupied is Type 5 (three-bedroom) at Dolphin II estate. It was over-occupied by 0.58 adult-equivalent occupants.

Another measuring indicator where over-occupancy was recorded is Aggregate Area of CEL. When this indicator was applied, four apartment types investigated in this research were over-occupied, while two apartment types were under-occupied. The over-occupied apartments include: Type 1 (2-bedroom) at Abesan, Type 2 (two-bedroom) at Dolphin II, Type 3 (three-bedroom) at Abesan and Type 4 (three-bedroom) at Iba. These four apartment types were accommodating more adult-equivalent number of persons per square metre of CEL than projected in the design. On the contrary, Type 5 (three-bedroom) at Dolphin and Type 6 (four-bedroom) at Ebute-Metta were under-occupied, based on the same indicator of Aggregate Area of CEL.

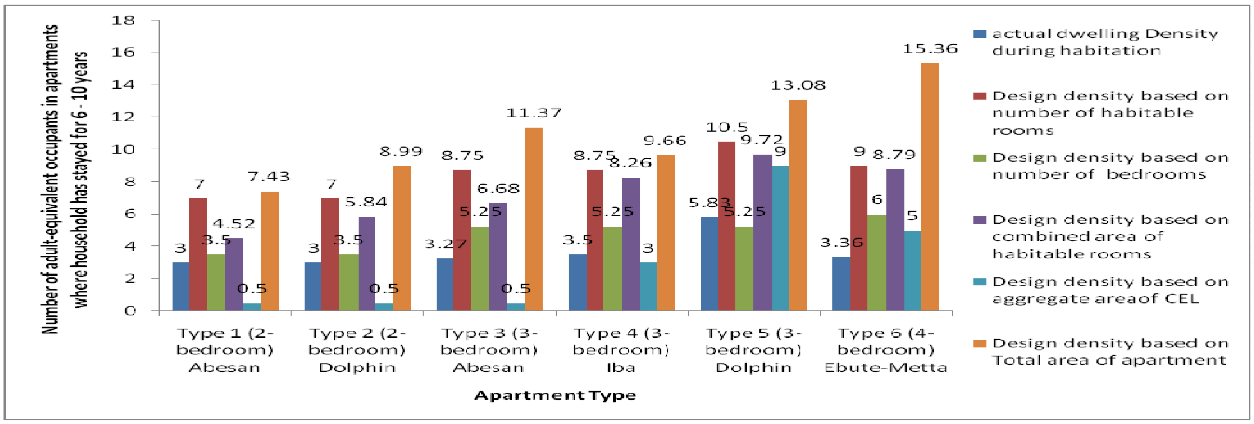


Figure 4.98: Dwelling density in apartments where households have lived for 6 – 10 Years

4.18.3 Dwelling density in apartments where households have lived for 11 – 15 Years

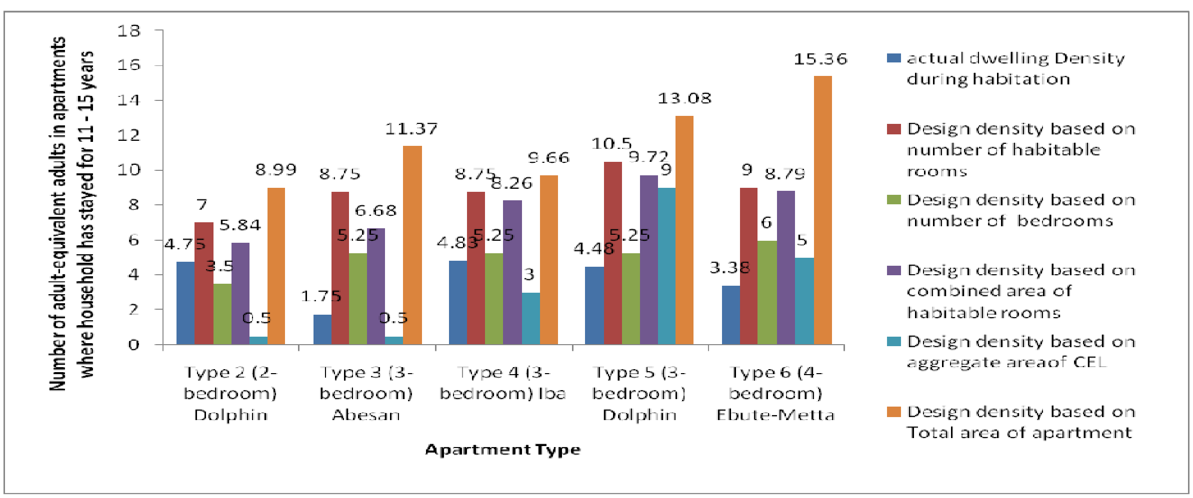


Figure 4.99: Dwelling density in apartments where households have lived for 11 – 15 Years

As indicated in Figure 4.99 respondents who have spent 11-15 years in their apartments were less likely to be found in Type 1 (two-bedroom) apartments at Abesan Estate. This group of respondents were however, available in all the other five apartment types investigated in this study.

4.18.4 Dwelling density in apartments where households have lived for 16 – 20 Years

Figure 4.100 indicates that household heads who have spent 16-20 years in their apartments were not likely to be found in Type 1 (two-bedroom) at Abesan estate. These category of residents were however, readily seen in all the other five apartment types selected for this research.

The table reveals that only Type 5 (3-bedroom) apartment located at Dolphin II estate recorded under-occupancy among all the five measurement indicators for determining dwelling density.

The figure also shows that the five apartments harbouring this group of respondents were all under-occupied, based on: (1) Number of Habitable Rooms (2) Combined Area of Habitable Rooms (3) Total Area of Each Apartment.

On the contrary, some of the apartments recorded over-occupancy on the basis of Number of Bedrooms. The apartment categories are Type 2 (two-bedroom) at Dolphin II and Type 6 (four-bedroom) at Ebute-Metta. Similarly, three apartment types showed over-occupancy based on Aggregate Area of CEL. Such apartments are Type 2 (2-bedroom) at Dolphin, Type 3 (three-bedroom) at Abesan and Type 4 (three-bedroom) at Iba. This type 2 (two-bedroom) at Dolphin exhibited the highest tendency for over-occupancy. On the other hand, Type 5 (three-bedroom) in the same location showed the highest tendency for under-crowding.

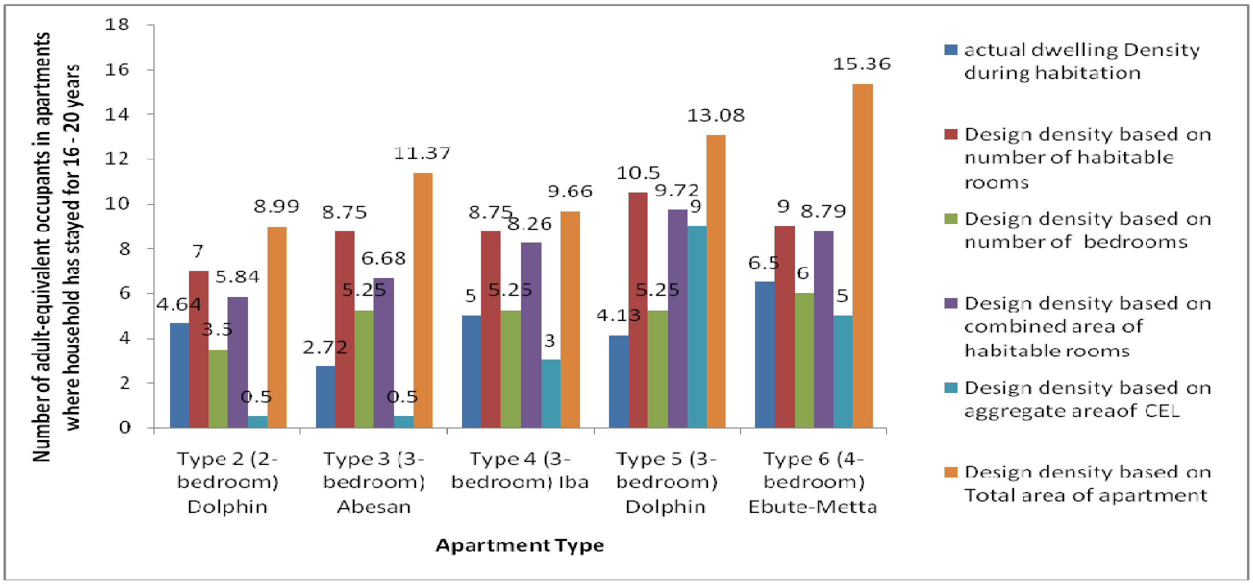


Figure 4.100: Dwelling density in apartments where households have lived for 16 – 20 Years

4.18.5 Dwelling density in apartments where households have lived for 21 – 25 Years

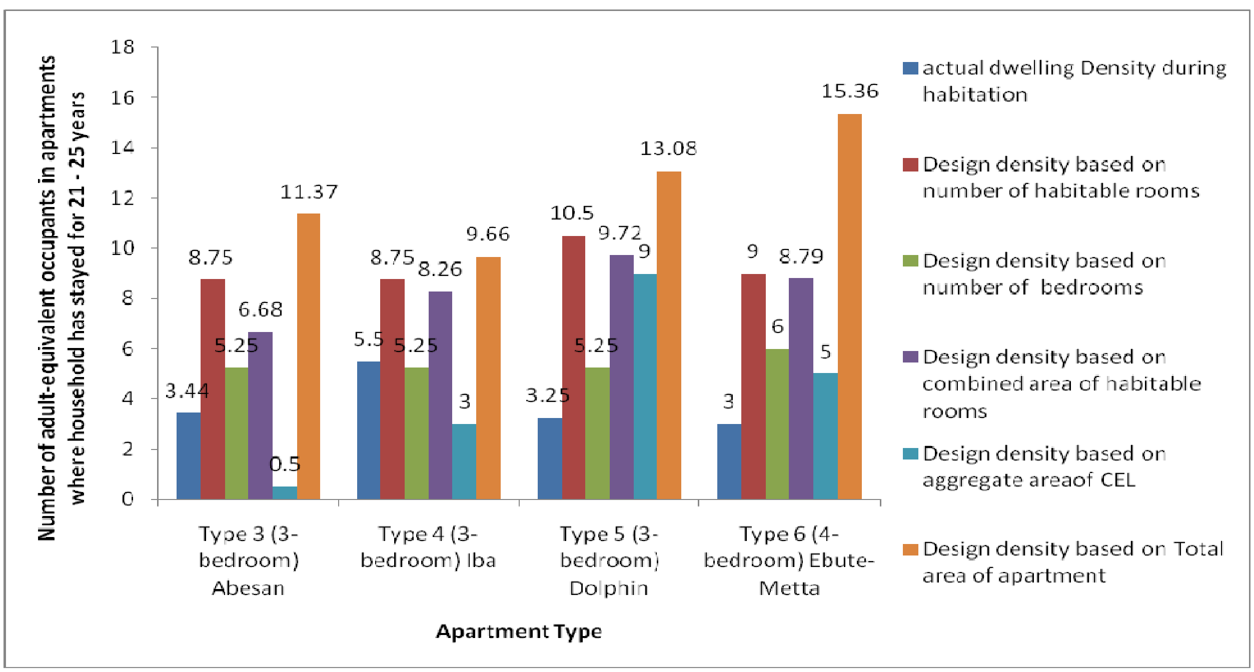


Figure 4.101: Dwelling density in apartments where households have lived for 21 – 25 Years

Figure 4.101 shows that households headed by persons who have lived in the study area for 21-25 years were less likely to be found in Type 1 (two-bedroom) at Abesan and Type 2 (two-bedroom) at Dolphin II estates. Among the five indicators adopted in this study for assessing dwelling density, three indicators revealed under-occupancy in all apartment types where the respondents have stayed between 21 and 25 years. These three indicators are Number of Habitable Rooms, Combined Area of Habitable Rooms, and Total Area of Each Apartment. The indicator of Number of Bedrooms shows that Type 4 (three-bedroom) at Iba was under-occupied. The other three apartment types were under-occupied. These are Type 3 (three-bedroom) st Abesan, Type 5 (three-bedroom) at Dolphin II, and Type 6 (four-bedroom) at Ebute-Metta.

Figure 4.101 also shows that Type 3 (three-bedroom) at Abesan and Type 4 (three-bedroom) at Iba are over-occupied based on Aggregate Area of CEL. On the other hand, the Aggregate Area of CEL indicator reveals that Type 5 (three-bedroom) at Dolphin II and Type 6 (four-bedroom) at Ebute-Metta are under-occupied.

The figure also shows that for this category of respondents, Type 5 (three-bedroom) at Dolphin II and Type 6 (four-bedroom) at Ebute-Metta were under-occupied, when assessed using all the five indicators adopted in this research.

4.18.6 Statistical Validation of Effect of Length of Residency on Dwelling Density

The chi-square statistical tool was employed to validate whether the duration of residency in an apartment has any effect on the incidence of dwelling density among the respondents. The results are shown in Table 4.22. The statistical level of significance for acceptance or rejection was set at 95% confidence interval. Thus P-Value (that is, T-tabulated) represents the effect of length of residency on dwelling density. The decision rule is that at the same degree of freedom, if the P-

Value is less than 0.05, the effect of length of residency on dwelling density is classified as "significant". This implies that at the same degree of freedom, if the P-Value is higher than 0.05, the effect of length of residency on dwelling density is classified as "not significant". At 95% confidence interval, the data reveals that the number of years a household has stayed in an apartment did not have any significant effect on the dwelling density.

Table 4.22: Effect of Length of Residency on Dwelling Density

Apartment type	Chi-square Value X^2	D.F.	P-Value (T- tabulated)	Remark
Type one (two-bedroom), Abesan	0.768	2	0.681	Length of stay has no Significant effect on dwelling density in all apartment types
Type two (two-bedroom), Dolphin II	10.125	6	0.119	
Type three (three-bedroom), Abesan;	8.564	10	0.574	
Type four (three-bedroom), Iba	7.917	8	0.442	
Type five (three-bedroom), Dolphin	14.191	8	0.077	
Type six (four-bedroom), Ebute-Metta	5.473	8	0.706	

Remarks/interpretation

P-Value (that is, T tabulated): effect of length of residency on dwelling density. Decision rule: At the same degree of freedom (D.F.) if the P-Value is less than 0.05, effect of length of residency on dwelling density is classified as "significant"; if the P-Value is higher than 0.05, effect of length of residency on dwelling density is classified as "not significant".

4.19 DWELLING DENSITY BY OWNERSHIP STRUCTURE OF APARTMENT

Table 4.23: Ownership Structure of Apartment

Ownership structure of apartment	No of Respondents	Percentage
Owned by head of household	71	40.6
Owned by spouse	6	3.4
Jointly owned by head of household &spouse	8	4.6
Owned by a child	3	1.7
Owned by a relative	11	6.3
Household rented the apartment	76	43.4
Total	**175**	**100.0**

Ownership structure refers to the nature of the occupancy of a household in a dwelling. In this study, ownership was treated as an attribute of the household rather than of the dwelling. These were measured using: (a) owned by household head (b) owned by a spouse (c) jointly owned by head of household and spouse (d) owned by a child (e) owned by a relative (f) household rented the apartment. Among the respondents, households who rented the apartment they occupied constitute 43.4% (76). Almost all the respondents from Abesan estate were renters.

The distribution of respondents among the other four modes of ownership shows that apartments owned by household heads were largest 40.6% (71). Respondents who were occupying apartments owned by relatives also constitute 6.3% (11), while those living in apartments owned by their children were the least 1.7% (3). It should be noted that ownership by children was not the same as child-headed household. In this circumstance of ownership by children, the age of the child was not necessarily below eighteen years. What is significant was that the apartment was acquired for the sole purpose of accommodating the parents of the apartment owner. The few respondents in this group suggest that the practice is at variance with socio-cultural norms that are prevalent in Nigeria. Children prefer to take care of their aged parents while living together in the same apartment. Similarly, the practice where apartments are owned by female spouses or jointly owned by both spouses does not command general acceptability in Nigeria. This seems to justify the small number of respondents in these categories, spouse 3.4% (6); head of household and spouse 4.6% (8). It is obvious from Table 4.23 that two most dominant ownership structures that constitute 84% of the respondents were household head and rent.

