

Evaluating Livability in Green High-Rise Housing: A Resident-Centered Evaluation in the National Capital Region, India

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ABSTRACT

The population of India's cities is projected to surge from 340 million in 2008 to 590 million by 2030, and the demand for affordable housing is expected to exceed supply by four times by 2030, according to a study by McKinsey Quarterly. In response to the burgeoning urbanization and land scarcity in India, high-rise apartments have emerged as a solution to housing shortages, driven by rising incomes and aspirations for improved lifestyles. Despite their touted sustainability benefits, assessing the Livability in these high-rise environments remains crucial. This study employs a scientific approach to evaluate the livability in high-rise housing within India's National Capital Region (NCR), examining factors such as safety, social cohesion, infrastructure, environmental sustainability, accessibility, and service provision. By integrating resident feedback and conducting comprehensive assessments of existing infrastructures, this research aims to provide evidence-based insights to inform urban planning strategies and recommend targeted interventions for enhancing overall livability in high-rise residential settings. Furthermore, the study seeks to address the unique challenges posed by high-rise living, including issues of community integration and sustainable resource management, to foster vibrant and resilient urban communities. By employing a mixed-methods approach, the research integrates quantitative and qualitative data to provide a comprehensive analysis of resident satisfaction. The study focuses on three green high-rise housing complexes in NCR region of India: Gaur Grandeur, Sector 119, Noida, ABA Cleo County, Sector 121, Noida, and Mahagun Moderne, Sector 78, Noida. The findings aim to offer actionable insights for developers, urban planners, and policymakers to enhance living conditions in urban high-rise environments.

INTRODUCTION

Housing is a fundamental human necessity that significantly influences an individual's quality of life, well-being, and socio-economic status. It extends beyond mere shelter to encompass the broader context of living environments that provide safety, comfort, and a sense of community. In the realm of urban planning and development, housing also plays a crucial role in shaping sustainable cities. Sustainable development aims to meet the needs of the present without compromising the ability of future generations to meet their own needs [1]. Housing is central to this goal, as it intersects with environmental sustainability, economic stability, and social equity. Efficient land use through high-rise housing can mitigate urban sprawl, reduce habitat destruction, and decrease the ecological footprint of cities [2]. High-rise buildings can also enhance resource efficiency, particularly in energy and water use, by leveraging technological advancements and economies of scale [3]. In India, sustainable housing is imperative given the country's rapid urbanization. The United Nations projects that by 2050, India's urban population will reach 877 million, adding considerable pressure on housing infrastructure [4]. The NCR, encompassing Delhi and its surrounding districts, exemplifies these challenges. As a hub of economic activity and a magnet for migrants, the NCR faces severe housing shortages and escalating property prices [5]. High-rise housing is increasingly viewed as a practical approach to addressing India's urban housing crisis. It allows for the vertical expansion of living spaces, optimizing land use in densely populated cities [6]. The implementation of high-

rise residential projects in the NCR has been driven by both government policies and private sector initiatives. For instance, the Delhi Master Plan 2021 advocates for higher Floor Area Ratios (FAR) to promote vertical growth and alleviate housing deficits [7]. Moreover, high-rise housing can enhance the socio-economic fabric by creating mixed-use developments that integrate residential, commercial, and recreational spaces [8]. These integrated communities can foster social interactions, improve accessibility to amenities, and reduce commuting times, thereby contributing to a higher livability [9]. Furthermore, modern high-rise buildings often incorporate green technologies and sustainable building practices, such as energy-efficient systems, rainwater harvesting, and waste management solutions, aligning with global sustainability goals [10].

The concept of livability encompasses various dimensions, including physical health, psychological well-being, social relationships, and environmental conditions [11];[12]. In the context of high-rise housing, these dimensions are intricately linked to the design, infrastructure, and social dynamics of high-rise living. While high-rise buildings offer solutions to housing shortages and urban sprawl [13], they also pose challenges that can affect residents' overall livability.

Despite its potential benefits, high-rise housing remains a contentious issue, particularly concerning its impact on residents' livability. Critics argue that high-rise living can lead to social isolation, reduced physical activity, and mental health issues due to limited access to natural environments and outdoor spaces [14]. The design and management of high-rise buildings

significantly influence these outcomes. For instance, poorly designed high-rise environments with inadequate lighting, ventilation, and communal spaces can detract from residents' well-being [15]. Furthermore, high-rise living can exacerbate socio-economic disparities if not inclusively planned. In the NCR, luxury high-rises contrast starkly with informal settlements and low-income housing, highlighting issues of affordability and social equity [16]. The risk of gentrification, where high-rise developments displace lower-income communities, remains a critical concern [17]. Additionally, high-rise housing projects often face opposition from local communities due to fears of increased congestion, environmental degradation, and loss of neighborhood character [18].

Studies have shown mixed results regarding the livability in high-rise housing. Some research indicates that high-rise residents report lower levels of neighborhood satisfaction and social cohesion compared to those in low-rise housing [19][20]. Conversely, other studies suggest that high-rise living can offer higher security, better views, and greater privacy, contributing positively to life satisfaction [21][22]. These conflicting findings underscore the need for context-specific evaluations to understand the unique dynamics of high-rise living in different urban settings.

