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# THE NATURE OF HIGHRISE RESIDENTIAL ESTATES: A COMPARATIVE ANALYSIS OF DESIGN CHARACTERISTICS AND TYPOLOGIES

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## Abstract

This study examines the nature of high-rise residential estates through a comparative analysis of seven case studies selected from Nigeria, Italy, Australia, and Israel. Using a mixed-method research approach, the study evaluates building height distribution, apartment typologies, provision of essential services, prototype variation, and building orientation patterns. Qualitative methods included visual observation, architectural analysis, and case study examination, while quantitative methods involved descriptive statistical analysis of measurable building characteristics. The findings reveal those high-rise residential buildings within the selected cases range between 14 and 34 storeys. Nigerian examples predominantly fall within the 14–26 storey range, whereas international examples demonstrate greater verticality. Two-bedroom and three-bedroom apartments were identified in all case studies (100%), indicating a universal preference for family-oriented housing. Essential facilities such as elevators, staircases, balconies, terraces, and parking were also universally provided across all developments. Prototype variation differed significantly among the case studies: 1004 Housing Estate contained six prototypes, Eko Court Complex had three, Bosco Verticale and One Central Park featured two each, while Bourdillon, A&A Towers Eko, and Tel Aviv Tower each adopted a single prototype configuration. In terms of orientation, 71% of the buildings adopted a north–south orientation to optimize ventilation and solar control. The study contributes baseline typological data for understanding contemporary high-rise residential development and provides practical recommendations for architects, urban planners, and policymakers involved in vertical housing design.

**Keywords:** High-rise residential estates; building typology; vertical housing; architectural design; residential towers; urban housing

## Introduction

Urbanization remains a dominant force shaping the spatial and socio-economic structure of contemporary cities. Recent global estimates indicate that over 55% of the world's population resides in urban areas, with projections suggesting an increase to approximately 68% by 2050 (United Nations, 2023). This rapid urban growth has intensified pressure on limited land resources, particularly in rapidly expanding metropolitan regions. In response to these constraints, high-rise residential developments have emerged as a viable and strategic solution for accommodating increasing urban populations while optimizing land use efficiency. High-rise residential

architecture has long been adopted in cities such as Singapore, Hong Kong, New York, Tokyo, and Shanghai, where land scarcity and economic considerations necessitate vertical development. Beyond their role in maximizing land use, high-rise residential estates embody complex design systems that integrate structural innovation, spatial organization, functional typologies, and building technologies. These elements collectively influence the performance, livability, and sustainability of vertical housing environments.

In recent years, policymakers and housing authorities have increasingly recognized the significance of high-rise developments in addressing mass housing demands (Dangiwa, 2024). Consequently, understanding the design characteristics and typological variations of such developments has become essential for informing effective housing strategies. Despite this growing relevance, there remains a limited body of comparative research that systematically examines the architectural and functional attributes of high-rise residential estates across different geographical contexts. This study addresses this gap by undertaking a comparative analysis of selected high-rise residential estates. It focuses on key parameters including building height distribution, apartment typologies, provision of essential services (such as elevators, staircases, balconies, terraces, and parking facilities), prototype variations, and building orientation patterns. By establishing a set of baseline typological characteristics, the study aims to contribute to the existing body of knowledge and provide practical insights for architects, urban planners, and policymakers involved in the design and development of high-rise residential environments.

**Definition of High-Rise Buildings**

The definition of a high-rise building extends beyond height alone to include structural, technological, and regulatory considerations. The Council on Tall Buildings and Urban Habitat (CTBUH, 2022) defines a high-rise building as a structure that is significantly taller than surrounding buildings and requires mechanical vertical transportation systems such as elevators. Regulatory definitions vary across countries. In the United States, buildings exceeding 75 feet (23 meters) are classified as high-rise buildings under NFPA fire safety regulations. In the United Kingdom, buildings above 18 meters qualify as high-rise structures. In architectural literature, buildings exceeding 12 floors or approximately 36 meters are generally considered high-rise developments.

## Structural and Mechanical Characteristics

The unique nature of high-rise buildings comes out clearly in the unique structural and mechanical systems employed to keep the building stable and working. Smith and Coull (2021) highlight various structural systems such as rigid frame, shear wall, braced frame, tube and tube with outrigger and core systems among others which add great rigidity and stability to high-rises. The employment of these systems allows the buildings to become extremely tall but safe. The unique nature of high-rises can be reinforced through the use of unique mechanical support systems. This involves the use of elevators and similar devices that facilitate vertical transportation, artificial air conditioning system, installation of firefighting equipment, evacuation facilities, and pressurized water pumps. Other facilities like waste management infrastructure also help in making the high-rise buildings unique compared to low-rises.