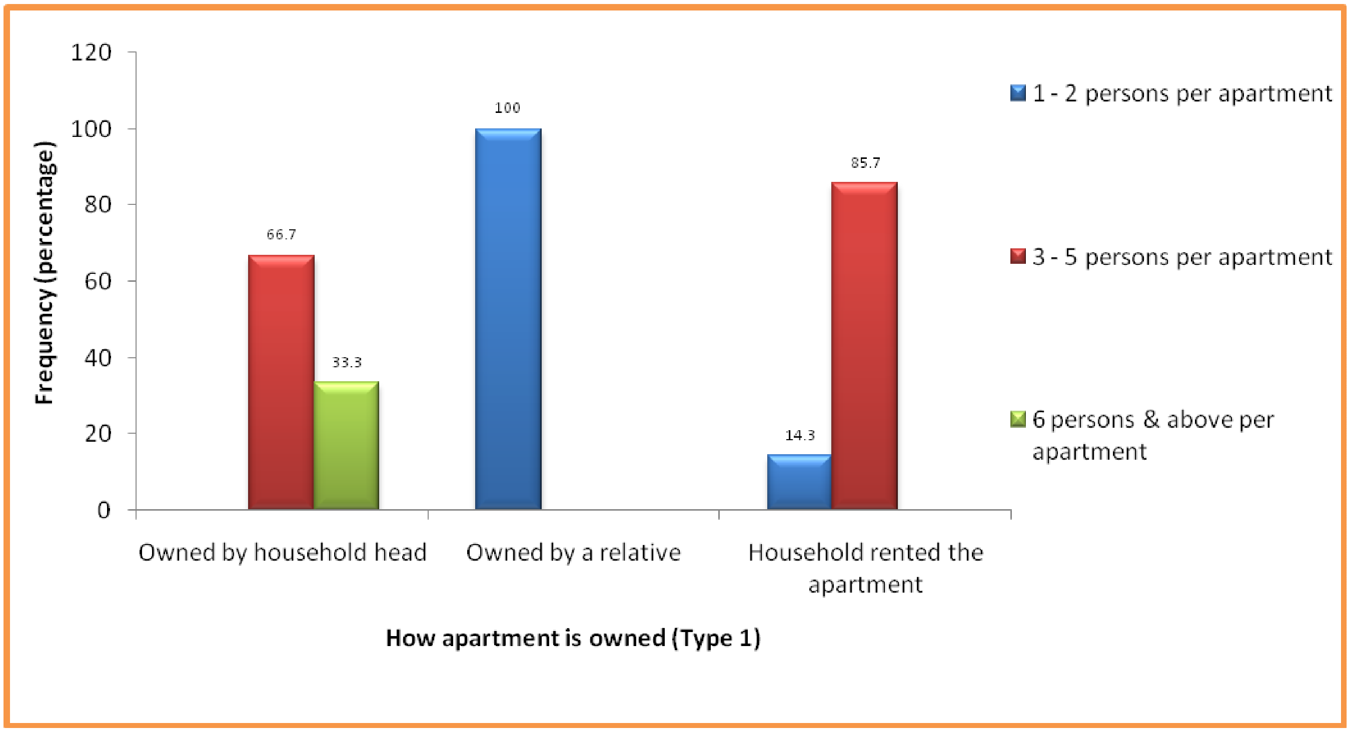


Figure 4.102: Actual Dwelling Density for Apartment Type 1 Based on How Apartment is Owned

Figure 4.103: Actual Dwelling Density for Apartment Type 2 Based on How Apartment is Owned

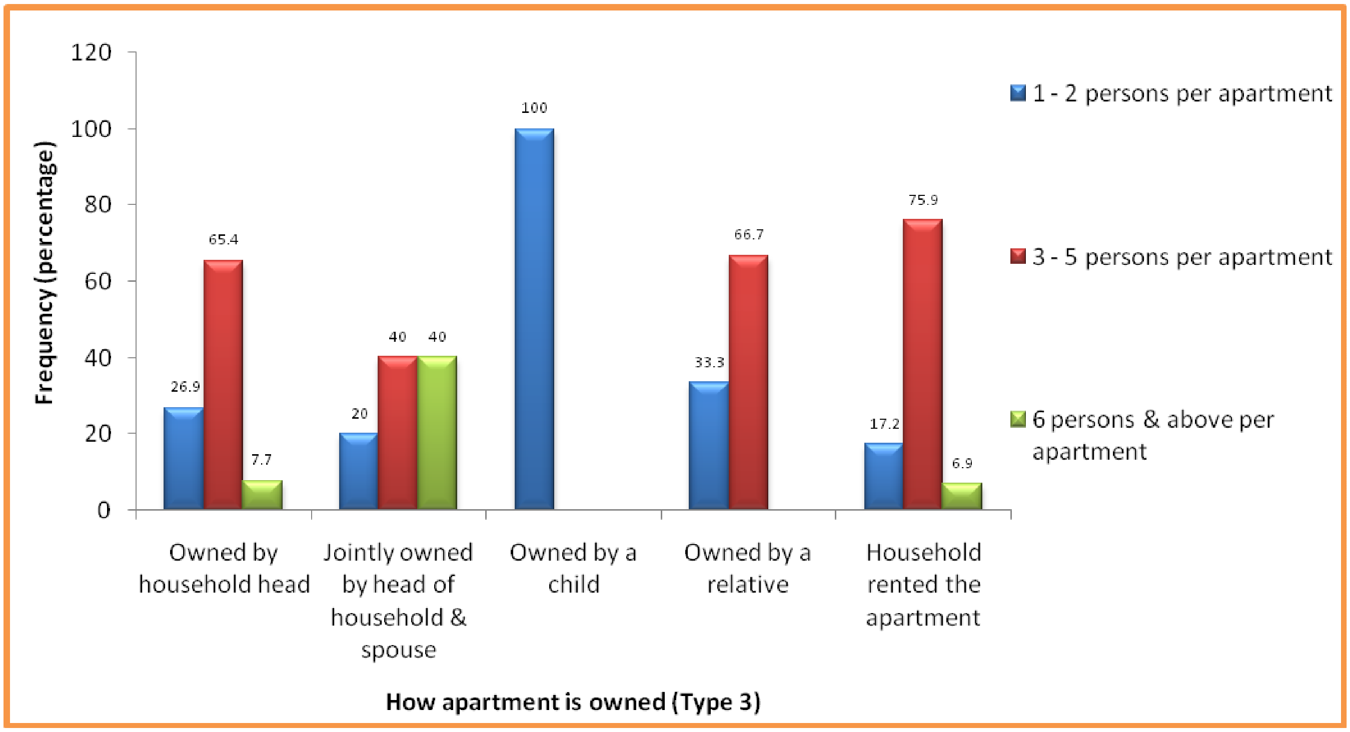


Figure 4.104: Actual Dwelling Density for Apartment Type 3 Based on How Apartment is Owned

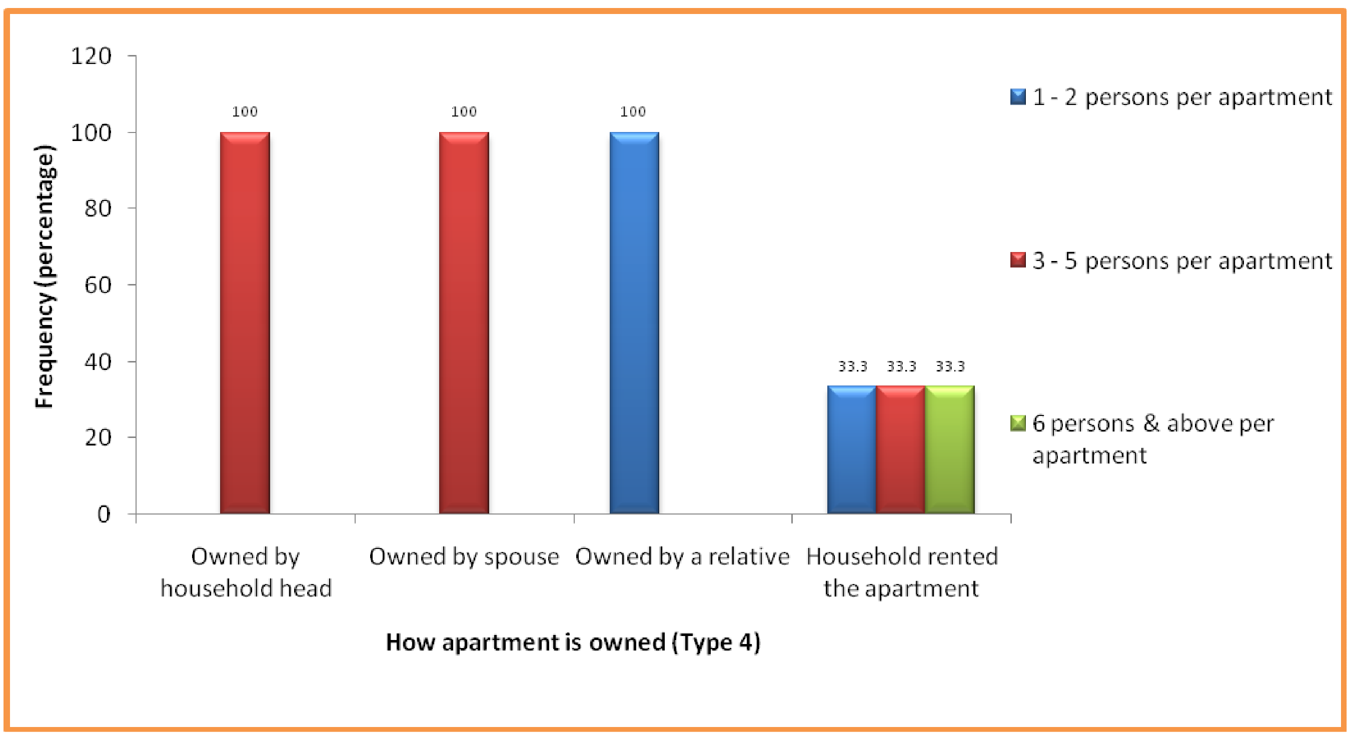


Figure 4.105: Actual Dwelling Density for Apartment Type 4 Based on How Apartment is Owned

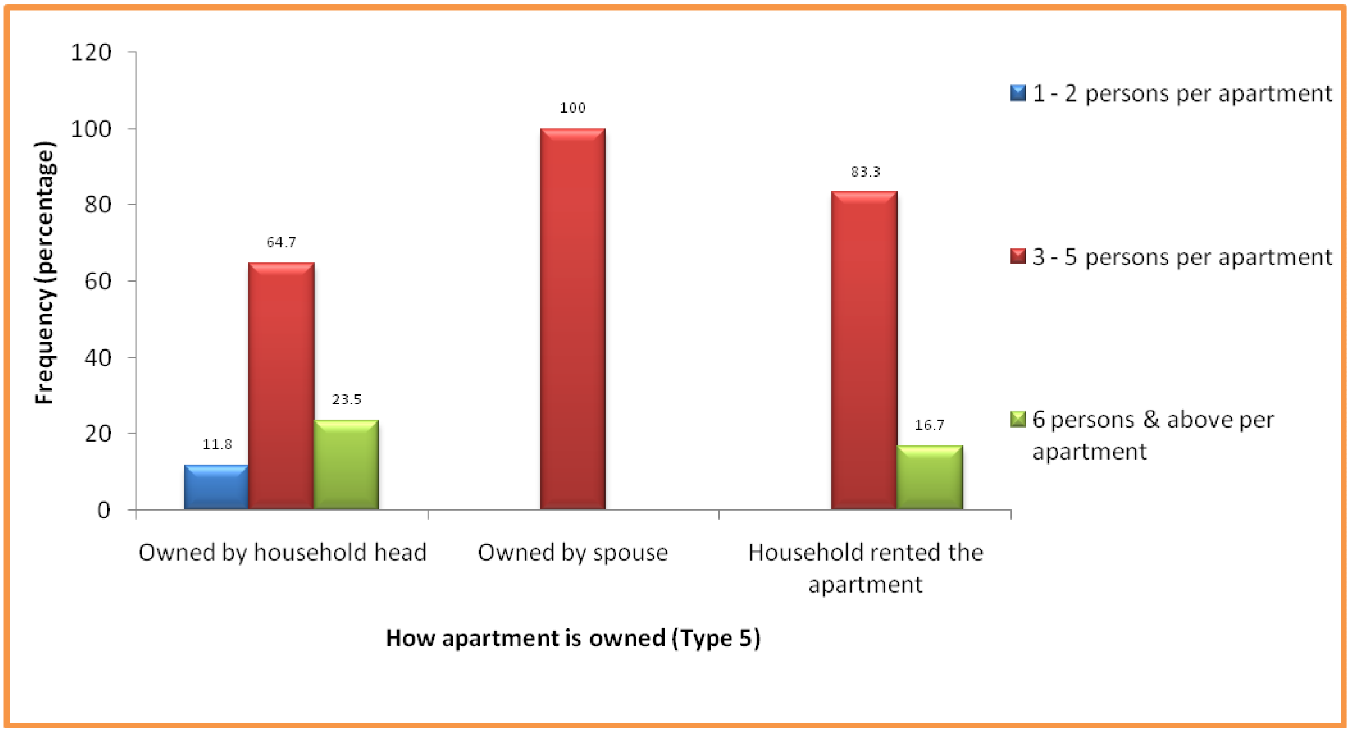


Figure 4.106: Actual Dwelling Density for Apartment Type 5 Based on How Apartment is Owned

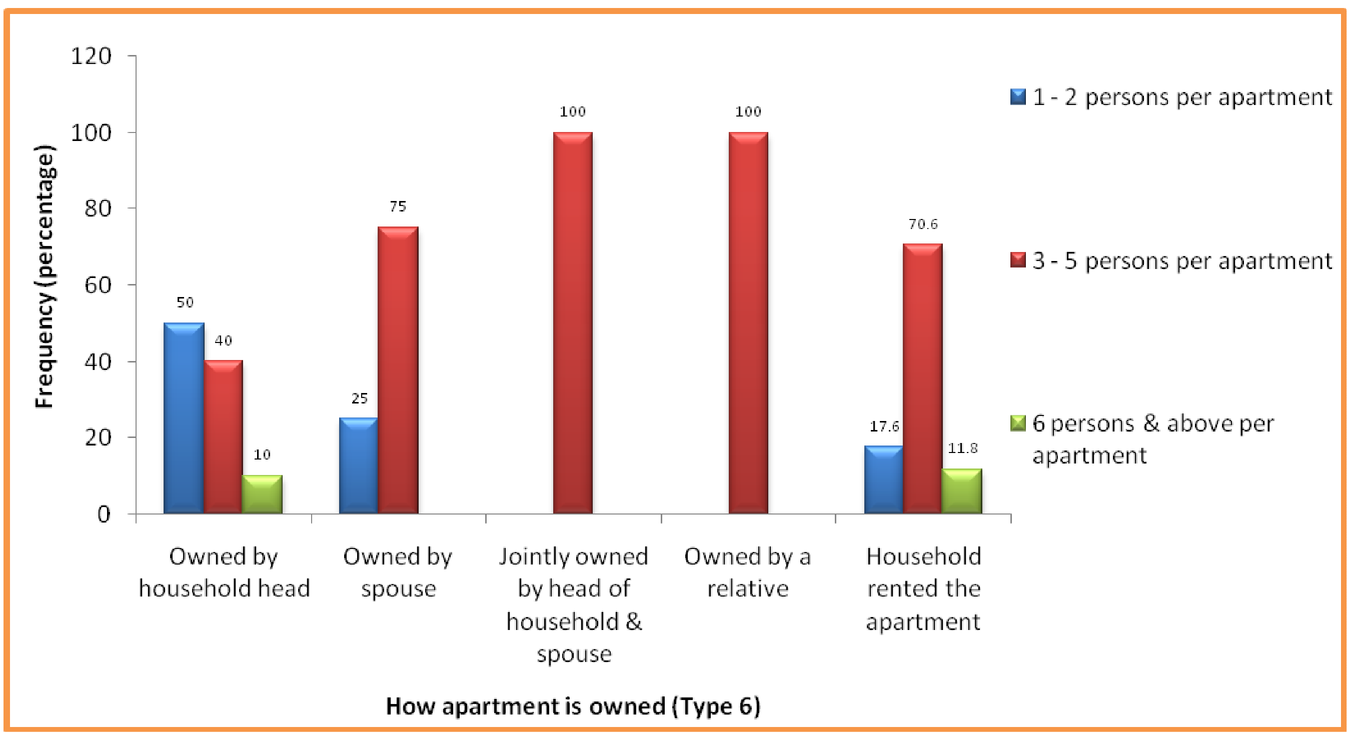


Figure 4.107: Actual Dwelling Density for Apartment Type 6 Based on How Apartment is Owned

4.19.1 Dwelling Density in Apartments Owned by Household Head

As indicated in Figure 4.108 apartments in the study area that were owned by household heads could scarcely be found in Type 1 (two-bedroom) located at Abesan estate. The data however, shows that apartments owned by household heads were available in all the other five types investigated in this study.

Among the five criteria selected in this research for measuring dwelling density, Type 5 (three-bedroom) at Dolphin II and Type 6 (four-bedroom) at Ebute-Metta revealed under-occupancy in all cases. Two other apartment classifications, Type 3 (three-bedroom) at Abesan and Type 4 (three-bedroom) at Iba recorded under-occupancy in all dwelling density indicators except based on Aggregate Area of CEL. These two apartment types were over-occupied when assessed on the basis of Aggregate Area of CEL.

Similarly, Type 2 (two-bedroom) apartments were over-occupied when two measurement indicators were applied. The indicators are Number of Bedrooms and Aggregate Area of CEL. The Type 2 (two-bedroom) apartments at Dolphin II estate were however, under-occupied, based on the other three measurement indicators namely; Number of Habitable Rooms, Combined Area of Habitable Rooms, and Total Area of Each Apartment.