Evaluating the livability in high-rise housing within the NCR requires a comprehensive approach that considers the socio-economic, cultural, and environmental contexts of the region. Key areas of investigation include the design and maintenance of high-rise buildings, accessibility to services and amenities, social interactions within high-rise communities, and residents' perceptions of safety and security [23][24]. Additionally, longitudinal studies can track changes in livability over time, offering valuable data on the long-term impacts of high-rise living [25]. The quest for sustainable housing solutions in the NCR highlights the dual role of high-rise housing in urban development. While it offers a strategic response to urban density and land scarcity, the quality of life it affords remains subject to debate. Ensuring that high-rise housing contributes positively to residents' well-being requires thoughtful design, inclusive planning, and robust policy frameworks. By critically examining the multifaceted impacts of high-rise living, this article aims to contribute to the ongoing discourse on urban sustainability and livability in India's rapidly evolving cities.

1. Understanding Resident Satisfaction in High-Rise Housing Developments

2.1 Livability and Resident Satisfaction

Livability is a critical factor in high-rise housing as it directly impacts the well-being, satisfaction, and overall experience of residents. Livability in high-rise housing significantly affects residents' physical and mental health. Studies have shown that poor living conditions, such as inadequate ventilation, noise, and lack of green spaces, can lead to adverse health outcomes [32]. Conversely, well-designed high-rise buildings with ample natural light, good air quality, and recreational facilities promote better health and well-being [33]. Resident satisfaction, a direct measure of livability, is crucial for the sustainability of high-rise housing developments. Satisfied residents are more likely to stay longer and take better care of their living environment. Research by Amerigo and Aragonés (1997) highlights that residential satisfaction is influenced by both the physical attributes of the housing and the social environment [34]. Addressing these factors can lead to higher resident satisfaction and stability in high-rise communities. High-rise buildings can either foster or hinder social interactions among residents. A high livability includes opportunities for social engagement and community building, essential for creating a sense of belonging and reducing feelings of isolation [35]. Common areas, communal gardens, and social programs can enhance social cohesion and improve residents' overall experience. High livability in residential environments is also associated with higher property values and better economic outcomes. Quality housing attracts more tenants and buyers, leading to increased demand and higher property values [36]. Investing in livability improvements can thus be financially beneficial for developers and investors. Integrating livability considerations in high-rise housing also promotes environmental

Resident satisfaction serves as a pivotal metric for assessing the livability in high-rise housing developments. It encapsulates the subjective experiences, perceptions, and preferences of individuals living within these vertical communities, offering valuable insights into the overall livability and well-being afforded by such environments. Understanding resident satisfaction is essential for several reasons. Firstly, high levels of resident satisfaction indicate that the housing environment effectively meets the needs and expectations of its occupants [26]. Satisfaction reflects the extent to which residents perceive their living conditions as fulfilling, comfortable, and conducive to their physical, social, and psychological welfare [27]. Positive resident experiences contribute to a sense of belonging, attachment, and pride in the community, fostering social cohesion and a supportive neighborhood environment [28].

Moreover, resident satisfaction is closely linked to long-term residential stability and tenure, influencing retention rates and the likelihood of residents investing in their homes and communities [29]. Satisfied residents are more inclined to engage in civic activities, maintain their properties, and contribute to local initiatives aimed at enhancing the built environment [30]. Conversely, dissatisfaction may lead to residential turnover, social disintegration, and disinvestment in the neighborhood, undermining the sustainability of high-rise developments [31].

Furthermore, resident satisfaction serves as a key indicator of housing affordability and accessibility, particularly in the context of high-rise housing where issues such as maintenance costs, service charges, and access to amenities can significantly impact residents' financial well-being. Assessing satisfaction allows policymakers, developers, and urban planners to identify areas for improvement and optimize resource allocation to enhance the overall livability and affordability of high-rise housing projects. In summary, resident satisfaction stands as a crucial measure for evaluating the livability in high-rise housing developments, providing valuable feedback on the effectiveness of design, amenities, services, and management practices. By prioritizing resident experiences and preferences, stakeholders can foster sustainable communities that promote well-being, social cohesion, and long-term viability.

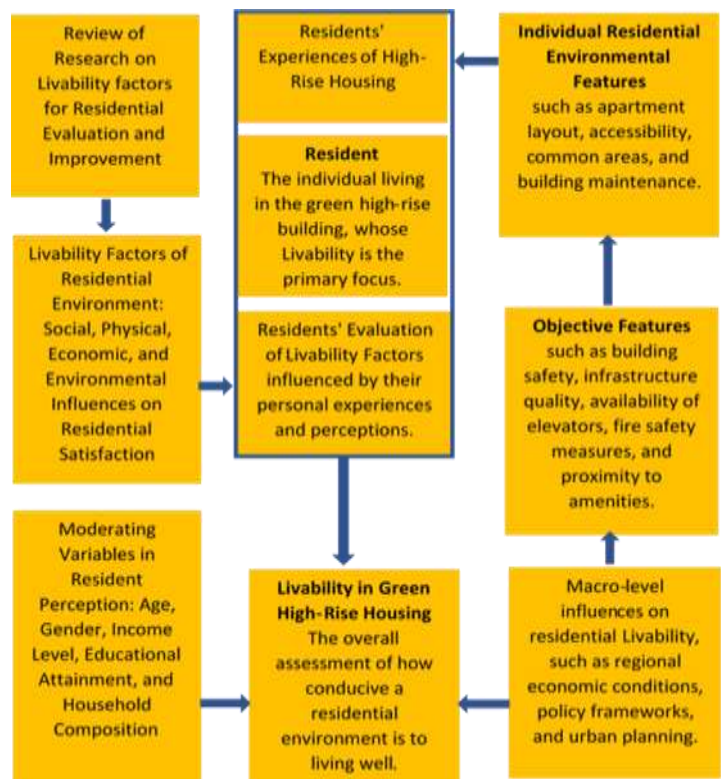


Figure 1 Framework formulated to conduct a resident-centric evaluation

sustainability. Sustainable design features such as energy-efficient systems, green roofs, and sustainable materials not footprint of the buildings [37]. This alignment with environmental goals is increasingly important in urban development.