## Typologies of High-Rise Residential Buildings

Residential high-rise buildings may be categorized according to spatial organization, structural configuration, functional complexity, and circulation patterns. Pfeifer and Brauneck (2015) classify residential typologies into high-rise towers, courtyard housing, row houses, and townhouse systems. Common high-rise residential typologies include:

**Apartment Tower Model:** This model consists of vertically stacked apartment units organized around a central circulation core containing elevators and staircases.

**Podium-Tower and Mixed-Use Developments:** These developments combine residential towers with podium structures accommodating commercial spaces, recreational facilities, parking, and community services.

**Clustered High-Rise Developments:** This typology involves multiple residential towers arranged around shared communal spaces such as gardens, plazas, or courtyards.

Nguyen (2025) further emphasizes the importance of circulation spaces, corridors, and threshold configurations in shaping social interaction and environmental quality within high-rise housing.

## High-Rise Development in the Nigerian Context

Rapid urbanization, population growth, and land scarcity have accelerated the development of high-rise residential estates in Nigerian cities such as Lagos, Abuja, and Port Harcourt. Government housing policies increasingly acknowledge vertical housing as a viable solution to urban housing shortages. The Renewed Hope Cities and Estates Programme introduced in 2024

aims to deliver large-scale housing developments nationwide. This initiative reflects growing policy support for mass housing schemes incorporating vertical residential structures. Studies on Nigerian high-rise developments have highlighted sustainability challenges. Ekhaese and Adewale (2025) observed that many high-rise condominiums in Lagos rely heavily on mechanical ventilation rather than passive environmental strategies. Similarly, Chukwujindu, Bansal, and Kasiraman (2023) found limited adoption of bioclimatic design principles in selected Nigerian high-rise residential buildings.

**The Strategic Importance of Vertical Urban Development**

The strategic value of high-rise construction in the urban context of Nigeria has gained attention from both urban planners and policymakers. In his advocacy for a paradigm change in the development strategy of Nigeria, Adeoye (2026) argues for vertical growth through the creation of skyscrapers, which according to him can help foster industrialization and economic development. Highlighting the adverse impacts that horizontal growth through sprawling cities such as Lagos, Ibadan, Abuja, and Port Harcourt have experienced, Adeoye calls for a paradigm shift towards vertical growth which he considers sustainable in comparison to other methods. Importantly, Ibadan City is one city in Nigeria that is suited to grow vertically given its expansive land area and rising economic power with specific emphasis on areas like the central business district and Ring Road. According to the Council on Tall Buildings and Urban Habitat, high-rise residential construction has several benefits in relation to land use, infrastructure development, and urban housing.

**Materials and Methods**

This study adopted a mixed-method research approach, integrating both qualitative and quantitative techniques to achieve a comprehensive analysis. The qualitative component involved visual and architectural assessments, supported by photographic documentation and detailed case study analysis of seven high-rise residential buildings. These methods enabled an in-depth understanding of design characteristics and spatial configurations. Case study methodology is widely recognized for its effectiveness in examining real-world contexts (Veal, 2006), and its relevance in architectural research has been emphasized by Oliugbo (2010).

The quantitative component focused on the systematic collection of measurable data. Key variables included building height (number of floors), apartment typologies (ranging from one-

bedroom to five-bedroom units), unit prototype variations (number of distinct layout designs), building orientation (north–south or east–west), and the availability of essential amenities such as elevators, staircases, balconies, terraces, and parking facilities. A purposive sampling technique was employed to select the case studies, ensuring both relevance and diversity. The sample comprised four buildings located in Lagos, Nigeria (1004 Housing Estate, Bourdillon Ikoyi, Eko Court Complex, and A&A Towers Eko), and three international examples: Bosco Verticale in Milan, Italy; One Central Park in Sydney, Australia; and Tel Aviv Tower in Israel. This selection provided a broad geographical representation for comparative analysis.