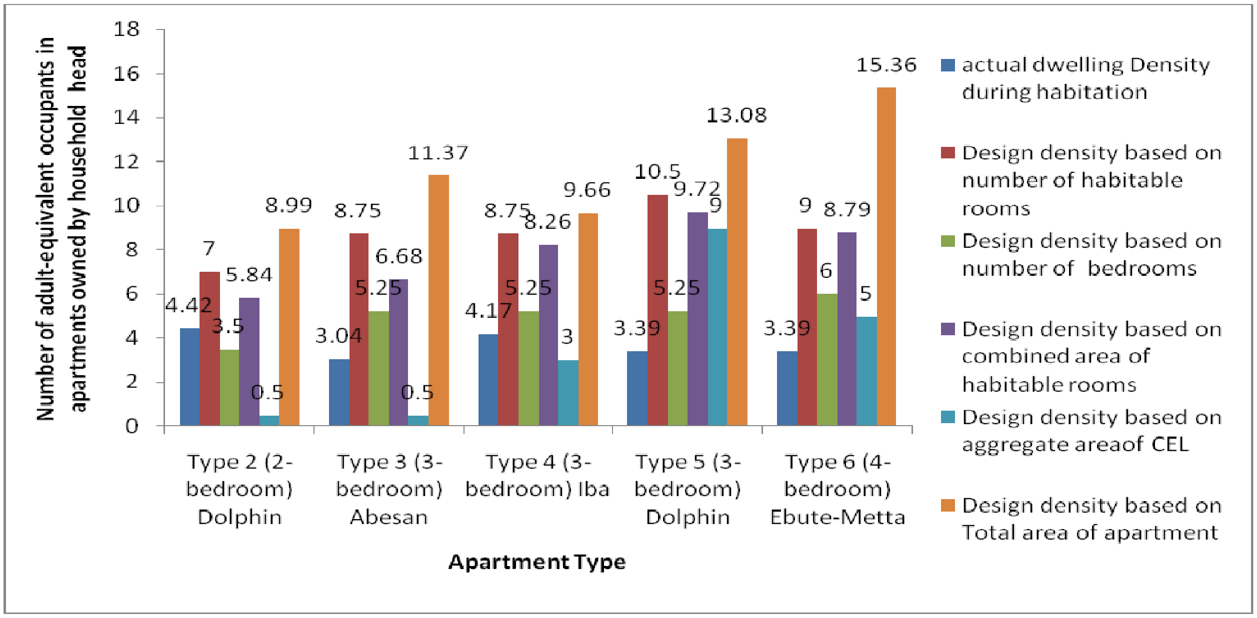


Figure 4.108: Dwelling Density in Apartments Owned by Household Head

4.19.2 Dwelling Density in Apartments Owned by Spouse of Household Head

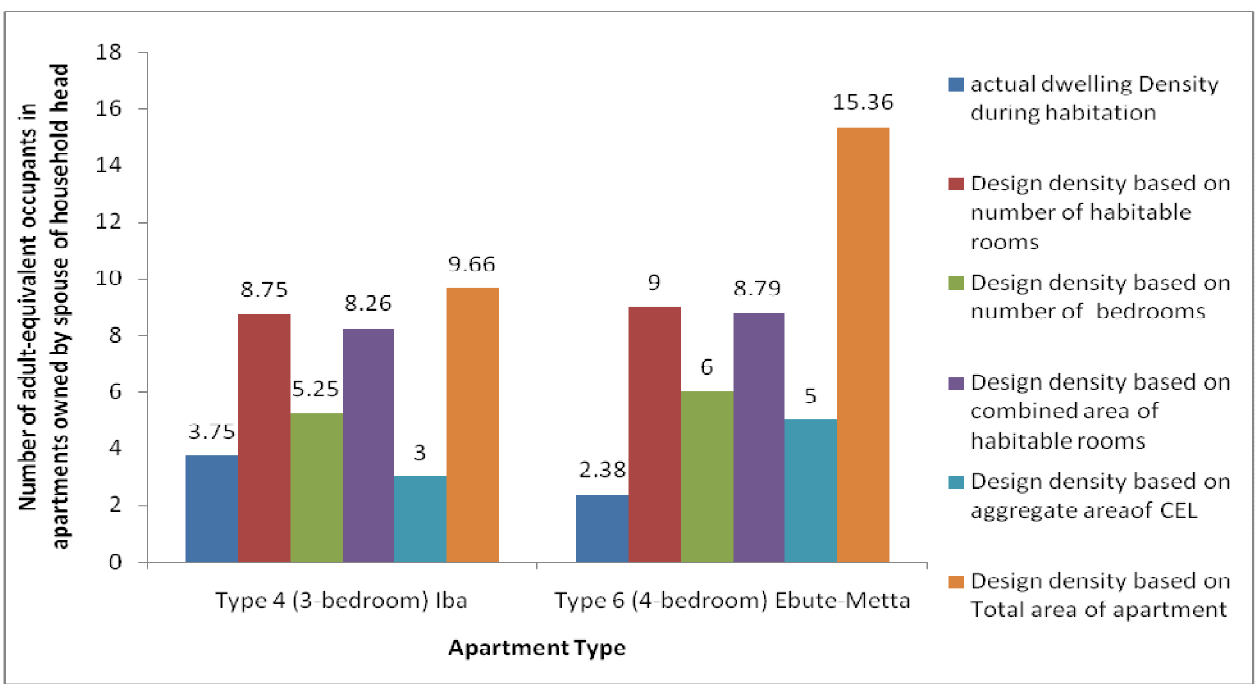


Figure 4.109: Dwelling Density in Apartments Owned by Spouse of Household Head

The data in Figure 4.109 reflects the general cultural bias towards home ownership by the feminine gender in the study area. Apartments owned by spouses were found only in Type 4 (three-bedroom) at Iba and Type 6 (four-bedroom) at Ebute-Metta. Apartments owned by spouses of respondents were hence not found in four types. These are: (1). Type 1 (two-bedroom) at Abesan, (2). Type 2 (two-bedroom) at Dolphin II, (3). Type 3 (three-bedroom) at Abesan and (4). Type 5 (three-bedroom) at Dolphin II. This result tends to suggest that apartments owned by spouses of household heads were rarely found among residents at two-bedroom apartments, no matter the location. Rather, persons belonging to this group seemed to favour three-bedroom and four-bedroom apartments. The table reveals the results of dwelling density computation for the two apartment types owned by spouses of respondents. The table further suggests that Type 6 (four-bedroom) apartments owned by spouses of respondents were largely under-occupied, using all the five measurement indicators adopted in this study.

Table Figure 4.109 indicates that it was only on the basis of Aggregate Area of CEL that Type 4 (three-bedroom) at Iba recorded over-occupancy. This was the only instance where apartments owned by spouses of respondents were likely to exceed the design density rating in Type 4 (three-bedroom) apartment by 0.03 adult-equivalent occupants per square metre of CEL.

4.19.3 Dwelling Density in Apartments jointly owned by Household Head and Spouse

Respondents whose apartments are jointly owned by household head and spouse were not found in three apartment types. These are: Type 1 (two-bedroom) units at Abesan, type 2 (two-bedroom) units at Dolphin II, Type 4 (three-bedroom) units at Iba, and Type 5 (three-bedroom) units at Dolphin II. In Abesan estate, Type 1 (two-bedroom) did not harbour this type of household. It could only be found in Type 3 (three-bedroom) apartments.

The data from the study shows that for this household category, Type 6 (four-bedroom) apartments were completely under-occupied, based on all the five measuring indicators adopted in this research. Type 3 (three-bedroom) at Abesan was only under-occupied when four indicators were applied. These four indicators are: Number of Habitable Rooms, Number of Bedrooms, Combined Area of Habitable Rooms and total Area of Each Apartment. On the other hand, the Type 3 (three-bedroom) apartment at Abesan recorded over-occupancy when assessed on the basis of Aggregate Area of CEL.

With regards to Type 2 (two-bedroom) apartment at Dolphin II, the households were under-occupied using three indicators. The three indicators that recorded under-occupancy are Number of Habitable Rooms, Combined Area of Habitable Rooms, and Total Area of Each Apartment. Figure 4.110, however, reveals that this Type 2 (two-bedroom) at Dolphin II was occupied as designed based on Number of bedrooms. On the contrary, this apartment category was over-occupied, based on Aggregate Area of CEL, by an excess of three adult-equivalent occupants.

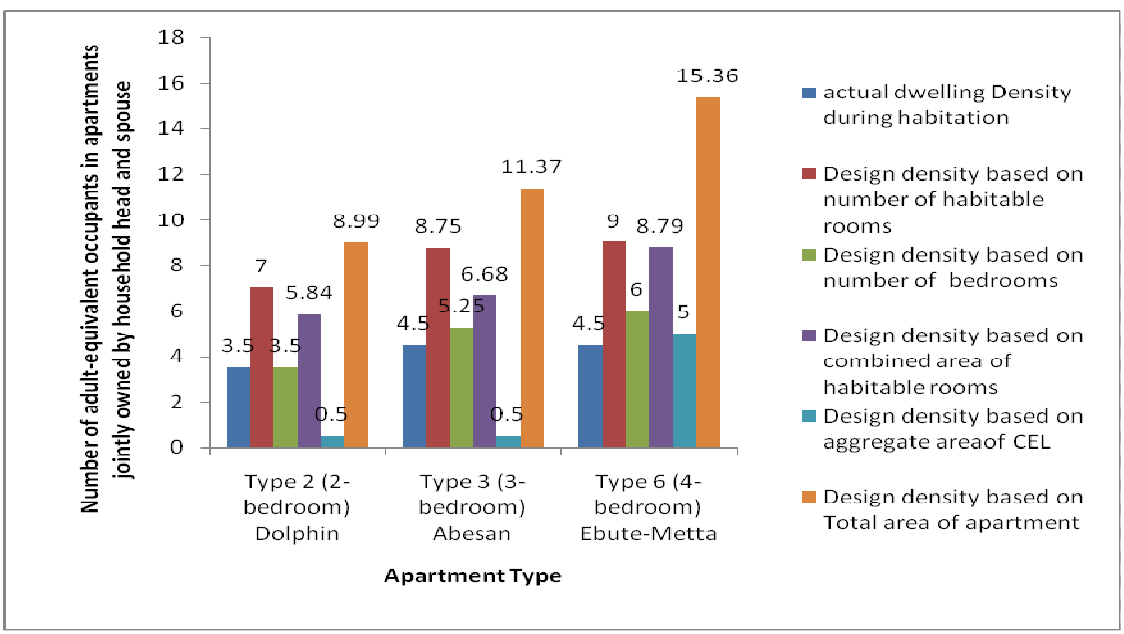


Figure 4.110: Dwelling Density in Apartments jointly owned by Household Head and Spouse

4.19.4 Dwelling Density in Apartments owned by Household Head's Child

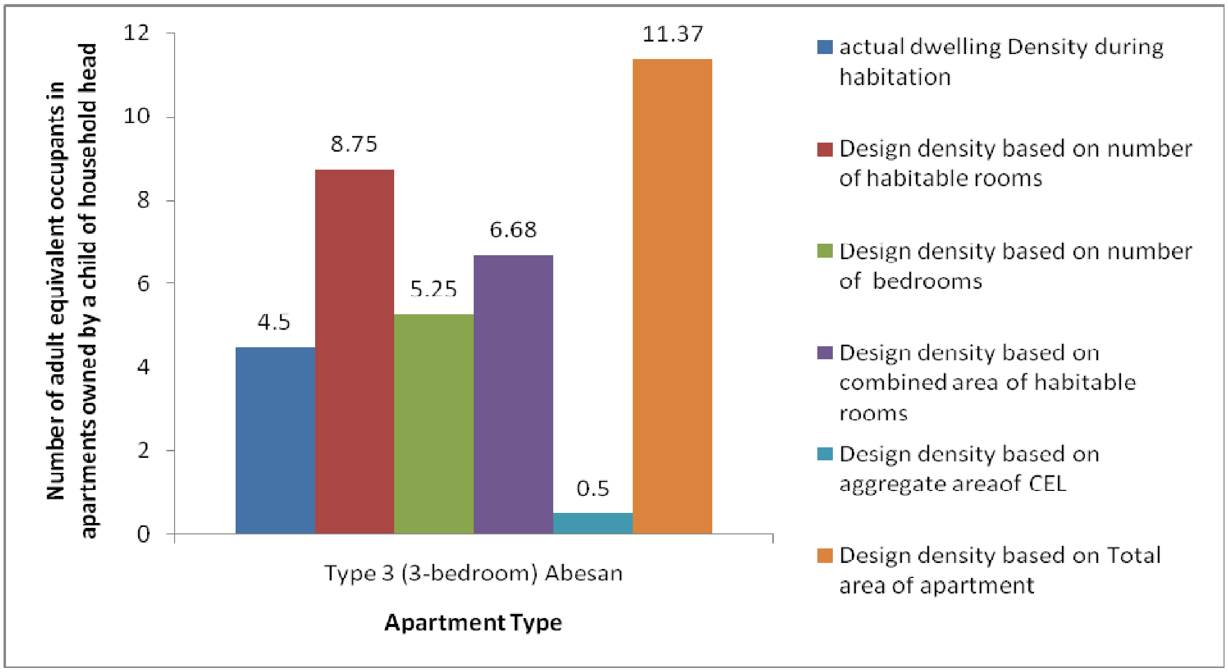


Figure 4.111: Dwelling Density in Apartments owned by Household Head's Child

Figure 4.111tends to reveal the unpopularity of child-headed households in the study area. The Table indicates that apartments owned by children of respondents could substantially be found only in Type 3 (three-bedroom) at Abesan. Results from the data show that there were no respondents from the other five apartment types investigated in this research. These are: Type 1 (two-bedroom) at Abesan, Type 2 (two-bedroom) at Dolphin II and Type 6 (four-bedroom) at Ebute-Metta. The research data from Figure 4.111further suggests that households where the owners are children of the respondents were not be found in two-bedroom apartments.

The five measurement criteria for dwelling density adopted in this study were applied to the Type 3 (three-bedroom) at Abesan. Results from Figure 4.111indicate that it was only on the basis of Aggregate Area of CEL that apartments owned by children of respondents were over-occupied.

This means that in this situation, the spaces available per square metre for each adult-equivalent occupant was less than what was rated based on the design.

On the contrary, the dwelling density outcome, based on the other four measurement criteria adopted in this research revealed under-occupancy. The four indicators that gave under-occupancy results are: Number of Habitable Rooms, Number of Bedrooms, Combined Area of Habitable Rooms, Aggregate Area of CEL, and Total Area of Each Apartment.

4.19.5 Dwelling Density in Apartments owned by Household Head's Relative

As indicated in Figure 4.112 respondents that live in apartments owned by relatives were found in five out of six apartment types selected for this study. The figure also shows that only Type 2 (two-bedroom) at Dolphin II was less likely to harbour this group of respondents. This was expected, given the largely held practice of kinship support in this part of the world.

Among the five measurement indicators adopted in this research for assessing dwelling density, Type 4 (three-bedroom) at Iba and Type (three-bedroom) at Dolphin II revealed under-occupancy in all cases. The other three apartment types recorded under-occupancy in three measurement indicators of Number of Habitable Rooms, Combined Area of Habitable Rooms, and Total Area of Each Apartment. These apartment types are Type 1 (two-bedroom) at Abesan, Type 3 (three-bedroom) at Abesan and Type 3 (three-bedroom) at Ebute-Metta. Conversely, these three apartment types also maintained a record of over-occupancy when other measurement indicators were applied. Thus, Type 1 (two-bedroom) at Abesan and Type 3 (three-bedroom) at Abesan were over-occupied based on Aggregate Area of CEL. The figure suggests that over-occupancy based on Aggregate Area of CEL occured only in Abesan Estate. This situation did not occur among respondents in other locations. Also, Type 6 (four-bedroom) at Ebute-Metta showed over-occupancy when an assessment indicator of Number of Bedrooms was used. The apartments had exceeded their optimum design density by 1.0 adult-equivalent occupants.