Governments and regulatory bodies recognize the importance of livability in urban planning and housing policies. Regulations often mandate certain standards for living conditions to ensure the health and well-being of residents [38]. Adhering to these standards is crucial for compliance and fostering a positive relationship with the community and regulators. In summary, livability in high-rise housing is a multi-dimensional concept that encompasses health, satisfaction, social interaction, economic value, and sustainability. Ensuring high livability is essential for creating livable, desirable, and sustainable high-rise residential environments and therefore understanding resident satisfaction is crucial. Therefore, for this study and after going through literature the framework shown in Figure 1 is formulated to conduct a resident-centric evaluation. This framework forms the basis of the questionnaire being sent to the occupants of high rise.

2.2 Green High-Rise Building: A Multifaceted Residential Environment

Green high-rise buildings offer a multifaceted residential environment that combines sustainable design with modern living amenities. These vertical communities are engineered to reduce environmental impact while enhancing residents' quality of life, promoting energy efficiency, social cohesion, and long-term well-being. Through innovative architecture and eco-friendly practices, green high-rise developments are shaping the future of urban living. High-rise housing comprises of various physical levels that contribute to the overall livability of its inhabitants. These levels encompass not only the individual apartment unit but also extend to the apartment building, apartment complex, and the urban areas in its vicinity. Examining each level provides insight into the diverse factors that shape the livability of residents. At the apartment unit level, factors such as layout, size, amenities, and access to natural light and ventilation significantly impact livability. Research by Kaplan and Kaplan (1982) suggests that elements like spaciousness, privacy, and views can enhance well-being and

only improve the living environment but also reduce the ecological

satisfaction within individual living spaces[39]. Additionally, the presence of modern conveniences and efficient design can contribute to a higher standard of living. Moving up to the apartment building level, considerations expand to include communal spaces, infrastructure, and building management. Amenities such as gyms, swimming pools, and communal gardens not only promote physical health but also foster social interaction and a sense of community [40]. Moreover, well-maintained common areas and efficient building management contribute to safety and security, further enhancing livability[41]. At the apartment complex level, the integration of various buildings within a larger community plays a crucial role in shaping residents' experiences. Access to retail outlets, parks, schools, and healthcare facilities within the complex or in close proximity can significantly enhance convenience and overall satisfaction [42]. Additionally, the presence of green spaces and recreational areas promotes outdoor activities and fosters a sense of belonging among residents [43]. Beyond the confines of the apartment complex, the urban areas in its vicinity also influence residents' livability. Access to public transportation, employment opportunities, cultural institutions, and recreational facilities contribute to a vibrant and fulfilling urban lifestyle [44]. Furthermore, factors such as walkability, safety, and air quality significantly impact residents' well-being and satisfaction with their living environment [45]. In conclusion, the livability in high-rise housing is shaped by various physical levels, including the apartment unit, building, complex, and urban surroundings. By systematically evaluating these livability attributes shown in Table 1 across four levels- Apartment Unit, Apartment Building, Apartment Complex, and Neighborhood Space, one can gain a comprehensive understanding of the living conditions and overall satisfaction of residents in high-rise buildings. This multi-faceted approach ensures that all aspects of daily life are considered, leading to better-informed decisions for residents, property managers, and urban planners.

Table 1 Table 1 Evaluating the livability attributes across four levels- Apartment Unit, Apartment Building, Apartment Complex, and Neighborhood Space

Four Levels	Livability Attributes for Analyzing High Rise Building Environment
Apartment Unit:	<ul style="list-style-type: none"> Size of Apartment Unit Layout of flat Comfortability in home Safety in home Privacy in home View from windows Private outdoor space Outdoor noise Internal sound proof Indoor air quality Indoor cooling in summer Indoor heating in winter Indoor natural ventilation Indoor natural lighting Infrastructure (Central AC, Gas supply etc.) Structure - quality Storage Property Cost
Apartment Building	<ul style="list-style-type: none"> Building elevation Building height Building form Identity of building Security in building Fire and earthquake safety Collection of domestic waste Upkeep of public facilities and spaces Household density in your apartment building Accessibility designs Public space ventilation Public lighting

	Common space in building Quality and quantity of lifts Construction quality Relationship with neighbours
Apartment Complex	Sense of community and reputation Security management Maintenance Wind environment Outdoor environment in winter Outdoor environment in summer Building density and spacing Accessibility designs for the elderly and the disabled Population density Public service facilities Car/bike parking Internal vehicular roads quality Pedestrian walkways Activity places for the elderly Play area for children Green area and landscape Overall Satisfaction of Your Housing Complex
Urban Neighborhood	Sense of Belonging and Identity Public Security Situation Environmental Cleanliness Public Transportation Traffic Condition Noise in Neighborhood Local Service Facilities Local Public Space Overall Satisfaction Level

3.0 Research Design

3.1 Research Questions

This research aims to provide empirical study to assess Livability indicators of residents in high-rise green building in Indian context; which will contribute in practical development of high-rise housing, and make theoretical contribution to the research on the Livability of green high-rise apartment building. The purpose of this study is to seek answer to the following questions:

1. How does the overall residential environment of green high-rise buildings in the NCR region of India relate to its four sub-dimensions: Apartment Unit, Apartment Building, Apartment Complex, and Neighborhood Space?
2. How do residents in the NCR evaluate the livability of their green high-rise residential environments and its four sub-dimensions? What factors influence their evaluations of different high-rise typologies, and how do these evaluations correlate with the specific features of their environment?