**Table 1: List of Case Studies**

| S/N | Name | Location | Country |
|---|---|---|---|
| *1* | 1004 Housing Estate | Lagos | Nigeria |
| *2* | Bourdillon, Ikoyi | Lagos | Nigeria |
| *3* | Bosco Verticale | Milan | Italy |
| *4* | One Central Park | Sydney | Australia |
| *5* | Tel Aviv Tower | Tel Aviv | Israel |
| *6* | Eko Court Complex | Lagos | Nigeria |
| *7* | A&A Towers Eko | Lagos | Nigeria |

Data collection utilized multiple instruments, including scholarly journal sources and structured observational methods guided by a comprehensive checklist. The collected data were analyzed using descriptive statistical techniques, with frequencies and percentages computed for each variable across the seven case studies. The results were subsequently presented using charts to enhance clarity and facilitate comparison.



***Figure 1**: 1004 Housing Estate, Lagos Nigeria. Source: Wikipedia*



***Figure 2:** Bosco Verticale, Milan Italy. Source: Pedestal*



***Figure 3:*** *One Central Park, Syndey Australia. Source: ArchDaily*

## Results and Discussion

### Building Height Distribution

The analysis of building heights across the seven case studies reveals a distinct pattern in vertical development between the Nigerian and international examples (Figure 4). The results indicate that high-rise residential buildings within the sample range from 14 to 34 storeys. The Nigerian case studies, 1004 Housing Estate, Bourdillon, Eko Court Complex, and A&A Towers Eko are predominantly concentrated within the mid-rise to lower high-rise category, spanning approximately 14 to 26 storeys. This suggests a relatively moderate approach to vertical residential development within the local context.

In contrast, the international case studies exhibit a greater degree of verticality. For instance, Tel Aviv Tower reaches 33 storeys, representing the upper limit within the dataset. Similarly, Bosco Verticale and One Central Park each comprise twin-tower configurations with varying heights (18 and 26 storeys, and 34 and 17 storeys, respectively), reflecting more complex and vertically diverse design strategies. Overall, the findings highlight a clear disparity in height distribution, with international developments demonstrating a stronger tendency toward taller and more varied high-rise forms compared to their Nigerian counterparts. This variation may be attributed to differences in technological capacity, urban density demands, regulatory frameworks, and design innovation across the respective contexts.

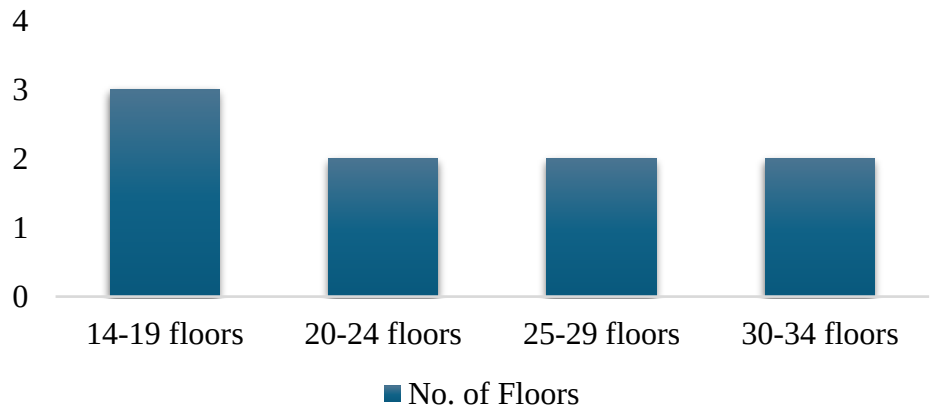



***Figure 4:*** *Showing Number of Floors. Source: Authors' Field Survey, 2026*

**Apartment Typology Distribution**

The analysis of apartment typologies across the seven case studies reveals a consistent presence of two-bedroom and three-bedroom units in all projects examined. Notably, the 1004 Housing Estate predominantly features two- and three-bedroom apartments, reflecting a focus on mid-range residential demand. In contrast, Bourdillon comprises a mix of three- and four-bedroom luxury units, indicating a higher-end market orientation. Bosco Verticale demonstrates the greatest diversity in typology, offering units ranging from two-bedroom to five-bedroom apartments, including penthouse configurations. Similarly, One Central Park provides a mix of one-, two-, and three-bedroom apartments, while Tel Aviv Tower incorporates two-, three-, and four-bedroom units. Quantitatively, two-bedroom and three-bedroom apartments are present in 100% of the case studies, underscoring their centrality in contemporary residential design. Four-bedroom units appear in approximately 57% of the developments, predominantly within high-end residential buildings such as Bourdillon, Bosco Verticale, Tel Aviv Tower, and A&A Towers Eko. In contrast, one-bedroom units are less common, occurring in only 29% of the case studies, suggesting a comparatively lower emphasis on smaller unit typologies within the selected developments.