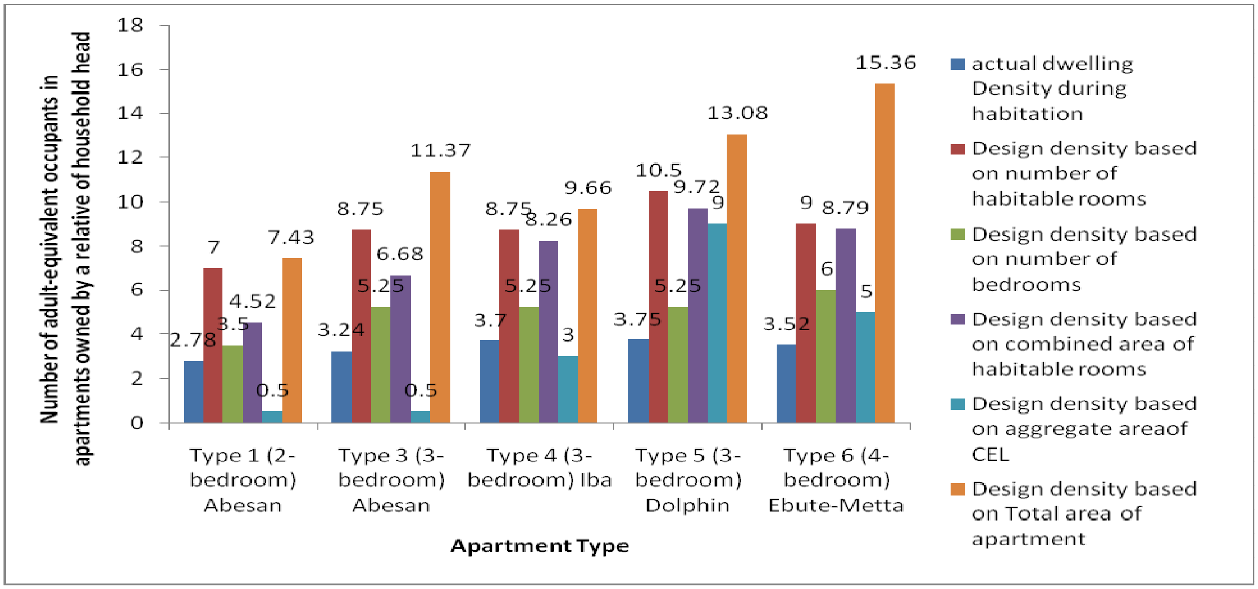


Figure 4.112: Dwelling Density in Apartments owned by Household Head's Relative

4.19.6 Dwelling Density in Apartments Occupied by Renters

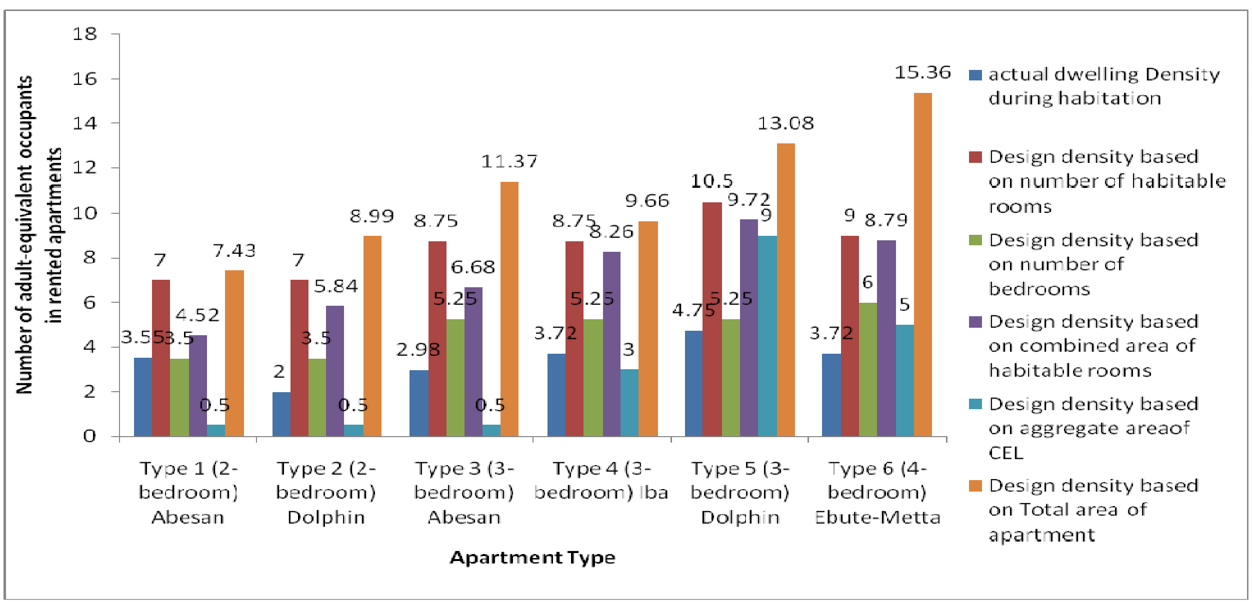


Figure 4.113: Dwelling Density in Apartments Occupied by Renters

Figure 4.113 shows that respondents who were occupying rented apartments could be found in all the six apartment types investigated in the research. As revealed in the figure, five criteria were employed in the measurement of dwelling density rating for each of the six selected apartments. Three of the measurement criteria show that all rented apartments were under-occupied. The three indicators that gave this result are (1) Number of Habitable Rooms (2) Combined Area of Habitable Rooms (3) Total Area of Each Apartment.

Results showing dwelling density based on Number of Bedrooms indicate that Type 1 (two-bedroom) at Abesan was over-occupied by 0.05 adult-equivalent occupants. All the remaining five apartment types investigated in this study gave results that indicated under-occupancy.

Figure 4.113 further shows that households in rented apartmentswe over-occupied based on a measuring indicator of Aggregate Area of CEL, in four apartment types. These are: Type 1 (two-bedroom) at Abesan, Type 3 (two-bedroom) at Dolphin II, Type 3 (three-bedroom) at Abesan, and Type 4 (three-bedroom) at Iba.

Based on Aggregate Area of CEL, these four apartment types that were over-occupied were unsuitable as rented apartments for households in the study area. Data from Figure 4.113 equally reveal that Type 5 (three-bedroom) at Dolphin II and Type 6 (four-bedroom) at Ebute-Metta were under-occupied based on the five measurement criteria adopted in this study for dwelling density in rented apartments.

4.19.7 Statistical Validation of Effect of Tenure on Dwelling Density

Table 4.24: Effect of Tenure on Dwelling Density

Apartment type	Chi-square Value X^2		P-Value (T- abulated)	Remark
Type one (two-bedroom), Abesan	10.653		0.031	Tenure type has significant effect on dwelling in this apartment type
Type two (two-bedroom), Dolphin II	16.000		0.014	Tenure type has significant effect on dwelling in this apartment type
Type three (three-bedroom), Abesan;	14.082		0.080	Tenure type has no significant effect on dwelling density in these 4 apartment types
Type four (three-bedroom), Iba	8.750		0.188	
Type five (three-bedroom), Dolphin	1.484		0.830	
Type six (four-bedroom), Ebute-Metta	6.501		0.591	

Remarks/interpretation

P-Value (that is, T tabulated): effect of tenure type on dwelling density. Decision rule: At the same degree of freedom (D.F.) if the P-Value is less than 0.05, effect of tenure type on dwelling density is classified as "significant"; if the P-Value is higher than 0.05, effect of tenure type on dwelling density is classified as "not significant".

In this study, the effect of tenure type on dwelling density was tested using the chi-square statistical tool. The data from the analysis are expressed in Table 4.24. The statistical level of significance for acceptance or rejection was set at 95% confidence interval. Thus P-Value (that is, T-tabulated) represents the effect of tenure type on dwelling density. The decision rule is that at the same degree of freedom, if the P-Value is less than 0.05, the effect of tenure type on dwelling density is classified as "significant". This implies that at the same degree of freedom, if the P-Value is higher than 0.05, the effect of tenure type on dwelling density is classified as "not significant". The result shows that the effect of tenure type on dwelling density was significant on only two bedroom apartments. These are Type 1 (two-bedroom) Abesan, and Type 2 (two-bedroom) at Dolphin II. Among the three bedroom apartments and the four bedroom apartments investigated in this research, the nature of ownership had no significant effect on dwelling density.

4.20 DWELLING DENSITY BY MODE OF OWNERSHIP OF APARTMENT

Table 4.25: Dwelling Density by Mode of ownership of apartment

Mode of ownership of apartment	**No of Respondents**	**Percentage**
Originally purchased from LSDPC	56	64.4
Purchased from previous private owners	31	35.6
Total	**87**	**100**

Table 4.25 shows the mode of purchase by respondents. The respondents that were not in rented apartments were expected to indicate the mode of purchase or acquisition of their housing units. The options are: (a) whether the apartment was purchased directly from LSDPC as an allottee or whether the apartment was purchased from a previous owner. Of the 87 participants that responded, 64.4% (56) indicated that their apartments were allocated directly by LSDPC. On the other hand, 35.6% (31) of the respondents acquired their apartments through third party purchase from earlier allottees. This seems to suggest a significant level of property transfer among residents of LSDPC apartments. The data, however, shows that such transfers occurred more in estates located within the metropolis, than those on the urban fringes.

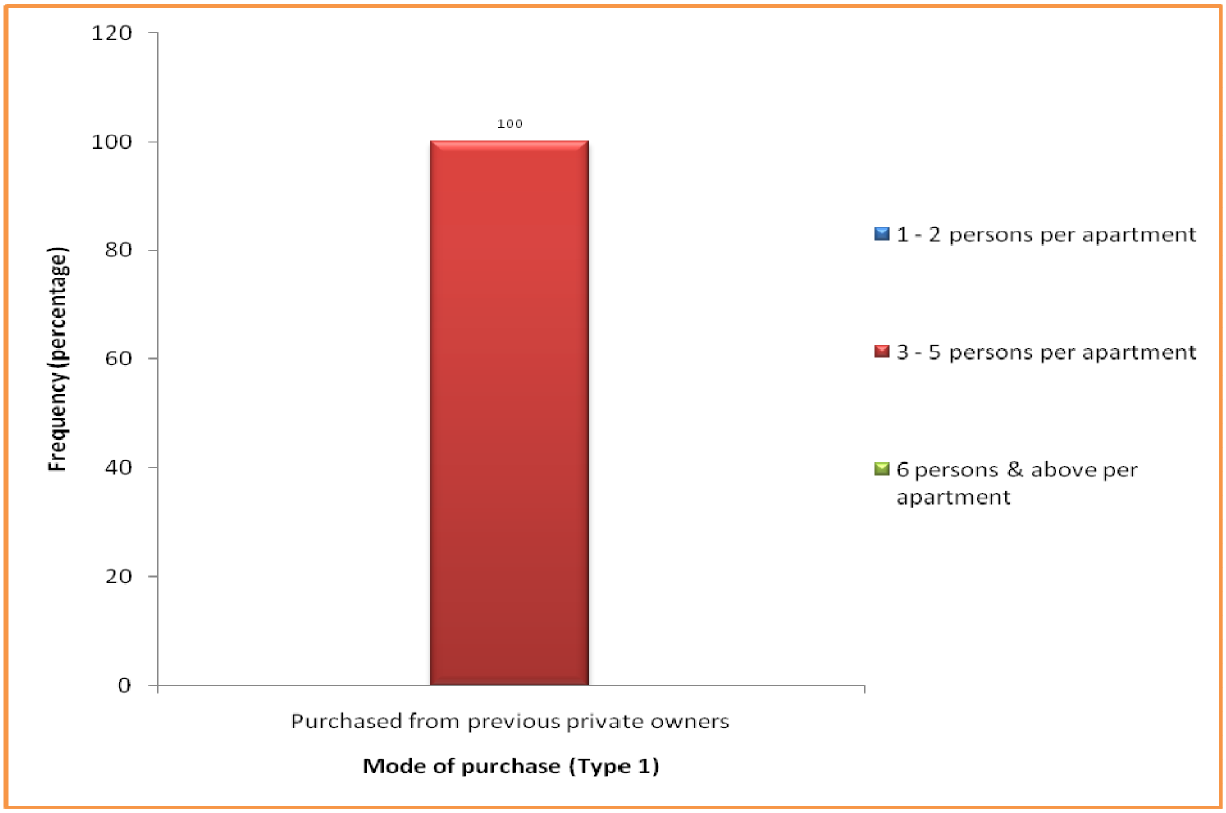


Figure 4.114: Actual Dwelling Density for Apartment Type 1 Based on Mode of Purchase

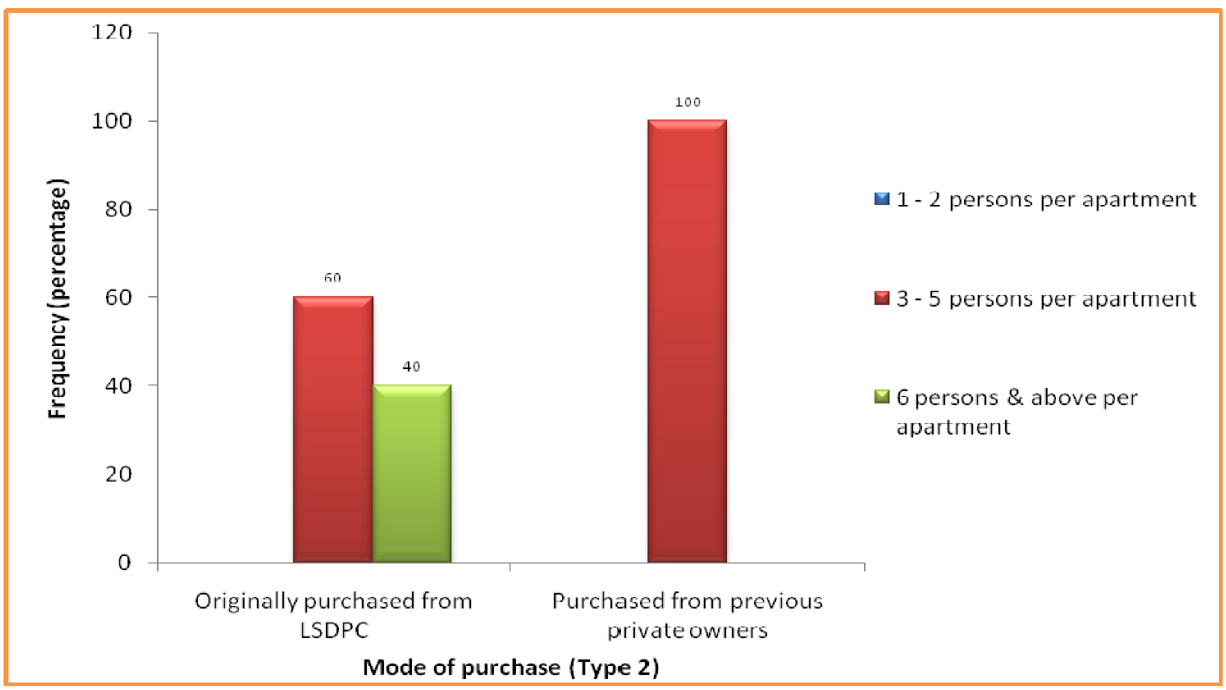


Figure 4.115: Actual Dwelling Density for Apartment Type 2 Based on Mode of Purchase

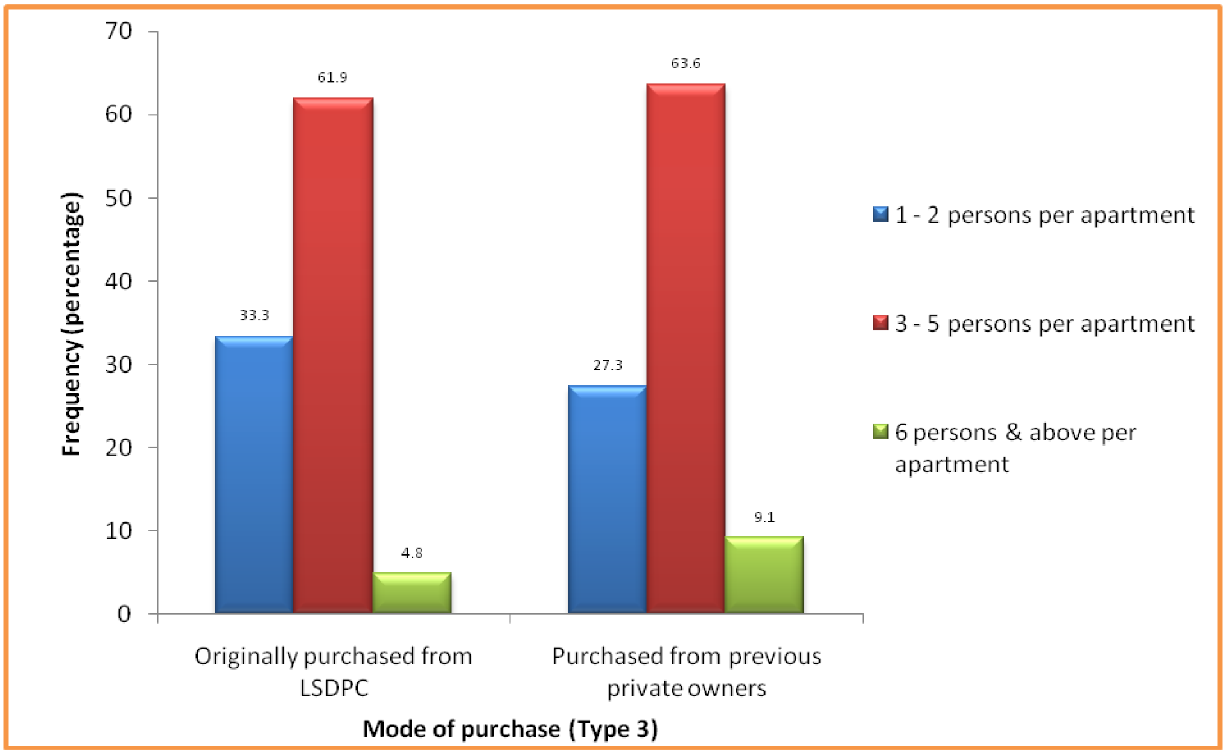


Figure 4.116: Actual Dwelling Density for Apartment Type 3 Based on Mode of Purchase