3. What improvements can be made in the planning and design of green high-rise buildings to enhance livability? How can policies and regulations in urban housing development be adapted to better guide and regulate the development of green high-rise estates to improve residential livability in the NCR?

3.2 Study Area: High Rise Buildings in NCR Region, India

The National Capital Region (NCR) of India is a metropolitan area encompassing the entirety of Delhi and several surrounding districts from neighboring states including Haryana, Uttar Pradesh, and Rajasthan. This region is a major economic hub and houses a diverse population, with rapid urbanization leading to a significant increase in high-rise residential buildings. The study focuses on three high-rise residential buildings located in different parts of the NCR region. These housing complexes shown in figure 2 and Table 2 were chosen to provide a comprehensive understanding of the Livability in varied urban contexts within the NCR as they represent a cross-section of the NCR's high-rise residential landscape, offering a diverse set of living conditions and amenities.

Figure 2 Study Area in NCR Region; Source: Google Earth Map



Table 2 Study Area in NCR Region

Case study	Location	Green Building
MahagunModerne, Sector 78, Noida, NCR	Situated in a prime area known for its modern infrastructure, corporate offices, and proximity to major highways. Designed by renowned architect Hafeez Contractor.	IGBC certified green building conforming to GOLD standards designed by renowned architect Hafeez Contractor.
ABA Cleo County, GH 05, Sector 121, Noida, NCR	Situated at one of the most prime location of Noida. Four side open plot with roads on all four sides Located amidst Industrial, IT Hub & fully inhabited residential area.	IGBC Gold Certified Green Building
Gaur Grandeur, Sector 119, Noida	The Gaur Grandeur is located at the plot no-GH-4, Sector-119, Noida, Uttar Pradesh. This building is built by the well-known builder the Gaursons India Limited.	Gold Certified by the Indian Green Building Council (IGBC)

3.3

Data Collection and Analysis:

The study employed a mixed-methods approach, combining quantitative surveys with qualitative interviews and observations to ensure a robust analysis of resident experiences in high-rise residential environments. Initially, a comprehensive documentary analysis was performed, which included reviewing existing literature and planning documents to delineate key livability attributes associated with high-rise housing as shown in Table 3. This phase aimed to synthesize livability factors from various contexts and assess the objective features of the selected buildings through site surveys. The second phase of the study involved a two-step survey process designed to quantify residents' satisfaction with their living environment. This process also collected demographic data and details on individual residential features. Structured surveys, employing Likert scale questions, multiple-choice items, and rating scales, were used to measure satisfaction across various livability dimensions, such as building amenities, safety, maintenance, and community

engagement. The sample size was determined using the formula for estimating a proportion, which is appropriate for large populations.

The formula is:

$$n = \frac{Z^2 \cdot p \cdot (1-p)}{E^2}$$

Where:

- n is the sample size.
- Z is the Z-value, corresponding to the confidence level (for 95% confidence, Z = 1.96).
- p is the estimated proportion of the population with the attribute (0.5 is used for maximum variability).
- E is the margin of error (0.05).

Assuming a 95% confidence level and a 5% margin of error, the sample size is 384. To account for potential non-response, we increased the sample size by 20%, resulting in approximately 460. Therefore, the study aimed to survey approximately 460 residents, with 120 residents from each building. In addition to surveys, in-depth semi-structured interviews were conducted

with 60 residents (20 from each building) to garner nuanced insights into their experiences and perceptions. On-site observations were also carried out to evaluate the physical

environment, maintenance status, and usage patterns of common areas and facilities.

Residential Environment of NCR Case Studies						
Apartment Unit		Apartment Building		Apartment Complex		Neighborhood Space
Case 1: MahagunModerne, Sector 78, Noida, NCR						
Size	2 BHK, 3 BHK, 4 BHK, 5 BHK	Building Form	Predominantly high-rise tower buildings	Site area	25 Acre	Established urban neighborhoods
Storey	28 Floors	Household density	2650 units	Number of Buildings	16 high-rise tower buildings	
Orientation and Layout	Predominantly North-South alignment with towers strategically positioned to maximize natural light and ventilation for most units.	Location of Apartment Building	Near the boundary of Apartment Complex around large open space.	Open Space	Approx. 80% of the plot area. 6 acres of the largest Central Park within the premises.	
Case 2: ABA Cleo County, Sector 121, Noida, NCR						
Size	3 BHK, 4 BHK	Building Form	Predominantly high-rise tower buildings	Site area	25 Acres	Promising social and physical infrastructure and recently developed neighborhood.
Storey	28 Floors	Household density	2600 units	Number of Buildings	24 high-rise tower buildings	
Orientation and Layout	The towers are oriented to balance sunlight exposure, with some buildings aligned East-West for morning and evening sunlight, and others aligned North-South to reduce direct heat during the day.	Location of Apartment Building	The towers are arranged in clusters around central green spaces, along the boundary.	Open Space	Approx. 70% green landscape. Central green spaces, creating a balanced mix of open areas and built-up spaces.	
Gaur Grandeur, Sector 119, Noida						
Size	2 BHK, 3 BHK, 4BHK	Building Form	High-rise Tower buildings	Site area	9.5 Acres	Established urban neighborhoods
Storey	19 Floors	Household density	1200 units	Number of Buildings	10 high-rise slab buildings	
Orientation and Layout	The towers are primarily aligned in a North-South direction to optimize sunlight exposure, reducing direct heat during peak hours while allowing sufficient natural light.	Location of Apartment Building	Buildings are largely placed around the periphery, with units overlooking either the central green spaces or the surrounding cityscape.	Open Space	Approx. 80% of the plot area. The towers are arranged in a way that creates clusters around central green spaces.	