***Figure 5:*** *Illustration of Apartment Types. Source: Authors' Field Survey, 2026*

**Provision of Essential Services**

The analysis indicates a universal provision of essential services across all seven case studies (Figure 6). This consistency highlights the fundamental role of these elements in high-rise residential design. Elevators are present in 100% of the buildings examined, underscoring their critical importance for vertical circulation in high-rise structures. Similarly, staircases are also provided in all cases (100%), serving not only as mandatory emergency evacuation routes but also as alternative means of internal movement. In addition, all buildings incorporate balconies or terraces (100%), emphasizing their significance in enhancing occupants' access to outdoor space, natural ventilation, and visual connection with the external environment. These features collectively contribute to both the functional performance and the overall livability of high-rise developments.

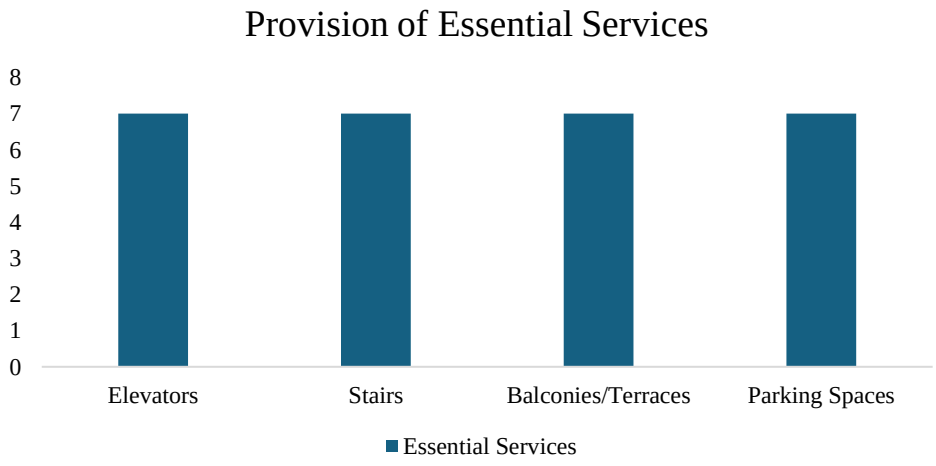



***Figure 6:*** *Provision of Essential Services Source: Authors' Field Survey, 2026*

**Prototype Variation**

An analysis of prototype variation defined as the number of distinct apartment layout types within each development reveals notable differences across the case studies (Figure 7). Developments characterized by larger floor plates and multiple towers, such as *Bosco Verticale* and *One Central Park*, exhibit a relatively limited degree of variation, each offering two prototype layouts. In contrast, *Eko Court Complex* demonstrates a moderate level of diversity with three distinct prototypes, while *1004 Housing Estate* presents the highest level of variation, comprising six different layout types. Conversely, developments such as *Bourdillon*, *A&A Towers Eko*, and *Tel Aviv Tower* show minimal variation, each providing only a single prototype. This pattern suggests a relationship between development scale, design complexity, and the degree of typological diversity in residential layouts.

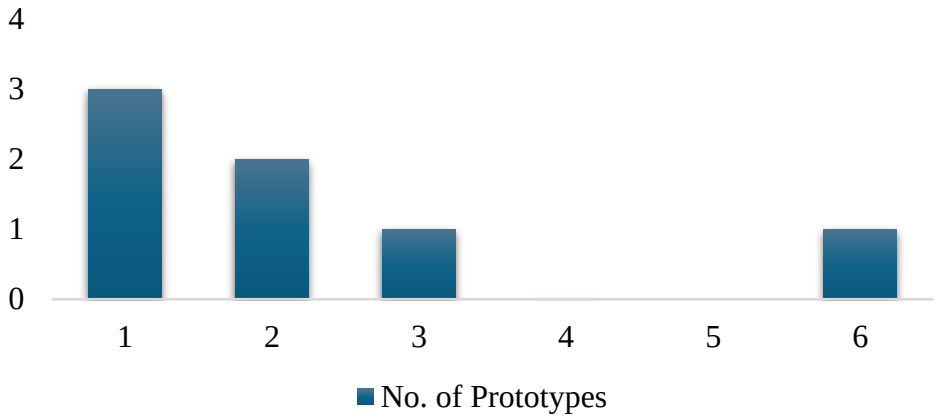



***Figure 7:*** *Number of Apartment Prototypes Across Case Study Developments. Source: Authors' Field Survey, 2026*

**Building Orientation**

The analysis of building orientation across the seven case studies reveals a clear predominance of north–south alignment. Specifically, five out of the seven cases (71%) adopt a north–south orientation, while the remaining two cases (29%) are oriented along the east–west axis (Figure 8). The preference for north–south orientation reflects a deliberate design strategy aimed at optimizing solar control and enhancing natural ventilation, which are critical considerations in tropical and Mediterranean climatic contexts. This orientation minimizes direct solar gain on building facades, thereby reducing cooling loads and improving indoor thermal comfort. Conversely, the adoption of east–west orientation in a minority of cases appears to be driven primarily by site-specific priorities, particularly the maximization of view corridors. For