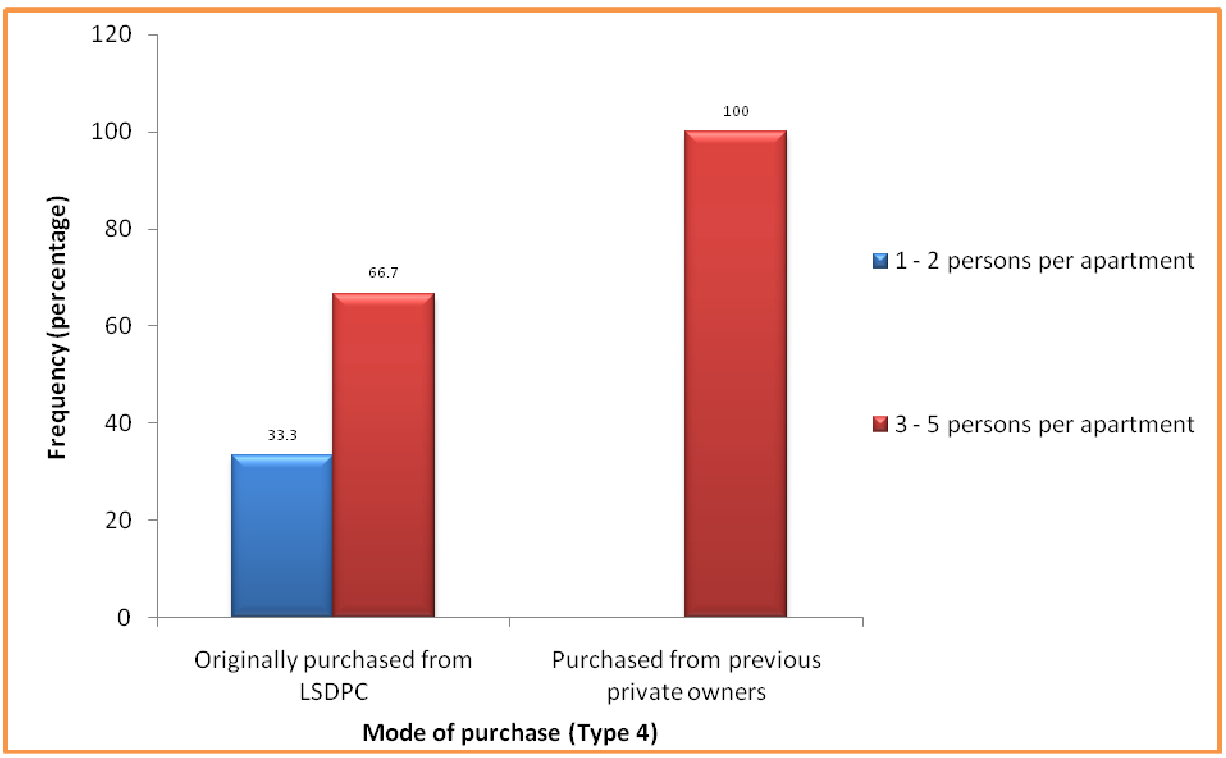


Figure 4.117: Actual Dwelling Density for Apartment Type 4 Based on Mode of Purchase

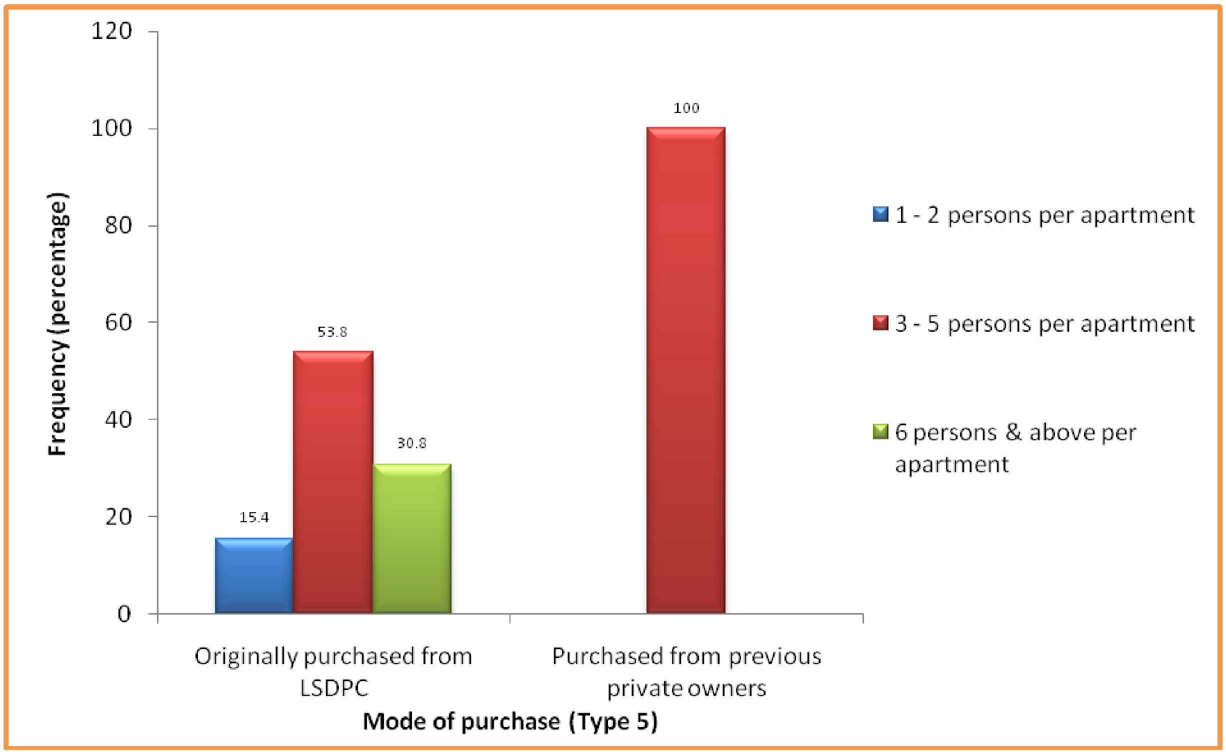


Figure 4.118: Actual Dwelling Density for Apartment Type 5 Based on Mode of Purchase

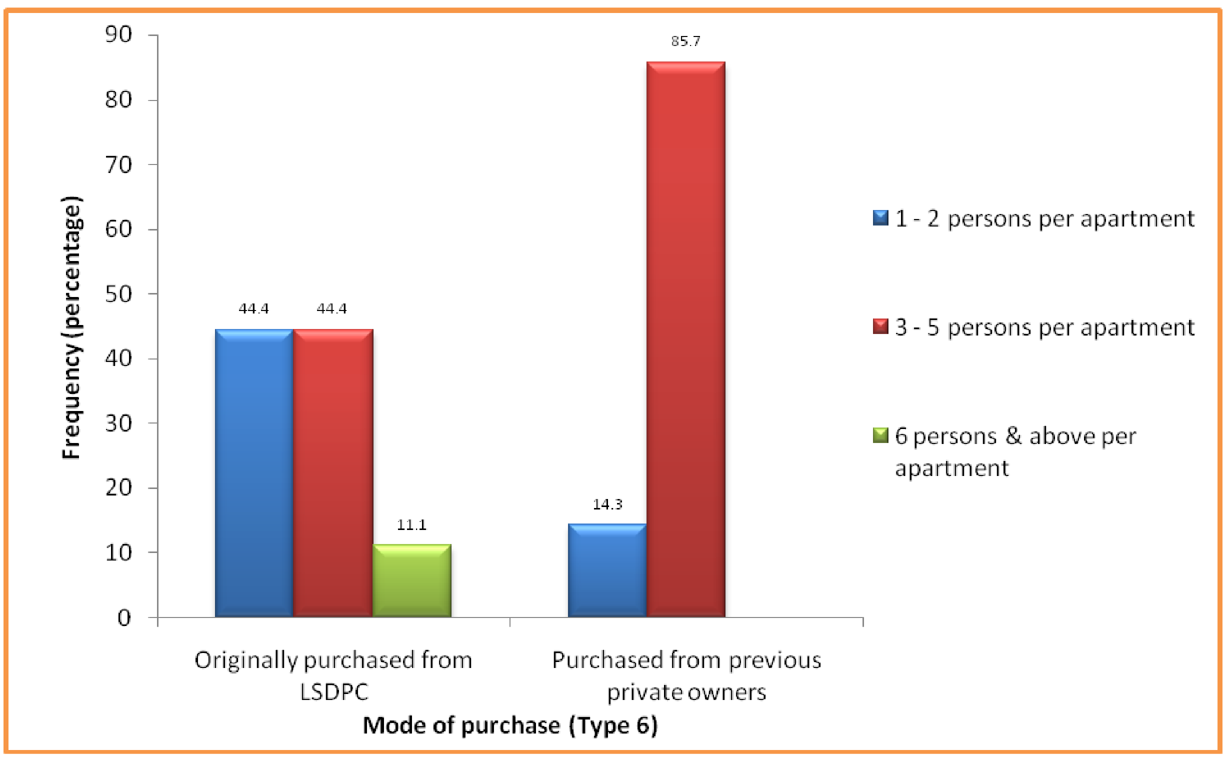


Figure 4.119: Actual Dwelling Density for Apartment Type 6 Based on Mode of Purchase

4.20.1 Dwelling Density in Apartments Originally Purchased From LSDPC by household head

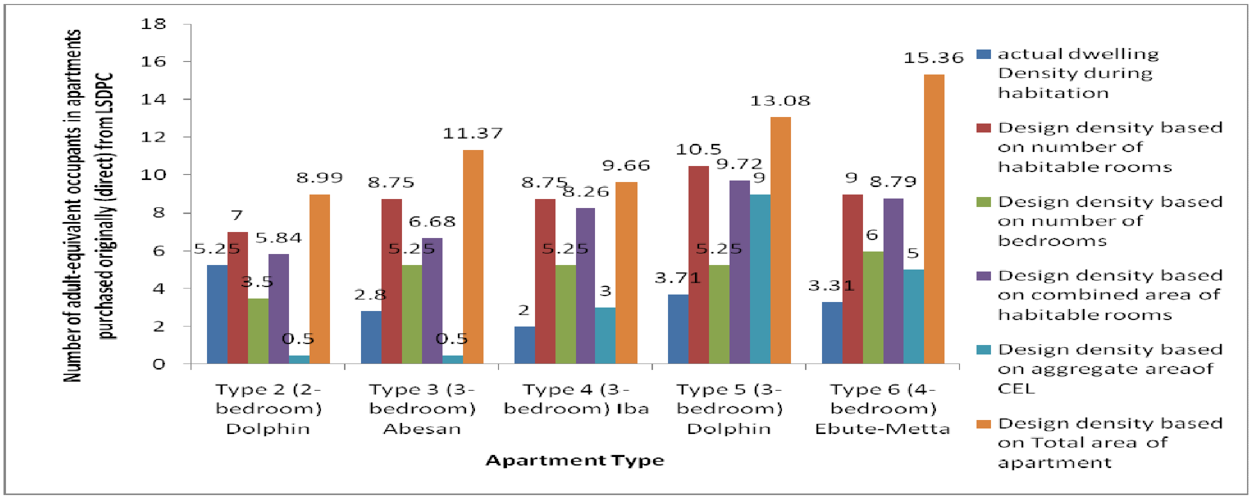


Figure 4.120: Dwelling Density in Apartments Originally Purchased From LSDPC by household head

4.20.2: Dwelling Density in Apartments Purchased by household head from Previous Owners

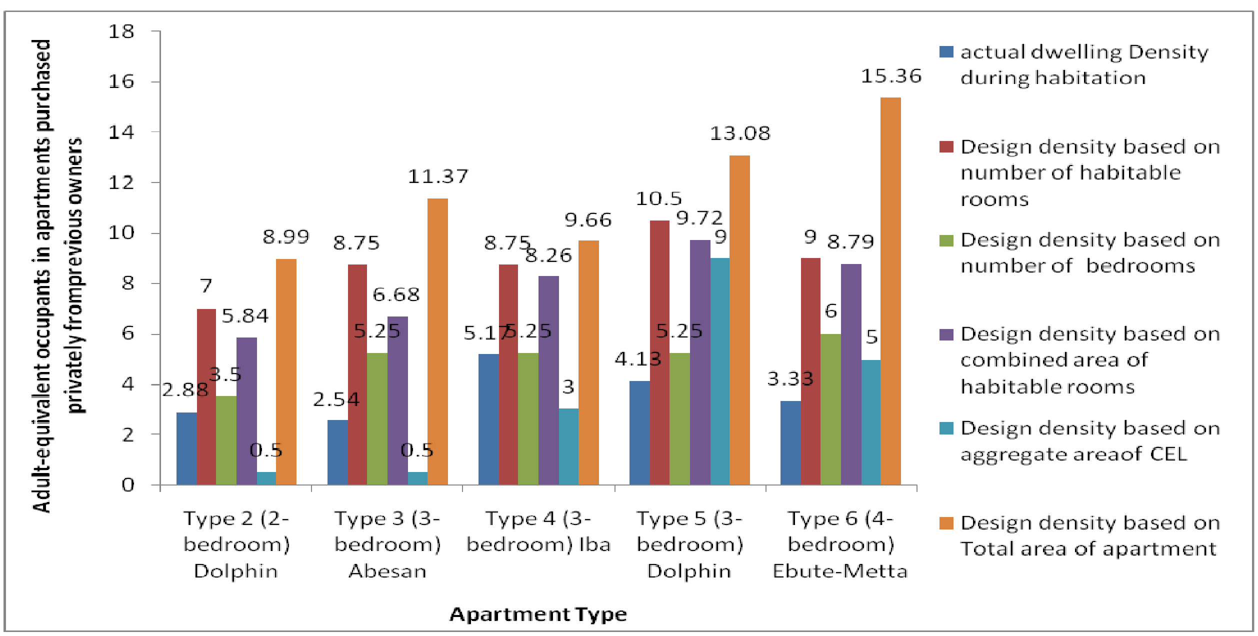


Figure 4.121: Dwelling Density in Apartments Purchased by household head from Previous Owners

4.20.3 Statistical Validation of Effect of Mode of Purchase on Dwelling Density

Table 4.26: Effect of Mode of Purchase on Dwelling Density

Apartment type	Chi-square Value X^2	D.F.	P-Value (T- tabulated)	Remark
Type one (two-bedroom), Abesan	CONSTANT			Mode of purchase has no Significant effect on dwelling density in all apartment types
Type two (two-bedroom), Dolphin II	2.240	1	0.134	
Type three (three-bedroom), Abesan;	0.305	2	0.859	
Type four (three-bedroom), Iba	1.200	1	0.273	
Type five (three-bedroom), Dolphin	2.853	2	0.240	
Type six (four-bedroom), Ebute-Metta	2.997	2	0.223	

Remarks/interpretation

P-Value (that is, T tabulated): effect of mode of purchase on dwelling density. Decision rule: At the same degree of freedom (D.F.) if the P-Value is less than 0.05, effect of mode of purchase on dwelling density is classified as "significant"; if the P-Value is higher than 0.05, effect of mode of purchase on dwelling density is classified as "not significant".

A chi-square tool was used to test whether the mode of purchase of LSDPC's apartments has significant effect on dwelling density of households investigated in this research. The test aimed to determine whether respondents who purchased their apartments directly from LSDPC encounter the same experience as those who purchased from private individuals. The statistical level of significance for acceptance or rejection was set at 95% confidence interval. Thus P-Value (that is, T-tabulated) represents the effect of mode of purchase on dwelling density. The decision rule is that at the same degree of freedom, if the P-Value is less than 0.05, the effect of mode of purchase on dwelling density is classified as "significant". This implies that at the same degree of freedom, if the P-Value is higher than 0.05, the effect of mode of purchase on dwelling density is classified as "not significant". The results indicate that, the mode of purchase of LSDPC's apartments had no significant effect on dwelling density among respondents.

CHAPTER FIVE

5.0 SUMMARY OF FINDINGS

In this chapter, data that have been analyzed are organized to represent findings or results of the study. The discovered patterns and trends are interpreted appropriately to indicate useful relationships among the factors examined. The findings presented in this chapter are organized according to the objectives of this research

5.1 OBJECTIVE ONE: to determine how the existing LSDPC's multifamily apartments were designed to be occupied.

The concept of density is of central importance in planning, urban design and architecture. The number of occupants in a residential apartment is a popular social issue and is clearly related to dwelling density in this study. The quality of design is considered one of the most significant tools to achieve quality of life within intensive housing developments, such as those embarked upon by LSDPC.

A major finding was the non-existence of a programme or theory that clearly states the rated capacity or estimated intensity of occupancy. The design density for each apartment covered in this research was obtained by inference. Significant differences in design density figures were recorded from different computation techniques. Design density (or rated capacity) was reported for each apartment type selected for this study, according to the five measurement criteria adopted in this research, as shown in Table 4.1. The rated capacity became the theory against which the actual dwelling density during habitation was tested.