Table 3 Residential Environment features of NCR Case Studies

The questionnaire was meticulously designed to collect data in three core areas: respondents' demographic profiles, specific characteristics of their residential environment, and overall satisfaction. The satisfaction component featured a tiered structure. Initially, respondents evaluated satisfaction across 60 distinct livability aspects using a 5-point scale, categorized into four spatial dimensions: Apartment Unit,

Apartment Building, Apartment Complex, and Neighborhood Space. Following this, respondents provided an aggregate satisfaction rating for each spatial category. Finally, an overall satisfaction rating of the residential environment was obtained, integrating experiences across all categories.

4. Results and Findings

The analysis of resident satisfaction across Mahagun Moderne, ABA Cleo County, and Gaur Grandeur in Noida reveals several key insights. The survey resultss shown in figure 3 of Mahagun Moderne Housing Complex in Noida, NCR, reveals generally high resident satisfaction, particularly with green areas, public

services, and apartment layout. However, key concerns include security management, indoor air quality, winter heating, and neighborhood noise. Areas like traffic conditions, property cost, and household density also exhibit higher dissatisfaction, indicating these as critical points for future improvements.

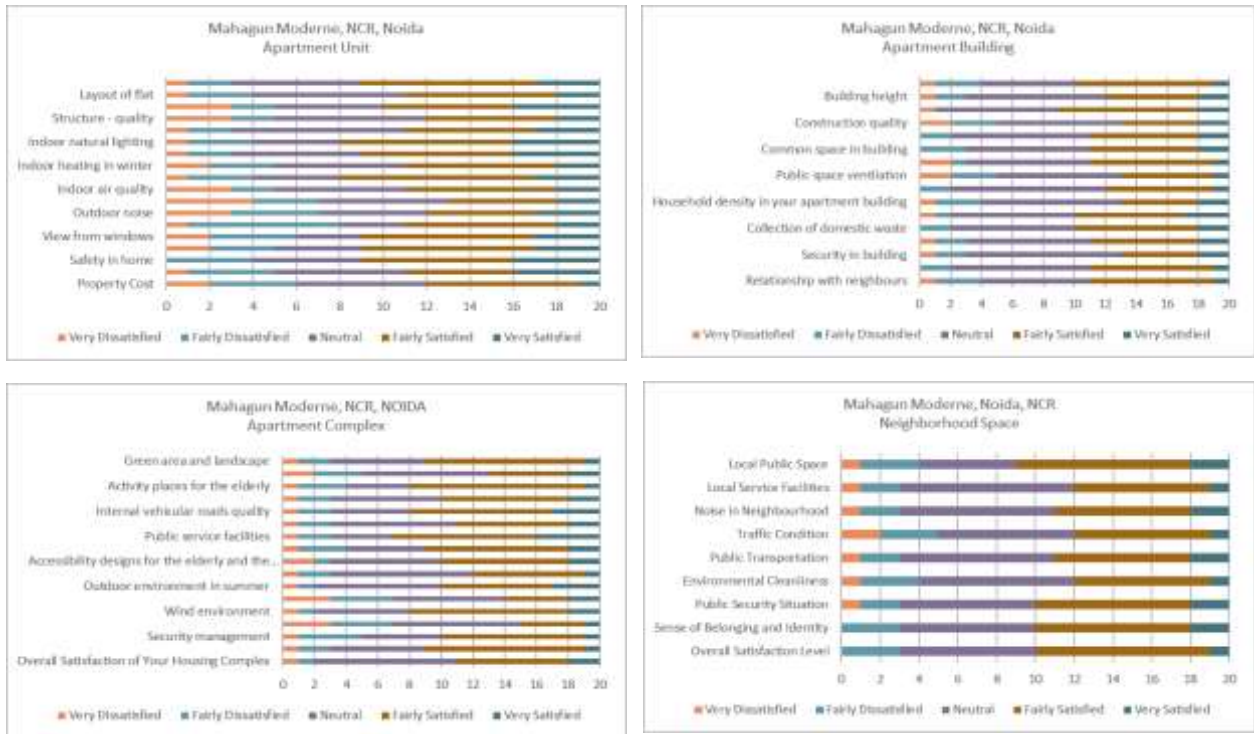


Figure 3 Resident Satisfaction Analysis for MahagunModerne Housing Complex, NCR, Noida