instance, projects such as One Central Park and A&A Towers Eko prioritize visual access to significant natural features, including harbour and ocean views, even at the expense of optimal solar performance.

Overall, the findings suggest that while climatic responsiveness remains a dominant factor in determining building orientation, contextual factors such as site views can significantly influence design decisions in specific cases.

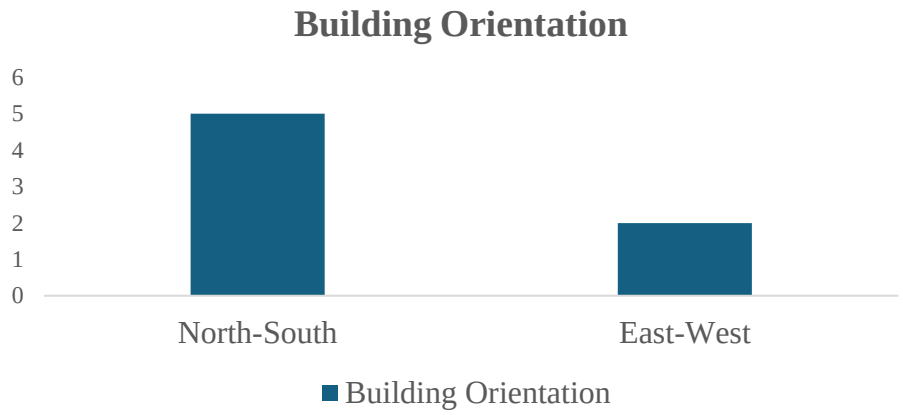



***Figure 8:*** *Illustration of Building Orientation. Source: Authors' Field Survey, 2026*

**Height Distribution Patterns**

Analysis of height variations across the seven case studies indicates that high-rise residential developments range between 14 and 34 storeys. Nigerian examples fall within a narrower band of 14–26 storeys, whereas international cases demonstrate greater verticality, with developments reaching up to 33 and 34 storeys. These findings align with existing literature suggesting that optimal high-rise residential buildings typically range between 14 and 25 storeys. Within this range, conventional elevator systems remain efficient without necessitating the advanced structural and mechanical complexities associated with super-tall buildings. Furthermore, the presence of multiple towers within single developments observed in selected international cases highlights a prevalent clustering strategy in global high-rise design. In contrast, Nigerian developments more commonly adopt single-tower configurations, although recent projects are gradually increasing in height and scale. Notably, buildings categorized locally as mid-rise may reach up to 14 storeys, reflecting contextual differences in classification standards.

**Apartment Typology and Market Orientation**

The consistent inclusion of two-bedroom and three-bedroom units across all case studies underscores a strong global emphasis on family-oriented housing. This uniformity suggests that, regardless of geographical or cultural context, high-rise residential developments are primarily designed to accommodate nuclear and extended family structures. One-bedroom units appear less frequently, indicating a secondary market focus on single occupants. In contrast, larger units such as four- and five-bedroom apartments are predominantly associated with luxury developments. Their limited occurrence suggests that they serve a niche, high-income market segment, often occupying premium positions such as penthouses.

Within the Nigerian context, similar patterns are evident. Earlier developments reflect the global dominance of two- and three-bedroom configurations, while more recent high-end projects increasingly incorporate larger units, signaling a shift toward luxury market integration.

**Essential Services: Universal Provision**

The findings reveal the universal provision of key infrastructural elements, including elevators, staircases, balconies, terraces, and parking facilities. These features constitute fundamental components of high-rise residential design. Elevators, in particular, distinguish high-rise buildings from lower-density typologies by enabling efficient vertical circulation. Similarly, the provision of staircases aligns with international safety regulations that mandate alternative means of egress.

Balconies and terraces play a critical functional and environmental role, offering occupants access to outdoor space and enhancing natural ventilation. This is especially significant in tropical climates, where passive cooling strategies are essential. The consistent inclusion of parking facilities reflects the continued reliance on private automobiles in contemporary urban living, with significant spatial implications for building design and site planning.