(a) Design density based on Number of Habitable rooms - This study is based on an occupancy index of 1.75 for low-income apartments, and 1.50 for medium-income apartments. Hence, the design density for different apartment types, based on habitable room indicator were:

i. Type 1 (2-bedroom) low-income apartment prototype at Abesan, containing 4 habitable rooms has a rated capacity of 7.0 adult-equivalent occupants.

ii. Type 2 (2-bedroom) low-income apartment prototype at Dolphin II, containing 4 habitable rooms has a rated capacity of 7.0 adult-equivalent occupants.

iii. Type 3 (3-bedroom) low-income apartment prototype at Abesan, containing 5 habitable rooms has a rated capacity of 8.75 adult-equivalent occupants.

iv. Type 3 (3-bedroom) low-income apartment prototype at Abesan, containing 5 habitable rooms has a rated capacity of 8.75 adult-equivalent occupants.

v. Type 4 (3-bedroom) low-income apartment prototype at Iba, containing 5 habitable rooms has a rated capacity of 8.75 adult-equivalent occupants

vi. Type 5 (3-bedroom) low-income apartment prototype at Dolphin II, containing 6 habitable rooms has a rated capacity of 10.50 adult-equivalent occupants

vii. Type 6 (4-bedroom) medium-income apartment prototype at Ebute-Metta, containing 6 habitable rooms has a rated capacity of 9.0 adult-equivalent occupants

(b) Design density based on Number of Bedrooms - This study is based on an occupancy index of 1.75 for low-income apartments, and 1.50 for medium-income apartments. Hence, the design density for different apartment types, based on bedroom indicator are:

i. Type 1 (2-bedroom) low-income apartment prototype at Abesan, containing 2 bedrooms has a rated capacity of 3.5 adult-equivalent occupants.

ii. Type 2 (2-bedroom) low-income apartment prototype at Dolphin II, containing 2 bedrooms has a rated capacity of 3.5 adult-equivalent occupants.

iii. Type 3 (3-bedroom) low-income apartment prototype at Abesan, containing 3 bedrooms has a rated capacity of 5.25 adult-equivalent occupants.

iv. Type 3 (3-bedroom) low-income apartment prototype at Abesan, containing 3 bedrooms has a rated capacity of 5.25 adult-equivalent occupants.

v. Type 4 (3-bedroom) low-income apartment prototype at Iba, containing 3 bedrooms a rated capacity of 5.25 adult-equivalent occupants

vi. Type 5 (3-bedroom) low-income apartment prototype at Dolphin II, containing 3 bedrooms rooms has a rated capacity of 5.25 adult-equivalent occupants

vii. Type 6 (4-bedroom) medium-income apartment prototype at Ebute-Metta, containing 4 bedrooms has a rated capacity of 6.0 adult-equivalent occupants

(c) Design density based on Combined Area of Habitable Rooms - the number of persons the apartments were designed to accommodate was obtained by interpolation from Table 2.5.

i. Type 1 (2-bedroom) low-income apartment prototype at Abesan, has a Combined Area of Habitable Rooms of 41.53 Square Metres. Therefore, the number of adult-equivalent persons the apartment was designed to accommodate is 4.52.

ii. Type 2 (2-bedroom) low-income apartment prototype at Dolphin II, has a Combined Area of Habitable Rooms of 52.53 Square Metres. Therefore, the number of adult-equivalent persons the apartment was designed to accommodate is 5.84.

iii. Type 3 (3-bedroom) low-income apartment prototype at Abesan, has a Combined Area of Habitable Rooms of 59.54 Square Metres. Therefore, the number of adult-equivalent persons the apartment was designed to accommodate is 6.68.

iv. Type 4 (3-bedroom) low-income apartment prototype at Iba, has a Combined Area of Habitable Rooms of 48.75 Square Metres. Therefore, the number of adult-equivalent persons the apartment was designed to accommodate is 8.26.

v. Type 5 (3-bedroom) low-income apartment prototype at Dolphin II, has a Combined Area of Habitable Rooms of 81.23 Square Metres. Therefore, the number of adult-equivalent persons the apartment was designed to accommodate is 9.72.

vi. Type 6 (4-bedroom) medium-income apartment prototype at Ebute-Metta, has a Combined Area of Habitable Rooms of 74.7 Square Metres. Therefore, the number of adult-equivalent persons the apartment was designed to accommodate is 8.79

(d) Design density based on Aggregate Area for Cooking, Eating, and Living (CEL) - the number of persons the apartments were designed to accommodate was obtained by interpolation from Table 2.7.

i. Type 1 (2-bedroom) low-income apartment prototype at Abesan, has an Aggregate Area of CEL of 19.2 Square Metre.s Therefore, the number of adult-equivalent persons the apartment was designed to accommodate is 0.5.

ii. Type 2 (2-bedroom) low-income apartment prototype at Dolphin II, has an Aggregate Area of CEL of 21.33 Square Metres. Therefore, the number of adult-equivalent persons the apartment was designed to accommodate is 0.5.

iii. Type 3 (3-bedroom) low-income apartment prototype at Abesan, has an Aggregate Area of CEL of 21.36 Square Metres. Therefore, the number of adult-equivalent persons the apartment was designed to accommodate is 0.5.

iv. Type 4 (3-bedroom) low-income apartment prototype at Iba, has an Aggregate Area of CEL of 25.17 Square Metres. Therefore, the number of adult-equivalent persons the apartment was designed to accommodate is 3.0.

v. Type 5 (3-bedroom) low-income apartment prototype at Dolphin II, has an Aggregate Area of CEL of 38.93 Square Metres. Therefore the number of adult-equivalent persons the apartment was designed to accommodate is 9.0.

vi. Type 6 (4-bedroom) medium-income apartment prototype at Ebute-Metta, has an Aggregate Area of CEL of 32.23Square Metres. Therefore, the number of adult-equivalent persons the apartment was designed to accommodate is 5.0

(e) Design density based on Total Area of Each Apartment - This study is based on the United Nations' stipulation of 7.0 square Metres of space per person in an apartment. Hence, the design density for different apartment types, based on Total Area of Apartment indicator are:

i. Type 1 (2-bedroom) low-income apartment prototype at Abesan, has a Total Apartment Area of 52.05 square Metres. Therefore, the number of adult-equivalent persons the apartment was designed to accommodate is 7.44.

ii. Type 2 (2-bedroom) low-income apartment prototype at Dolphin II, has a Total Apartment Area of 62.96 square Metres. Therefore, the number of adult-equivalent persons the apartment was designed to accommodate is 8.99.

iii. Type 3 (3-bedroom) low-income apartment prototype at Abesan, has a Total Apartment Area of 79.57 square Metres. Therefore, the number of adult-equivalent persons the apartment was designed to accommodate is 11.37.

iv. Type 4 (3-bedroom) low-income apartment prototype at Iba, has a Total Apartment Area of 67.6 square Metres. Therefore, the number of adult-equivalent persons the apartment was designed to accommodate is 9.66.

v. Type 5 (3-bedroom) low-income apartment prototype at Dolphin II, has a Total Apartment Area of 91.53 square Metres. Therefore, the number of adult-equivalent persons the apartment was designed to accommodate is 13.08.

vi. Type 6 (4-bedroom) medium-income apartment prototype at Ebute-Metta, has a Total Apartment Area of 107.49 square Metres. Therefore, the number of adult-equivalent persons the apartment was designed to accommodate is 15.36.

The occupancy thresholds for each of the six design types of LSDPC's housing units obtained in objective one represent the benchmarks beyond which occupants were likely to experience space deficits or overcrowding. The result also showed remarkable differences in the figures obtained from different computation techniques. These figures represent the programme theories that were evaluated in this research. They indicate how the apartments were designed to be occupied, which were not explicitly stated in any document of LSDPC as a policy guideline.

5.2 OBJECTIVE TWO: To determine the levels of occupancy of LSDPC's multifamily apartments in Lagos during usage.

Objective two was to determine whether LSDPC's multifamily apartments in Lagos were under-occupied, over-occupied or occupied as programmed in the design. This study provided a way to measure how the occupancy propositions have worked (that is, its effectiveness). In this way, a major concern regarding how far LSDPC's multifamily occupancy programme has succeeded or failed to meet the occupancy needs of users during habitation was brought to the fore. The findings are summarized in Table 5.1 and discussed according to the five measurement criteria adopted in this research, viz:

a) **Habitable rooms –** All the six apartment types investigated in this study were under-occupied for all household groups except two, where over-occupancy occurred. The two household types that experienced over-occupancy, using habitable room measurement indicator were households where the respondent's highest educational attainment were primary School and College of Education. Each of these two household types recorded an excess of 1.0 adult-equivalent occupant above the design density estimate. However, while the over-occupancy of 1.0 for respondents with primary School occurred in Type 3 (three-bedroom) at Abesan, the over-occupancy of 1.0 for respondents with College of Education occurred at Type 2 (2-bedroom) at Dolphin II Estate. There is no other apartment that was over-occupied, based on the number of habitable room measure.

As indicated, all other variables employed in this study showed under-occupancy. This implies that under these circumstances, the apartments were capable of accommodating more persons than currently exists. The four household classifications that had the highest level of under-occupancy were; (1) Persons of Ibibio ethnic background requiring additional 8.5 adult-equivalent occupants to attain its optimum design density rating, (2) Respondents above 65 years of age, requiring additional adult-equivalent occupants to attain its optimum design capacity, (3) Respondents with Primary School as the highest Education Level, requiring 8.75 additional adult-equivalent occupants to attain optimum design density, (4) Respondents who are government employees, requiring 8.9 additional adult-equivalent occupants to attain its optimum design density.

On the other hand, among the lowest level of under-occupancy, three household classifications required additional 1.75 adult-equivalent occupants to attain the optimum design density. The three were: Respondents who are widows; Respondents whose maximum educational level is College of

Education; Respondents who purchased their apartments through direct allocation originally from LSDPC. Two other household types with low under-occupancy figure were respondents belonging to age group 31-40 years requiring 1.17 additional adult-equivalent occupants and respondents who indicated “just single” in their marital status.

Thus, the estimate of under-occupancy was higher than over-occupancy. The range for under-occupancy was between 1.0 and 8.9 additional adult-equivalent occupants.

b) **Bedrooms –** The results show that each of the six apartment types investigated reported under-occupancy in some household types and over-occupancy in some other household types. The least record of under-occupancy required additional 0.25 adult-equivalent occupants. This situation involved: (1) High-income households in Type 2 (two-bedroom) apartments at Abesan, (2) Widow(er) households in Type 4 (three-bedroom) apartments at Iba, (3) Households headed by persons of Igbo and Edo ethnic origins in Type 5 (three-bedroom) apartments at Dolphin II. On the other hand, the highest record of under-occupancy required additional 4.5 adult-equivalent occupants. This situation involves households headed by persons of Edo ethnic origin in Type 6 (four-bedroom) apartments in Ebute-Metta. Hence, the range of under-occupancy in all the apartments investigated was from 0.25 to 4.50 to attain optimum design density.

The indicator of Number of Bedrooms also showed that all the apartment types were over-occupied in some households. The highest record of over-occupancy indicated an excess of 4.5 adult-equivalent occupants above what was estimated in the design. This occured in two instances. One instance was Type 2 (two-bedroom) at Dolphin II Estate, involving households where the highest educational attainment of the household head was College of Education. The other instance was Type 3 (three-bedroom) apartment at Abesan Estate involving households where the highest educational attainment of household head was Primary School. On the contrary, some apartments recorded very low excess figures above their design. The minimum of 0.050 over-occupancy was scored for Type 1 (two-bedroom) apartment involving households living in rented apartments. This was closely followed by an over-occupancy score of 0.082 for Type 2 (two-bedroom) apartments at Dolphin II estate. Two household types in Type 4 (three-bedroom) apartments at Iba scored 0.25. These were households headed by married persons, and households headed by persons who hadlived in their apartments for 21-25 years. Seven household types were over-occupied by 0.5 adult-equivalent occupants. These involved

a. Households headed by medium-income persons and households headed by persons employed by private firms in Type 1 (two-bedroom) apartments at Abesan Estate.

b. Households headed by self-employed persons, households headed by persons aged 51-65 years, and households headed by persons of either Igbo or Hausa-Fulani ethnic origin, all in Type 2 (two-bedroom) apartments at Dolphin II estate.

c. Households that have inhabited their apartment for 16 years to 20 years, in Type 6 (four-bedroom) at Ebute-Metta.

Table 5.1: Occupancy Status in Different Apartment Types

Apartment Type	Under-occupancy	Over-occupancy	Occupied as designed
Type 1 (two-bedroom) at Abesan	16 (59.3%)	11 (40.7%)	0 (0%)
Type 2 (two-bedroom) at Dolphin II	10 (30.3%)	21 (63.6%)	2 (6.1%)
Type 3 (three-bedroom) at Abesan	41 (97.6%)	1 (2.4%)	0 (0%)
Type 4(three-bedroom) at Iba	29 (87.9%)	4 (12.1%)	0 (0%)
Type 5 (three-bedroom) at Dolphin II	33 (91.7%)	3 (8.3%)	0 (0%)
Type 6 (four-bedroom) at Ebute-Metta	37 (94.9%)	2 (5.1%)	1 (3.1%)
TOTAL	166 (78.7%)	42 (19.9%)	3 (1.4%)

Generally, the study revealed that there was a higher spread of under-occupancy (78.7%, 166) than over-occupancy (19.9%, 42), based on Number of Bedroom indicator. This was clearly evident among five apartment types, the only exception being Type 2 (two-bedroom) at Dolphin II estate.

Table5.1 summarizes the levels of under-occupancy and over-occupancy among the six apartments.Thus, Type 3 (three-bedroom) apartment at Abesan exhibited the highest level of over-occupancy (2.1%). On the other hand, Type 2 (two-bedroom) at Dolphin II exhibited the lowest level of under-occupancy (30.3 %, 41), and the highest level of over-occupancy (63.6%, 21).

Only very few apartments were actually occupied as designed (1.4%, 3). These few were available in two apartment types namely, Type 2 (two-bedroom) at Dolphin II and Type 6 (four-bedroom) at Ebute-Metta. This represents an ideal or perfect situation. The household types that fit into this perfect situation for Type 2 (two-bedroom) at Dolphin II were those headed by persons above sixty-five years of age and those occupying apartments jointly owned by respondents and their spouses. In the case of Type 6 (four-bedroom) at Ebute-Metta, the household type that fits the perfect occupancy standard were those where the maximum educational attainment of household head was Secondary education.

The results of dwelling density, based on Number of Bedroom indicator suggest that Type 2 (two-bedroom) at Dolphin II was grossly ineffective. LSDPC should therefore discontinue its uses for future mass housing, until the design is reviewed.

Also, the effectiveness of Type 1 (two-bedroom) at Abesan was merely marginal. The design of this apartment type should equally be subjected to critical review before further mass productions. What was obvious from the use of Number of Bedroom indicator was that two-bedroom apartments investigated in this study were not as suitable as the three-bedroom, and four-bedroom apartments.

The study shows that three-bedroom apartments tended to be most suitable for the households in the study area.

c) **Combined Area of Habitable Rooms –** The summary of research results regarding the use of Combined Area of Habitable Rooms to establish dwelling density in selected LSDPC apartments shows that four out of six apartment types investigated were completely under-occupied, with no record of over-occupancy. These apartments areType 3 (three-bedroom) at Abesan, Type 4 (three-bedroom) at Iba, Type 5 (three-bedroom) apartment at Dolphin II, and Type 6 (four-bedroom) apartment at Ebute-Metta.

Even in the two other apartment types that recorded over-occupancy, the rate was highly skewed in favour of under-occupancy. Nevertheless, the distribution of the results shows that the lowest rung of performance was obtained from Type 1 (two-bedroom) at Abesan. This was closely followed by Type 2 (two-bedroom) at Dolphin II.

Even though the use of Combined Area of Habitable Rooms tended to exhibit more capacity to accommodate additional adult-equivalent persons, the result was consistent with the use of Number of Bedroom. Again this seems to imply that the Type 2 (two-bedroom) at Dolphin II was the least effective, in this context, followed by Type 1 (two-bedroom) at Abesan.

This proposition should be interpreted purely in relative terms. The record of over-occupancy was very marginal. Moreover, in the few instances where over-occupancy occured, the range was between 0.16 to 0.48 adult-equivalent occupants. These were found in Type 1 (two-bedroom) at Abesan for household headed by married persons. They were also be found in Type 2 (two-bedroom) at Dolphin II involving households where the highest educational attainment of household head was College of Education; or in households headed by “just singles”

The degree of under-occupancy could also be of interest in this research. The minimum level of under-occupancy was interpreted as the household that required the smallest number of adult-equivalent occupants to attain the optimum design density. In the present circumstance, this occurred in Type 2 (two-bedroom) at Dolphin II, involving two households headed by widow(ers) and households that live in apartments directly allocated to them originally by LSDPC.

On the other hand, the highest levels of under-occupancy were recorded in Type 4 (three-bedroom) at Iba. The household types were those where: (1) The household head's marital status is "Separated", (2) Marital status "Single Father", (3) Where the head of household is of Edo ethnic origin, (4) Where the owner of the apartment is a relative of those residing in it, (5) Where the occupants are the original also allottes of the apartment from LSDPC.

d) **Aggregate Area for Cooking, Eating, and Living (CEL) –** By applying this measurement option in this research, it was found that three apartment types were completely over-occupied in all household classifications. These are Type 1 (two-bedroom) at Abesan, Type 2 (two-bedroom) at Dolphin II, and Type 3 (three-bedroom) at Abesan. On the contrary, Type 5 (three-bedroom) at Dolphin II and Type 6 (four-bedroom) at Ebute-Metta were completely under-occupied for all household classifications. Type 4 (three-bedroom) at Iba was the only apartment type that had a mixture of over-occupancy and under-occupancy in different household types.

e) **Total Area of Apartment –** The use of this measurement indicator in this research showed that all the six apartment types investigated were under-occupied for all household classifications.

Understandably, this Indicator gave results that were directly proportional to the superficial area of each apartment. Since all apartments were under-occupied, the significance or impact of this measurement indicator could only be assessed in terms of the degree of under-occupancy. The highest record of under-occupancy occured in Type 6 (four-bedroom) at Ebute-Metta. This involved households headed by persons from Edo ethnic background, requiring 13.86 additional adult-equivalent occupants to attain optimum design density. This apartment type also recorded the next highest level of under-occupancy requiring 13.36 additional adult-equivalent occupants to attain optimum design density. Four household classifications were involved in this case. These are: Households headed by persons from Ijaw ethnic group, households headed by persons aged 41-50 years, households headed by unemployed persons and households headed by Government employees. For this type 6 (four-bedroom) apartments, the minimum record of under-occupancy required 8.36 additional adult-equivalent occupants. This occured in households that had stayed between 16 and 20 years in their apartments. This rating was not surprising given that Type 6 (four-bedroom) is 107.49 square metres in area. In contrast, the maximum occupancy for Type 1 (2-bedroom) requires 6.43 additional adult-equivalent occupants. This occured in three household types namely, households headed by persons aged 18-30 years, households headed by retired persons and apartments owned by relatives of occupants. The superficial area of Type 1 (2-bedroom) is 52.05 square metres. This area is less than one-half the area of Type 6 (four-bedroom) apartment.