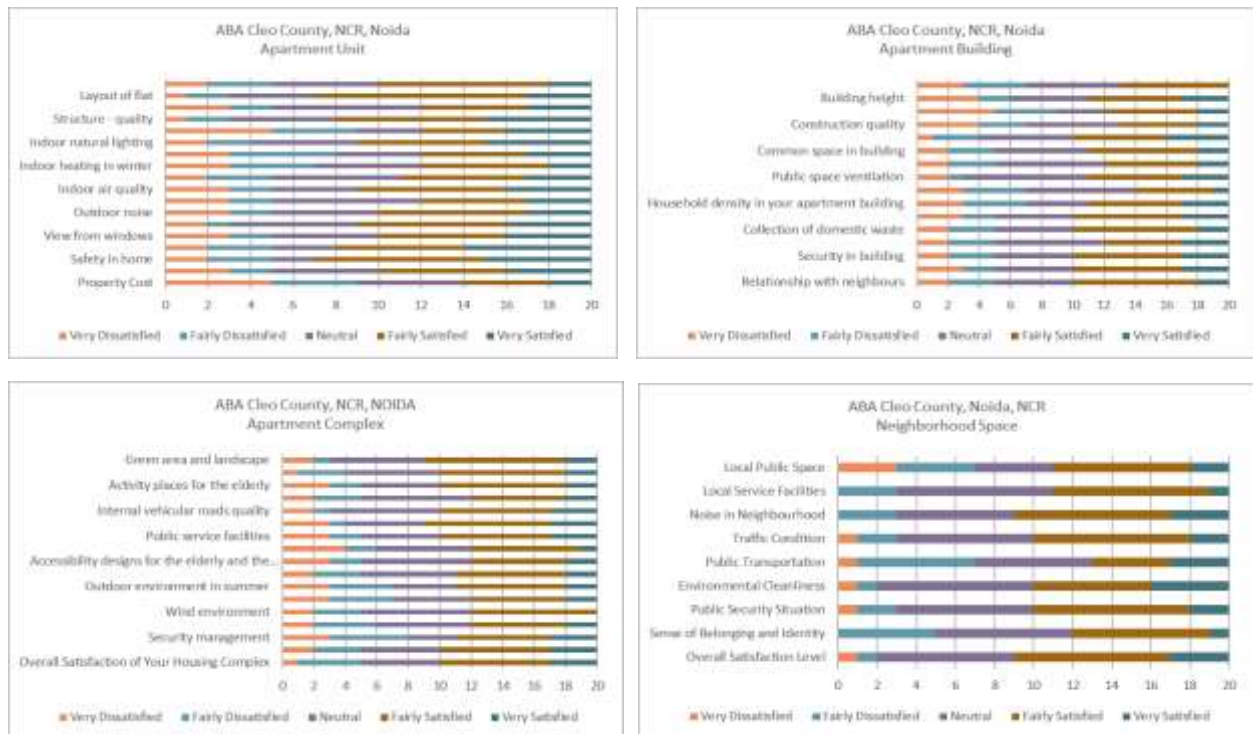


Figure 4 Resident Satisfaction Analysis for ABA Cleo Counting Housing Complex, NCR, Noida