**Prototype Variation and Design Efficiency**

Variations in prototype configurations across the case studies reveal a relationship between project scale, development typology, and design strategy. Large-scale housing estates exhibit greater prototype diversity, enabling accommodation of a wider range of household types and socio-economic groups. Conversely, developments characterized by larger floor plates or multiple towers tend to employ fewer prototypes, prioritizing design efficiency and construction

standardization. Luxury developments, in particular, typically adopt a single prototype, reflecting a focus on exclusivity and streamlined delivery. These observations support existing research indicating that reduced prototype variation can enhance construction efficiency, simplify logistics, and improve maintenance operations. However, exceptions exist where large-scale developments incorporate multiple prototypes to achieve broader social and functional objectives.

**Orientation Patterns and Climatic Responsiveness**

Orientation analysis demonstrates a strong preference for north–south alignment, adopted in the majority of case studies. This orientation minimizes direct solar exposure from the east and west, thereby reducing heat gain during peak periods and improving thermal comfort. Alternatively, east–west orientation is employed in cases where visual amenity and view corridors take precedence over climatic optimization. In such instances, design strategies typically incorporate shading devices and other passive measures to mitigate increased solar exposure.

Within tropical contexts, particularly in Nigerian cities, the predominance of north–south orientation reflects an appropriate climatic response to hot-humid conditions. Nonetheless, deviations from this approach in high-end developments suggest that aesthetic and experiential considerations such as waterfront or skyline views—can outweigh environmental factors in determining building orientation.

**Conclusion**

This study comparatively analyzed high-rise residential developments in Nigeria, Italy, Australia, and Israel, focusing on key parameters including building height, apartment typology, access to services, design prototypes, and building orientation. The findings reveal both global convergences and context-specific variations in high-rise housing design. Building heights across the case studies range from 14 to 34 storeys. Nigerian developments typically fall within 14 to 26 storeys, whereas international examples exhibit greater verticality, such as Tel Aviv Tower (33 storeys) and One Central Park (34 and 17 storeys). The prevalence of multiple towers within single developments—evident in projects like Bosco Verticale and One Central Park—highlights a global trend toward clustered high-rise configurations. Within the Nigerian context, 14-storey buildings are considered moderate in scale, while more recent developments such as Bourdillon and A&A Towers Eko reach 20–25 storeys, reflecting a gradual shift toward increased density.

In terms of apartment typology, all case studies incorporate two- and three-bedroom units, indicating a consistent global emphasis on family-oriented housing. Larger units (four-bedroom) are present in 57% of the developments, predominantly within luxury segments, while one-bedroom and five-bedroom units are less common, appearing in 29% and 14% of cases, respectively. Core building amenities including elevators, staircases, balconies, terraces, and parking are universally provided, underscoring their fundamental role in high-rise residential functionality. Notably, in tropical climates such as Nigeria, balconies contribute significantly to passive cooling and occupant comfort. Prototype diversity varies across developments. Public-sector projects such as the 1004 Housing Estate demonstrate greater variation (up to six prototypes), reflecting the need to accommodate diverse household structures. In contrast, luxury developments tend to adopt fewer or single prototypes, prioritizing design uniformity and operational efficiency. This suggests that prototype variation is influenced more by project objectives than by scale.

Building orientation patterns further reflect climatic responsiveness and design priorities. A majority (71%) of the buildings adopt a north–south orientation to reduce solar heat gain and enhance natural ventilation, particularly in hot-humid climates like Lagos. The remaining 29% are oriented east–west, often to capitalize on premium views, as seen in waterfront developments. This indicates a balance between environmental performance and market-driven design considerations.

**Recommendations**

Based on the findings, the following recommendations are proposed:

1. Architects and planners should prioritize north–south building orientation in tropical climates to improve thermal comfort and natural ventilation.
2. Large-scale public housing projects should incorporate multiple apartment prototypes to accommodate diverse household needs.
3. Luxury residential developments may adopt fewer prototypes to improve construction efficiency and simplify maintenance.
4. Balconies and terraces should be considered essential components of high-rise residential design, particularly in tropical regions.
5. Elevators, staircases, and parking facilities should remain mandatory features in all high-rise residential developments.

6. Where scenic views require east–west orientation, appropriate shading systems and passive cooling strategies should be integrated.
7. Future research should examine occupant satisfaction in relation to apartment prototype diversity and environmental performance.

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