The use of this measurement approach in this research showed that all the building types studied were under-occupied for all household classifications apart from one instance. The only exception was found in Type 4 (three-bedroom) apartments where male-headed households were over-occupied. The study hence shows that over-crowding tends to be more a function of male-headed households than dwelling size, and was concentrated in apartment Type 4.

In summary, the findings from objective two justify the recommendations by earlier researchers such as King (1994), and Batten (1999), that the same measure used to define overcrowding should also be applicable to under-occupancy. The finding from this study equally suggests that policies on housing occupancy standard and focus of research in Nigeria should recognize the existence of significant under-occupancy at one end of the housing scale and over occupancy at the other end.

5.3 OBJECTIVE THREE: To examine variations in dwelling densities of LSDPC's multifamily apartments in Lagos

The dwelling density for each of the six apartment types investigated in this study was determined, based on the number of adult-equivalent occupants per apartment. The actual or observed dwelling density during habitation across various design models is presented in two parts.

1) **Single Measure:** Table 4.8 shows the mean value of actual dwelling density extracted from the responses to the questionnaires for the different design models. The dwelling density for each of the six design models investigated in this study was determined, based on the number of adult equivalent occupants per apartment. The results from the least to the highest are:

Type 1 (two-bedroom) at Abesan = 3.31

Type 3 (three-bedroom) at Abesan = 3.36

Type 6 (four-bedroom) at Ebute-metta = 3.40

Type 4 (three-bedroom) at Iba = 3.77

Type 5 (three-bedroom) at Dolphin II = 4.14

Type 2 (two-bedroom) at Dolphin II = 4.17

Generally, the results show that there was no substantial disparity in the incidence of dwelling density (crowding) across design models. This finding was supported by the results of a chi-square test employed to evaluate the effect of apartment type on dwelling density. The result gave a chi-square figure of 10.525 and a P-Value of 0.396. Thus this study found that, at 95% confidence level, design model (apartment type) had no significant effect on dwelling density. However, it could be observed that the two design models at Dolphin II recorded the highest dwelling density. The Type 2 (two-bedroom) design model can therefore be regarded as facing the highest level of occupancy stress. On the other hand, the situation in Type 6 (four-bedroom) design model at Ebute-Metta showed that occupants were more likely to live in under-crowded conditions based on Number of Bedroom indicators.

2) **Group Measure:** The variability of dwelling density among the six design models investigated in this study was equally considered by grouping all the occupants into three categories. These are:

i. Households that harboured one to two adult-equivalent occupants.
ii. Households that harboured three to five adult-equivalent occupants.
iii. Households that harboured six or more adult-equivalent occupants.

The groupings were indicative of the intensity of occupancy in each apartment design model during habitation. The groupings were used as a basis for understanding and interpreting the variations in the dwelling density across various design models of LSDPC's multifamily apartments, during habitation. This was the focus of objective three, and question three of the present research. Therefore, the results of dwelling density groupings described below were taken as the outcome of research objective three, and research question three.

a) **Dwelling density grouping 3 - 5 persons:** Household size of three to five persons was the dominant in each of the six design models. Overall, 66% of all respondents fell into this group. The distribution was as follows: Type 1 (two-bedroom) at Abesan (78%), Type 2 (two-bedroom) at Dolphin II (67%), Type 3 (three-bedroom) at Abesan (66%), Type 4 (three-bedroom) at Iba (53%), Type 5 (three-bedroom) at Dolphin II (68%), Type 6 (four-bedroom) at Ebute-Metta (66%).

b) **Dwelling density grouping 1 - 2 persons:** Household size of one to two adult-equivalent persons was the second most dominant in four design models. The distribution was as follows: Type 1 (two-bedroom) at Abesan (17%), Type 3 (three-bedroom) at Abesan (25%), Type 4 (three-bedroom) at Iba (27%), Type 6 (four-bedroom) at Ebute-Metta (26%). Among these four design models, households that contain six or more persons were very few.

c) **Dwelling density grouping 6 persons and above:** Household size of six or more adult-equivalent persons was the second most dominant in only two design models. These are Type 2 (two-bedroom) at Dolphin II (27%), and Type 5 (three-bedroom) at Dolphin II (20%). These two design models incidentally, were located in Dolphin II housing estate. Apartments that harbour one to two persons were the least occurring in the two Types.

In **summary**, the findings from this study regarding dominant household size is consistent with claims by Asiyanbola (2010) that the average household size in Nigeria was 4.48, based on an analysis of National Population Commission household survey, 1995/1996. On the other hand, a comparison between the results of this research and Algeria's national average household size of 7.55 in 1988, based on Sibley-Behloul (2005)'s study reveals a substantial disparity between Nigeria and Algeria.

5.4 OBJECTIVE FOUR: To investigate the effect of occupants' household characteristics on dwelling density in LSDPC's multifamily apartments in the study area.

The idea was to find out how dwelling density in LSDPC's multifamily apartments correlated with occupants' household characteristics. In this study, the head of household was regarded as the reference point in determining the status and characteristics of households. Ten household characteristics were used as variables for this purpose. These are:

i) Gender of household head.

ii) Marital status of household head

iii) Socio-economic status of household head

iv) Ethnicity of household head

v) Length of stay in the apartment

vi) Ownership structure of apartment

vii) Mode of purchase of apartment

viii) Age of household head

ix) Education level of household heads

x) Employment status of household head

i) Gender of household head

The findings from this research indicate that households headed by males were most prevalent in all the apartment types. The percentage of female respondents was minimal. In fact, there were no female-headed households among the respondents in Type 5 (three-bedroom) apartments at Dolphin II. This trend seemed to be influenced by the prevailing social and cultural norms which encourage males more than females in property ownership. This result is consistent with findings of Illesanmi (2005).

A chi-square test, however, indicated that in all the six apartment types, the gender of household head had no significant effect on dwelling density, at 95% confidence level. Therefore, whether the household head is a male or female is not likely to be relevant in formulating an occupancy, or a crowding policy for LSDPC's multifamily apartments in future. This result is at variance with Baskerville (2001)'s study of spacious homes in early-twentieth-century Canada which found that female-headed households were more likely to live in less crowded apartments than male-headed households. It is reasonable to assume that the factor of time may have accounted for the difference.

ii) Marital status of household head

This study found that only two marital groups were dominant in all the six apartments. These are households headed by persons who are married, and persons who are “just single”. The third most available marital household type was the widow(er) and it was found in five apartment types. The fourth dominant household type was headed by divorced persons. This means that the dwelling density in these four household types should be of interest to LSDPC. A chi-square test, however, indicated that marital status of household head had no significant effect on actual dwelling density outcome during habitation in the six selected apartment types.

For the two most dominant household types, dwelling density in households headed by married persons was considered less than in households headed by just singles in three apartment types. These apartments are Type 2 (two-bedroom) at Dolphin II, Type 3 (three-bedroom) at Abesan, and Type 5 (three-bedroom) at Dolphin II. The results in these three apartment types were inconsistent with generally held belief that being married and presence of children leads to greater occupancy. On the other hand, among the other three apartment types dwelling density in households headed by married persons was higher than in households headed by just singles. The apartments are Type 1 (two-bedroom) at Abesan, Type 4 (three-bedroom) at Iba, and Type 6 (four-bedroom) at Ebute-Metta. This was consistent with previous research indications.

iii) Socio-economic status of household head

In this study, 81.5% of the respondents were expected to be low-income earners. None of the respondents was supposed to belong to the high income group, while only respondents living in

Ebute-Metta (18.5%) were supposed to be the only medium income group. The data from Table 4.11, however, reveals that contrary to expectation, only 20.6% (34) of the respondents were actually low-income. The implications are far reaching because policies targeted towards low income urban residents will end up largely with the medium and high income groups. One of the likely explanations was scarcity of the right type of accommodation, thereby escalating the resort to gentrification. The low-income apartments were harbouring more medium-income and high-income households. Similarly, the medium-income apartments were harbouring more high-income households. This is critical for policy formulation. The suspicion is that either the initial low-income occupants have now grown to higher levels, or they have moved away to slum neighbourhoods. This tends to suggest that LSDPC must take initiatives to forestall the disappearance of low-income households from its multifamily apartments. The social implications of not doing this are manifold.

The general understanding in urban housing studies is that occupancy rates (or crowding) are higher in Low-income households than in medium-income household. It is also taken for granted that occupancy rates in medium-income households are higher than in high-income households.

Results from the present study did not support this assertion. A chi-square test involving the six apartment types investigated reveals that at 95% confidence level, socio-economic income status of household head had no significant effect on the intensity of dwelling density. This tended to be true, irrespective of whether the apartment was two-bedroom, three-bedroom or four-bedroom. It is therefore important for LSDPC to realize that income status of household head is not a strong factor in predicting the likely level of occupancy in its multifamily apartments. The mix of income level of household heads found in this research was contrary to theoretical propositions. There was high preponderance of gentrification in all the apartment types investigated.

The results contradict the claim in New Zealand that overcrowding is a feature of poverty, because affordability limits families' ability to set up new households (Statistics New Zealand, n.d.). It is difficult, however, to wholesomely compare the results of the two studies because the present one is focussed on public housing while the previous was concerned with households in private occupied apartments.

iv) Ethnicity of Household Head

Households headed by persons from Yoruba ethnic group were the only type that could be found in all the six apartment types investigated. The research results however indicate that four ethnic groups of Yoruba, Igbo, Edo and Hausa Fulani constituted 91.4% of the total number of respondents. The policy implication is that housing provision should be targeted at meeting the harmonized needs of these four ethnic groups. The cultural traits and life styles that are common and acceptable to these four dominant groups should capture the attention of public housing providers in Lagos. The widespread speculation that Nigeria is made up of over 250 ethnic nationalities was not supported by the data from this study. Only 14 ethnic groups were represented among the 176 household heads who responded to questionnaire.

Disaggregating across groups reveals that no one ethnic group consistently maintained higher or lower dwelling density over the other groups across apartments. A chi-square test further reveals that ethnicity of household head did not have any significant effect on dwelling density, at 95% confidence level. This result contrasts with an earlier study by Myers et. Al. (1996) which found that crowded households with people of Pacific ethnicity, was 71.5% while 56.5%, was recorded for crowded households with people of European ethnicity, thus highlighting differences among ethnic groups in their apparent acceptance of higher levels of crowding. However, it is unclear from these findings how the different levels of crowding connote with affordability issues, obligations towards family members, personal preference or a combination of these factors.

The study found that over all, LSDPC should be mindful of patterns of occupancy of persons from Yoruba, Edo, Ibo and Hausa-Fulani ethnic origin. The design of apartments should lay emphasis on meeting the spatial needs of these ethnic groups as a baseline target.

v) Length of stay in the apartment

The results of this research show that at 95% confidence interval, the number of years a household had lived in an apartment did not have any significant effect on the dwelling density. Therefore, there was no guaranty that long-stay occupants in three-bedroom and four-bedroom apartments would exhibit higher dwelling density compared to new occupants.

vi) Ownership Structure of Apartment

The results from this research reflect the general cultural bias towards home ownership against the feminine gender in the study area. This result tends to suggest that apartments owned by spouses of household heads were rarely found among residents of two-bedroom apartments, no matter the location. Rather, persons belonging to this group seemed to favour three-bedroom and four-bedroom apartments.

In this study, the effect of how an apartment is owned on dwelling density was significant on only two bedroom apartments. These are Type 1 (two-bedroom) Abesan, and Type 2 (two-bedroom) at Dolphin II. Among the three bedroom apartments and the four bedroom apartments investigated in this research, the nature of ownership had no significant effect on dwelling density.

The strong influence of ownership structure on dwelling density tends to tally with results of earlier studies by Baskerville (2001) and Myers et. al. (1996), although these previous studies aggregated all the variables into two namely, owners and renters.

vii) Mode of Purchase of apartment

The research result shows that seven out of every thirteen respondents acquired their apartments through third party purchase from earlier allottees. This seemed to suggest a significant level of property transfer among residents of LSDPC apartments. It was, however, observed that such transfers occurred more in estates located within the metropolitan area, than those on the urban fringes. The results of a chi-square test indicate that at 95% confidence interval, the mode of purchase of LSDPC's apartments had no significant effect on dwelling density among respondents.

viii) Age of Household Head

The results show that all age groups were significantly available in LSDPC apartments chosen for this study. The result of a chi-square test reveals that at 95% confidence level, age of household head had no significant effect on dwelling density. These findings are important for LSDPC in its determination to improve the designs of its multifamily apartments.

As expected, a household headed by a senior citizen had a significant negative effect on dwelling density. Among the three apartment types where they reside, their households were either most under-occupied, or the second most under-occupied. This may be due to the exit of children from the houses.

ix) Education Level of Household Heads

Contrary to expectations this study found that the effect of education on the degree of under-occupancy was not consistent across various apartments. At 95% confidence interval, the education level of household head had significant effect on dwelling density in Type 3 (three-bedroom) at Abesan, and Type 5 (three-bedroom) at Dolphin II. On the contrary, the effect of education level of household head on dwelling density was not significant, at 95% confidence level for the remaining four apartment types namely, Type 1 (two-bedroom) at Abesan, Type 2 (two-bedroom) at Dolphin II, Type 4 (three-bedroom) at Iba and Type 6 (four-bedroom) at Ebute-Metta.

Ordinarily, it is expected that high school education for the head of the household should reduce the dwelling density, and university education should further reduce this. The findings from the present study somehow supported this expectation. Possession of a university degree is a strong indication that an apartment was more likely to experience lower occupancy level.

x) Employment Status of Household Head

The study shows that LSDPC apartments were substantially occupied by working class persons or retired heads of households. The agency however, needs to understand the relationship between the different employment categories and dwelling density. At 95% confidence interval, the study reveals that employment level of household head had significant effect on dwelling density in Type 3 (three-bedroom) apartment at Abesan. On the other hand, the effect of household head's employment level on dwelling density was found to be insignificant on five other apartment classifications. These are Type 2 (two-bedroom) at Dolphin, Type 4 (three-bedroom) at Iba, Type 5 (three-bedroom) at Dolphin II, and Type 6 (four-bedroom) at Ebute-Metta.

Results equally indicate that households headed by persons in government employment were more likely to experience lower dwelling density than households headed by persons that were self-employed. Households headed by private firm employees had the highest dwelling density in the two-bedroom apartments, and the lowest dwelling density in two out of three of the three-bedroom apartments studied. These findings are significant for LSDPC in understanding the match between apartment types and employment status of household head, as they relate to dwelling density.

Summary of Objective Four finding: Ten household characteristics were tested to determine their effect on dwelling density in each of the six apartments investigated in this research. Only three household characteristics were observed to have significant effect on dwelling density in selected apartments.

a) How apartment is owned had significant effect on Type 1 (two-bedroom) at Abesan, Type 2 (two-bedroom) at Dolphin II.

b) Education Level of Household head had significant effect on Type 3 (three-bedroom) at Abesan, and Type 5 (three-bedroom) at Dolphin II.

c) Employment Level of Household head had significant effect on Type 3 (three-bedroom) at Abesan.

Following these findings, a case can be made that for LSDPC's future multifamily apartments to be meaningful, these three household demographic characteristics must not be ignored. They are the hallmarks of middle class. Therefore dwelling density in LSDPC's apartments can be consistently enhanced by not only addressing housing policy but also ensuring that the issue of social policy in the areas of education and employment are of significant concern.

5.6 CONTRIBUTIONS TO KNOWLEDGE

1. This study provided a set of evidence-based criteria for determining the design density of internal spaces in residential apartments.

2. To the best of the researcher's knowledge, the study revealed for the first time that LSDPC's apartments were substantially under-occupied, contrary to general perception.

3. The study provided evidence-based decision parameters for determining optimum apartment sizes in relation to household sizes, in the design of public housing.

4. The study revealed three household variables that significantly affect dwelling density, which have to be taken into consideration by public housing developers in Lagos.

CHAPTER SIX

6.0 CONCLUSION AND RECOMMENDATIONS

6.1 CONCLUSION

Dwelling density is regarded as one of the most important residential quality index factors. The aim of the present evaluation study was to compare the actual dwelling density in six selected multifamily apartments during habitation, with explicitly stated dwelling density criteria at the planning and design stage. From the findings of this study, the following conclusions are made:

1. The study discovered that the six multifamily apartments investigated were developed by LSDPC without how the apartments were designed to be occupied. Inconsistencies in the estimation of housing space needs were largely because comparative analyses by previous researchers were not based on common denominators. For occupancy postulations to be meaningful, the benchmark indicators should be cited. This study has identified five distinct indicators that can be applied to minimize the ambiguities surrounding research outputs in this area. The five indicators are: Number of habitable Rooms; Number of Bedrooms; Combined Area of Habitable Rooms; Aggregate Area of Rooms for Cooking, Eating, and Living (CEL); and Total Area of Each Apartment.

   The rated capacity or occupancy benchmarks for each apartment covered in this research was obtained by inference based on the five measurement criteria.

2. The current study raises a new focus on certain contradictions in the way previous researchers interpreted what constitutes “a person”, in their attempt to measure the “number of persons” in an

apartment. This has often resulted in unreliable computations, with adverse implications for policy formulation. The present study found the concept of "adult-equivalent number of persons" to be contextually more appropriate than "number of persons". The contradiction surrounding the use of "number of persons" probably explains why most previous research results declared that public housing units in Nigeria were over-crowded. The present research on LSDPC's multifamily apartments was based on "adult-equivalent number of occupants". The results reveal an unexpectedly high degree of under-occupancy, in comparison to over-occupancy. Claims that over-crowding exists in LSDPC's multifamily apartments were probably associated with families where children, above one year and below eighteen years were assigned rooms inappropriately.