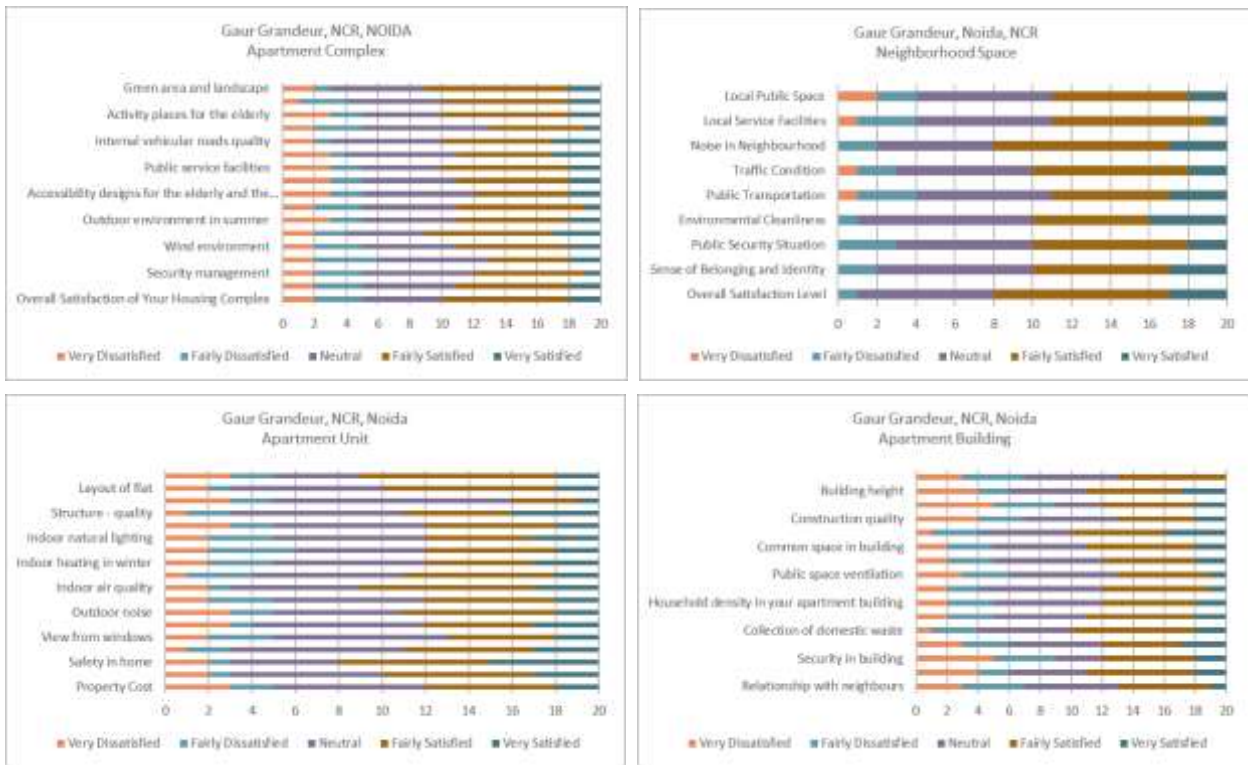


Figure 5 Resident Satisfaction Analysis for Gaur Grandeur Housing Complex, NCR, Noida

The survey results from ABA Cleo County, NCR, Noida, shown in figure 4 indicate that residents are generally satisfied with various aspects of their living environment across apartment buildings, complexes, and units. High satisfaction levels were observed in areas like safety in the home, structure quality, and property cost. However, there are mixed responses in areas such as indoor air quality, outdoor noise, and public space ventilation, suggesting room for improvement. Overall, the findings reflect a positive resident experience, with specific areas highlighted for further enhancement. The survey of Gaur Grandeur in Noida, shown in figure 5 indicates that residents are largely satisfied with the green areas, public services, and overall housing complex management. However, issues such as security management, noise in the neighborhood, and indoor air quality show higher levels of dissatisfaction. Additionally, concerns are noted regarding the layout of flats, winter heating, and the relationship with neighbors. Overall, while the living environment is generally well-regarded, specific areas require targeted improvements to enhance resident satisfaction.

Overall Residential Environment (RE): ABA Cleo County leads with 8.2% of residents being "Very Satisfied" with the overall residential environment, followed closely by Gaur Grandeur at 7.8%. Mahagun Moderne trails slightly with 6.5%. The "Fairly Satisfied" category dominates across all three complexes, with ABA Cleo County scoring the highest at 69.9%, Gaur Grandeur at 60.9%, and Mahagun Moderne at 63.1%. This suggests a generally positive perception of the living conditions across the board, with ABA Cleo County standing out slightly.

Apartment Unit (AU): ABA Cleo County again shows the highest "Very Satisfied" rate at 9.1%, reflecting strong approval of the apartment units. Gaur Grandeur and Mahagun Moderne are close behind, with 8.4% and 7.6%, respectively. The "Fairly Satisfied" category is also highest in ABA Cleo County at 69.1%, followed by Gaur Grandeur at 64.2% and Mahagun Moderne at 66.7%. This indicates that while all three complexes receive good feedback on apartment units, ABA Cleo County residents are slightly more content.

Apartment Building (AB): Gaur Grandeur leads in "Very Satisfied" responses with 8.9%, slightly ahead of ABA Cleo County at 8.4% and

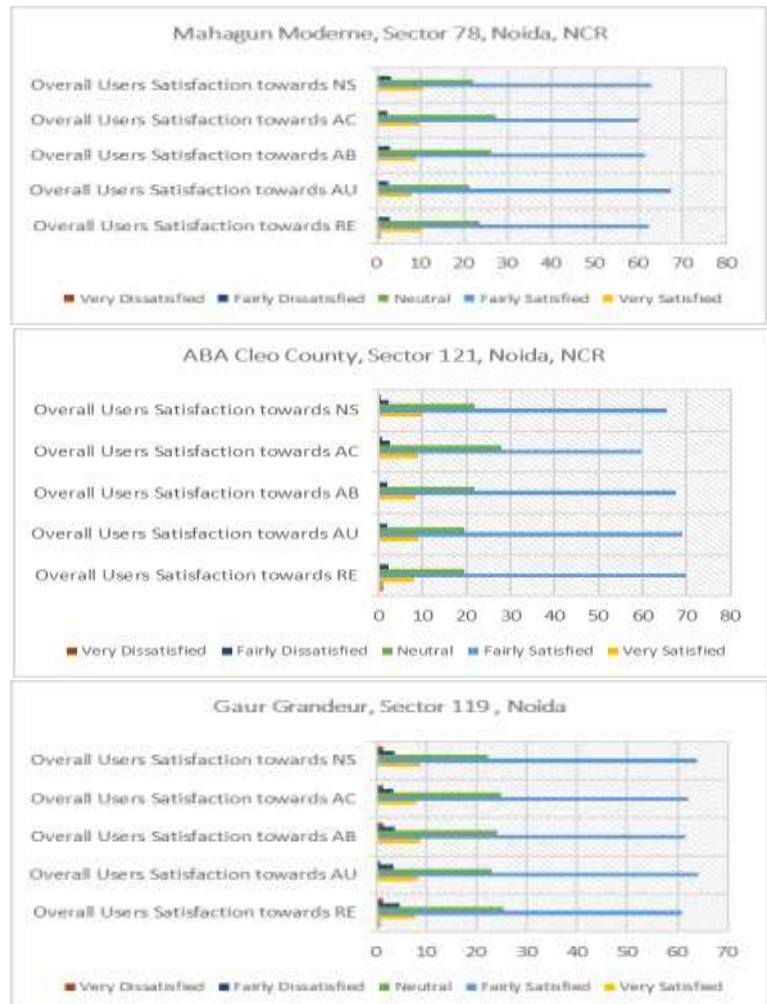


Figure 4 Residents Overall Satisfaction towards RE, AU, AB, AC and NS

Mahagun Moderne at 7.3%. Satisfaction levels are again high across all complexes, with ABA Cleo County achieving 67.5% "Fairly Satisfied," Gaur Grandeur at 61.7%, and Mahagun Moderne at 62.1%. However, Gaur Grandeur has a slightly higher "Neutral" response (24.2%), suggesting some residents find the apartment buildings adequate but not exceptional.