What was obvious from the use of Number of Bedroom and Combined Area of Habitable Rooms indicators was that two-bedroom apartments investigated in this study were not as suitable as the three-bedroom, and four-bedroom apartments. The three-bedroom apartments tended to be most suitable for the households in the study area. The results obtained by applying Aggregate Area for Cooking, Eating, and Living (CEL) and Total Area of Apartment were diametrically opposed. While CEL gave substantial over-occupancy, the use of Total Area of Apartment indicator showed that all the six apartment types investigated were largely under-occupied.

3. Generally, the apartment design model and location did not significantly affect dwelling density in LSDPC's estates. In other words, there was no substantial disparity in the incidence of dwelling density (crowding) across design models. The study found that household size of 3-5 persons was dominant in each of the six design models investigated. Household size of one to two adult-equivalent persons was the second most dominant in four design models while households that contain six or more persons were very few. These demographic data are relevant for policies regarding provision of infrastructure and other complementary facilities in the estates to improve

residents' quality of life. Regarding the welfare of households in LSDPC's estates, it may be necessary to increase the funding for selected public services (e.g., schools, trash collection, and parking provision).

4. The conclusions based on occupants' household characteristics are as follows:

Gender of household head: Households headed by males were most prevalent in all the apartment types. This trend seemed to be influenced by the prevailing social and cultural norms which encourage males more than females in property ownership. This result was consistent with findings of Illesanmi (2005) that the predominance of male-headed household, accords with the traditional notion which regards men as heads of households. Whether the head of household is a male or female was not relevant in formulating an occupancy policy for LSDPC's multifamily apartments in future as this study showed that dwelling density was not significantly affected by gender of household head.

Marital status of household head: This study found dwelling density in four dominant household types should be of interest to LSDPC. These are households headed by persons who are married, persons who are "just single", the widow(er), and "Separated" or "Divorced". Marital status of household head had no significant effect on dwelling density outcome during habitation.

The close link between "Separated" and "Divorced" was revealed in this research, as both household types were not found among respondents living in two-bedroom apartments. This shows that divorced households were more likely to occupy three-bedroom and four-bedroom housing units.

In the study area, single fatherhood and single motherhood were regarded as an aberration. The cultural reluctance in accepting the reality of these emerging types of household was reflected in the paucity of respondents in these categories.

Socio-economic status of household head: The mix of income level of household heads found in this research was contrary to theoretical propositions. 81.5% of the study respondents were expected to be low-income earners while the remaining 18.5% were supposed to belong to medium income group. Contrary to expectation, however, only 20.6% were actually low-income, suggesting high preponderance of gentrification. The implications are enormous, because policies targeted towards low income urban residents will end up largely with the medium and high income groups. This tends to suggest that LSDPC must take initiatives to forestall the disappearance of low-income households from its multifamily apartments. The social implications of not doing this are manifold.

Ethnicity of Household Head: Of the 14 ethnic groups that were found to inhabit the investigated apartments, households headed by persons from Yoruba, Igbo, Edo and Hausa Fulani ethnic groups constituted 91.4% of the total number of respondents. The implication is that LSDPC's housing design should lay emphasis on meeting the spatial needs of these four dominant ethnic groups. Disaggregating across groups, however, reveals that ethnicity of household head did not have any significant effect on dwelling density.

Length of stay in the apartment: The number of respondents in the estates decreases according to length of stay. Respondents who have lived in the selected estates for sixteen years or less constitute about 75%. It is likely that LSDPC's apartments served as first accommodation for households in early stages of family life-cycle. The tendency to move therefore increased as the length of stay increased, if the wherewithal was available. The study, however found that the number of years a household had occupied an apartment had no significant effect on dwelling density.

How apartment is owned: The two most dominant ownership structures that constitute 84% of the respondents were household head and rent. The results from this research reflected the general cultural bias towards home ownership against the feminine gender in the study area. The practice where apartments are owned by female spouses or jointly owned by both spouses does not command general acceptability in Nigeria. Among most of the apartments investigated in this research, the nature of ownership had significant effect on dwelling density.

Mode of Purchase of apartment: The study found a significant level of property transfer among residents of LSDPC's apartments, particularly in estates located within the metropolis. The mode of purchase of LSDPC's apartments had no significant effect on dwelling density among respondents.

Age of Household Head: ***A**ge of household head had no significant effect on dwelling density. As expected, a household headed by a senior citizen had a significant negative effect on dwelling density. Among the three apartment types where they reside, their households were either most under-occupied, or the second most under-occupied.

Education Level of Household Heads: This study found that the education level of household head had significant effect on dwelling density. Possession of a higher degree was a strong indication that an apartment was more likely to experience lower occupancy level.

Employment Status of Household Head: The study shows that LSDPC needs to understand the relationship between different employment categories and dwelling density. The study revealed that employment level of household head had significant effect on dwelling density. These findings are significant for LSDPC in understanding the match between apartment types and employment status of household head, as they relate to dwelling density.

6.2 RECOMMENDATIONS

- The present research identifies design density as a quality index factor that LSDPC needs to consider at the design stage of its multifamily housing units. The design density estimates for existing multifamily apartments were obtained by inference, to provide a knowledge-base and guidance regarding performance of spaces in the agency's multifamily housing units. It is recommended that LSDPC initiates a policy framework to standardize these design density data, to serve as quantitative technical performance guideline for future multifamily apartment designs. Through this approach design density will be established as an essential component of best practice in LSDPC. It is further recommended that the data should be readily available for use across other housing development initiatives and facilities.

- There have been many cases where earlier results of dwelling density postulations became unreliable due to broad differences in the interpretation of what constitutes "number of persons" in an apartment. This has affected LSDPC in the sense that its multifamily apartments were generally classified as over-occupied (over-crowded); whereas evidence from the present study shows that the apartments were, in fact, under-occupied. To maintain consistency, it is recommended that the norms applied in this study regarding "adult-equivalent number of persons" should be standardized and adopted for use by LSDPC in particular, and Nigerian housing industry in general. This will make it possible to interpret occupancy outcomes across design types and across cities or countries.

- Disaggregating across dwelling density groupings in LSDPC's housing estates provides a relevant backdrop to some policy issues that relate apartment types to household sizes. It is recommended that policy should be fine-tuned to ensure that household sizes and apartment sizes are properly matched in the agency's future housing schemes. Thus two-bedroom apartments should be matched with household sizes 1-2 persons. Similarly, three-bedroom apartments should be matched with household sizes 3-5 persons, while four-bedroom apartments should be the best match for household sizes 6 persons and above. The results of the present study suggest that an appropriate mix of 21.0% (two-bedroom), 66.5% (three-bedroom), and 12.5% (four-bedroom) already exists in the housing estates investigated. The three bedroom typology is highly favoured. The need for one-bedroom apartments is also evident from the study; to form part of the 21.0% allotted to two-bedroom typology. A focus on policies that encourage these proportions is likely to serve the goal of space efficiency in addition to enhancing housing quality and quality of life.

- This study demonstrates that a portfolio of household characteristics could be beneficial for LSDPC in its effort to improve the spaces of its future apartments. Disaggregating the ten household types investigated can assist LSDPC in establishing standards that define intensity of occupancy for its multifamily apartments. Policy should focus on particular household characteristics that impact on dwelling density.

  It is recommended that social policies in the areas of education and employment should be integrated into LSDPC's housing provision initiatives, to enhance the dwelling density of its apartments. Also, the results of this study suggest that tenure is a strong determinant of dwelling density. Therefore, LSDPC should embark on policies that focus on ownership structure of its multifamily apartments.

  This study exposes the radical and rapid changes that have taken place in the socio-economic character of households living in LSDPC's housing estates. The present situation reveals that only 20.6% of respondents were low-income instead of 81.5% expected. The implication of this wide disparity is that policies targeted towards low income urban residents will hardly get to them. Therefore, LSDPC must be interested in forestalling the disappearance of low-income households from its multifamily dwelling units. It is recommended that LSDPC should focus on policies that will reverse this trend and reduce high level of gentrification.

- It is suggested that post-occupancy evaluation should be adopted as an essential component of best practice in LSDPC to enhance the efficiency and effectiveness of spaces in its future multifamily housing designs. Since post-occupancy evaluation addressed in this study relates to performance standard, it can be adopted in other parts of Nigeria or countries with similar demographic inclinations.

6.3 SUGGESTIONS FOR FURTHER RESEARCH

This research has identified certain issues that could not be exhaustively addressed or investigated due to the scope of the study. Emerging aspects that may require further research consistent with evaluation of dwelling density in multifamily apartments are discussed below.

1. The current research involves identifying the estimates of dwelling density at design phase in LSDPC's multifamily apartments. This may provide significant information to designers regarding the physical attributes of an apartment's internal spaces. Five measurement indicators were identified and used through the course of this research to establish the design density of LSDPC's multifamily apartments: (i) Number of Habitable Rooms, (ii) Number of Bedrooms, (iii) Combined Area of Habitable Rooms, (iv) Aggregate Area of CEL, (v) Total Area of Each Apartment. The outcome shows that the results are not consistent, suggesting that a lot is yet to be discovered about the indicators. Continued research into these measurement indicators would reveal quantitatively, the extent of variability of results across different criteria. This may reveal the extent to which one measurement indicator is more reliable than the other.

2. The evidence from present study shows that LSDPC's multifamily apartments are substantially under-occupied, thereby suggesting that less spacious homes were needed. The focus on "sufficient space" or "surplus space" in this research was based purely on objective quantitative measurements. The total exclusion of subjective qualitative indicators raises several unanswered questions that further research should address. Further research will be needed on how to integrate objective and subjective measures into assessing occupancy levels in LSDPC's multifamily apartments. Attention of research should hence extend to psychological and social aspects of estimating whether LSDPC's multifamily apartments are under-occupied, over-occupied or occupied as designed. It is also important that future research should be directed towards unravelling the implications of these conditions.

3. Findings on the intensity of crowding were focused on classifying household sizes into three categories namely (a) 1-2 occupants, (b) 3-5 occupants, and (c) 6, or more occupants. A major limitation is that the study is based on a snapshot of household composition at a given period – the time of the survey. Further research may be relevant to investigate the extent to which the results obtained from the present research match the way in which households are composed over a longer range of time during their life-course. Detailed evaluation of spatial behaviour of the three household categories identified in this study should also be of concern to future researchers, as this will affect intricate policy decisions regarding appropriate apartment types and designs.

4. One of the overall findings of this study is the great importance of household characteristics in explaining the incidence of dwelling density in LSDPC's housing estates. The argument presented

is that household characteristics are an integral part of interpreting and predicting dwelling density in LSDPC's housing estates. Therefore, rather than classify households solely by income group, LSDPC should allow for more diverse social expressions. As would be expected, the incidence of dwelling density is not spread evenly across household types. Instead, the problem affects certain types of households more than others. Further research that focuses on a number of different household characteristics may be required, to examine in detail why some have much higher incidences of crowding. Such research outcomes will assist policy makers in understanding households that are burdensome and more likely to experience higher level of crowded living conditions than others. Policy should expectedly be fine-tuned to recognize and deal with the particular needs of each household characteristic.

5. The current study is restricted to public housing provision in Lagos. It may not be easily applicable to similar designs in the less urbanized environments. Further research that focuses on public housing in rural settings may be required, to increase the authenticity of the findings by comparing the results.

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Appendix 1-1

QUESTIONNAIRE

TITLE**: A Post-Occupancy Evaluation of Dwelling Density in Multifamily Apartments in Public Housing Estates in Lagos**

Preamble

The Department of Architecture, University of Lagos, is currently engaged in a research on evaluation of occupancy level in LSDPC's multifamily apartments. The aim is to understand how the interior spaces of the apartments are utilized by occupants, with a view to establishing how far the spaces provided are adequate for normal household functioning.

A sample of apartments like your own has been outlined to obtain views on this issue, estimating that it will take less than fifteen minutes to complete the questionnaire. We hope you will want to collaborate in this investigation. Please be assured that your name, and the information supplied by you, will not be revealed or used for any purpose other than this research work.

If you want a summary of the results of this research when published, kindly provide your name and address at the end of this questionnaire.

Accept our thanks, please.

ANTHONY, C. O. **IWEKA**

SECTION A: HEAD OF HOUSEHOLD'S PERSONAL INFORMATION

For questions 1 – 5, please put a tick in the appropriate box

1. The location of this estate is

   Abesan ☐ Iba ☐ Ebute-Metta ☐ Dolphin II ☐

2. What classification category does your apartment belong

   Two-bedroom ☐ Three-bedroom ☐ Four-bedroom ☐

3. Gender of head of household: male ☐ female ☐

4. How would you describe your marital status?

- ☐ Married
- ☐ Separated
- ☐ Divorced
- ☐ Widow(er)
- ☐ Single mother
- ☐ Single father
- ☐ Just single
- ☐ Others (specify)

5. Apart from you are there other persons living in this apartment who are married? Yes ☐ No. ☐

If the answer to question 5 is yes, please answer question 6

6. Excluding yourself (the head of household), please give details of the number and sex of other persons in your household who are married or widowed.

	Male Number	**Female Number**
Your spouse		
Your children		
Your relatives		
Your parents		
Grand parents		
Your parents'-in-law		
Others (specify)		

7. State of Origin ---------------------------------

8. Local Government Area of Origin --

9. How would you describe your average monthly income?
- ☐ Less than #45,000.00
- ☐ #45,000.00 and above, but less than #100,000.00
- ☐ #100,000.00 and above

For questions 10 – 17 Please put a tick in the appropriate box

10 Which of these best describes the ethnic group of head of household?

☐ Yoruba	☐ Ibibio
☐ Hausa-Fulani	☐ Kanuri
☐ Igbo	☐ Tiv
☐ Ijaw	☐ Ebira-Nupe
☐ Edo	☐ Others (specify)

11. How long have you lived in this apartment?

0-5 years	6-10 years.	11-15 years	16-20 years.	21-25 years.	26-30 years.	Above 30 years.
☐	☐	☐	☐	☐	☐	☐

12. How is this apartment owned?
- ☐ Owned by household head
- ☐ Owned by a spouse
- ☐ Jointly owned by head of household and spouse
- ☐ Owned by a child
- ☐ Owned by a relative
- ☐ Household rented the apartment

13. If you own it, please indicate the mode of ownership.
- ☐ Originally purchased from LSDPC
- ☐ Purchased from previous private owners

14. Please indicate your age as of your last birthday.

☐ Less than 18 years	☐ 41 – 50 years
☐ 18 – 30 years	☐ 51 – 65years
☐ 31 – 40 years	☐ Above 65 years

15. Which of these best describes the highest level of education of the head of household?

☐ Below primary	☐ College of education
☐ Primary school	☐ Polytechnic
☐ Secondary school	☐ University

16 Which of these best describes the employment status of head of household?

- [ ] Self employed
- [ ] Retired or Pensioner
- [ ] Private firm employee
- [ ] Government employee
- [ ] Daily paid casual Worker
- [ ] Unpaid family work
- [ ] Unemployed

SECTION B: DWELLING & HOUSEHOLD CHARACTERISTICS

17. Including yourself, please provide details about persons *who usually live* in this apartment on regular basis whether presently at home or on holiday, or away at school, or at hospital.

Age	Male Number	Female Number
Under 1 year old.		
1 year and above but below 5 year		
5 years and above but below 10 years		
10 years and above but below 12 years		
12 years and above but below 18 years		
18 years and above but below 65 years		
Above 65 years		

18. Among all the members of your household listed in your answer to question 21, is any of them here on a short visit of less than 3 months?

Yes [ ] No [ ]

19. If the answer to question 22 is yes, please provide details of such persons who are here on a short visit of less than 3 months.

Age	Male Number	Female Number
Under 1 year old.		
1 year and above but below 5 year		
5 years and above but below 10 years		
10 years and above but below 12 years		
12 years and above but below 18 years		
18 years and above but below 65 years		
Above 65 years		

20. Excluding you (the head of household) please indicate the employment status of other household members who are 18 years and above

	Male Number	Female Number
Working		
Retired		
Unemployed		
Schooling		

21. What year did you move into this apartment? ……………………

22. Overall, how many people live in your apartment, including you? ……………

NAME & CONTACT ADDRESS (OPTIONAL)

……………………………………………….…………………………………………

……………………………………………………………..……………………………………

…………………………………………………………………………..

Appendix 3 -1

Determining Sample Size From Given Population
Source: Krejcie and Morgan (1970) p. 608

N	S
10	10
15	14
20	19
25	24
30	28
35	32
40	36
45	40
50	44
55	48
60	52
65	56
70	59
75	63
80	66
85	70
90	73
95	76
100	80
110	86
120	92
130	97
140	103
150	108
160	113
170	118
180	123
190	127
200	132
210	136

N	S
220	140
230	144
240	148
250	152
260	155
270	159
280	162
290	165
300	169
320	175
340	181
360	186
380	191
400	196
420	201
440	205
460	210
480	214
500	217
550	226
600	234
650	242
700	248
750	254
800	260
850	265
900	269
950	274
1000	278
1100	285

N	S
1200	291
1300	297
1400	302
1500	306
1600	310
1700	313
1800	317
1900	320
2000	322
2200	327
2400	331
2600	335
2800	338
3000	341
3500	346
4000	351
4500	354
5000	357
6000	361
7000	364
8000	367
9000	368
10000	370
15000	375
20000	377
30000	379
40000	380
50000	381
75000	382
1000000	384

Note:

N = Population size
S = Sample size