Apartment Complex (AC): ABA Cleo County has the highest "Very Satisfied" rating at 8.9%, followed by Gaur Grandeur at 8.1% and Mahagun Moderne at 7.2%. In terms of "Fairly Satisfied" responses, Gaur Grandeur and Mahagun Moderne are close, with 62.2% and 63.4%, respectively. ABA Cleo County scores slightly lower at 59.8%. This suggests that, while the complexes are generally well-received, Gaur Grandeur and Mahagun Moderne may offer slightly more consistent satisfaction.

Neighborhood Space (NS): ABA Cleo County excels in neighborhood space satisfaction, with 9.9% "Very Satisfied," the highest across all categories. Gaur Grandeur and Mahagun Moderne follow with 8.8% and 8.6%, respectively. The "Fairly Satisfied" category is led by ABA Cleo County at 65.6%, with Gaur Grandeur at 63.9% and Mahagun Moderne at 62.1%. This indicates that all three complexes offer appealing neighborhood spaces, with ABA Cleo County standing out for its exceptional resident satisfaction.

To conclude, the study indicates that respondents in the selected areas generally positive outlook on their living conditions, with a mean overall satisfaction of 3.776 out of 5 for the residential environment (RE). Satisfaction with specific aspects of their living environment shows slight variations: Apartment Units received the highest mean satisfaction score of 3.802, followed by Apartment Buildings at 3.769, Apartment Complexes at 3.740, and Neighborhood Spaces at 3.709. These findings shown in figure 6 suggest that while residents are fairly satisfied with their immediate living spaces, there is slightly less satisfaction with the broader neighborhood environment.

DISCUSSIONS AND CONCLUSIONS

In conclusion, this study highlights the multifaceted relationship between high-rise housing and residents' livability in the National Capital Region (NCR), India. The findings underscore the complexity of resident satisfaction, shaped by factors across multiple spatial levels—apartment units, apartment buildings, apartment complexes, and the surrounding urban neighborhood. While high-rise housing presents a viable solution to urban density and land scarcity, its impact on residents' Livability is contingent upon several critical factors.

Firstly, the analysis reveals that residents generally express satisfaction with various aspects of their living environments, particularly in terms of green spaces, public services, and building maintenance. However, key areas of dissatisfaction—such as indoor air quality, noise levels, winter heating, and security management—emerge as significant concerns. These findings suggest that while high-rise developments in the NCR are meeting basic residential needs, there are substantial opportunities for improvement, particularly in areas that directly affect physical health and well-being. To enhance the

Livability in high-rise housing, it is recommended that developers and urban planners prioritize the following:

- **Indoor Environmental Quality:** Addressing issues related to air quality, noise insulation, and temperature control should be a primary focus. Implementing advanced HVAC systems, soundproofing materials, and energy-efficient heating solutions can significantly improve indoor living conditions.
- **Security and Safety:** Enhancing security measures, including better surveillance, access control, and emergency preparedness, is crucial. A more resident-centric approach to security management could involve regular safety drills and the integration of smart home technologies that provide real-time monitoring and alerts.
- **Community Engagement and Social Cohesion:** The development of communal spaces and the organization of social events can foster a stronger sense of community, which is vital for mitigating the social isolation that can accompany high-rise living. Mixed-use developments that incorporate retail, recreational, and green spaces can further promote social interactions and improve overall satisfaction.
- **Maintenance and Management Practices:** Regular maintenance of common areas and prompt responses to resident concerns are essential for maintaining high levels of resident satisfaction. Property management teams should be proactive in addressing issues and ensuring that facilities remain in optimal condition.
- **Sustainable Design and Green Technologies:** Incorporating green building practices, such as energy-efficient systems, sustainable materials, and waste management solutions, can align high-rise developments with broader environmental goals. Additionally, increasing the availability of green spaces within and around residential complexes can enhance residents' connection to nature and contribute to their overall well-being.

The study also highlights the need for context-specific evaluations of Livability in high-rise housing, given the diverse socio-economic, cultural, and environmental contexts within the NCR. Future research should focus on longitudinal studies that track changes in resident satisfaction over time, providing valuable insights into the long-term impacts of high-rise living. Moreover, a more nuanced understanding of the interplay between different Livability attributes and resident satisfaction can guide the development of more targeted interventions. In summary, while high-rise housing in the NCR offers strategic advantages in addressing urbanization challenges, its success in enhancing residents' Livability depends on thoughtful design, inclusive planning, and responsive management. By addressing the identified areas of concern and implementing the recommended strategies, stakeholders can create high-rise environments that not only meet the demands of urban density but also promote the well-being and satisfaction of their residents.

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