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Exploring the Conceptual Framework of Urban Morphology and Its Impact on Quality of Life: Insights from Jeddah, Saudi Arabia

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Abstract: ***Urban morphology-defined as the study of the form, structure, and layout of urban areas-provides valuable insights into how cities develop and how various spatial configurations impact the everyday experiences of residents. This article explores the relationship between urban morphology and quality of life in Jeddah, a prominent Saudi Arabian city undergoing significant change under Saudi Vision 2030. This study analyzes the key morphological features of Jeddah, considers their implications for residents' well-being, and presents policy recommendations to promote sustainable growth and enhance quality of life. By examining land-use distributions, street configurations, building types, and the social dynamics woven into the urban fabric, the research demonstrates that a greater understanding of morphological characteristics can inform strategic planning to create a more equitable, vibrant, and resilient city.***

Keywords: Urban Morphology; Quality of Life; Sustainable Urban Development; Jeddah.

1. Introduction

Jeddah, situated on the Red Sea coast of western Saudi Arabia, stands as a vital economic and cultural hub of the Kingdom. Over the decades, it has undergone rapid urban development, spurred by accelerated population growth, substantial oil revenues in the latter half of the 20th century, and a diversification of economic activities (Aljoufie et al., 2013). Today, Jeddah is marked by a dynamic mix of modern high-rises, suburban expansions, and historic neighborhoods, revealing a mosaic of urban forms and layers of architectural history.

Against the backdrop of Saudi Arabia's national development initiatives—most notably, Saudi Vision 2030—cities like Jeddah are poised for further transformation. Vision 2030 aims to reduce the country's reliance on oil, invest in diverse economic sectors, and enhance the livability of cities (Vision 2030, 2021). Within this strategic framework, urban morphology—the study of how cities' physical structures and layout evolve—offers a powerful lens for understanding the spatial organization of Jeddah and its implications for residents' quality of life (Oliveira, 2020). As city officials implement ambitious modernization and redevelopment plans, it is more important than ever to investigate how morphological features—street layouts, land-use mixes, building densities—affect community well-being, environmental performance, and social cohesion.

Jeddah's current urban challenges revolve around urban sprawl, infrastructural stress, and socioeconomic disparities across its neighborhoods (Hegazy et. al., 2021). The city's historically compact core, known as Al-Balad, stands in stark contrast to the expansive suburban fringes, which often feature low-density housing and automobile-oriented design. This morphological fragmentation has implications for transportation efficiency, environmental sustainability, and access to essential services such as healthcare, education, and recreation.

While urban morphology has become a well-established field, fewer studies have focused explicitly on its correlation with quality of life—an umbrella term encompassing physical, mental, social, and economic dimensions of well-being—in fast-growing Saudi cities like Jeddah. This research gap is notable because an understanding of how urban form shapes everyday experiences can inform targeted interventions that improve residents' living conditions, whether through better land-use integration, enhanced public spaces, or more robust public transport networks. Central to this study is the primary research question:

How does the urban morphological structure of Jeddah influence its residents' quality of life?

The secondary objectives include:

- Identifying key morphological elements in Jeddah, such as street patterns, plot sizes, building typologies, and land-use allocations.
- Examining how these morphological features affect accessibility, socio-spatial integration, and general well-being among different urban districts.
- Proposing policy recommendations that harmonize with broader sustainable development goals—particularly those spelled out in Saudi Vision 2030—to foster a more equitable and resilient urban environment.

2. Defining Urban Morphology

Urban morphology can be broadly described as the study of urban form, focusing on the physical elements that make up cities and the processes that shape them (Oliveira, 2020). Scholars examine street networks, plot divisions, building typologies, and land-use configurations to discern how cities

evolve over time (Conzen, 1960). Two major methodological currents stand out:

- **Conzenian Approach**: Developed by M. R. G. Conzen, this approach analyzes the town plan—comprising streets, plots, and block patterns—alongside building forms and land use. It emphasizes historical layering, demonstrating how each development period leaves a morphological imprint on the urban landscape (Oliveira, 2020).
- **Typo-Morphological Analysis**: Advanced by scholars such as Saverio Muratori and Gianfranco Caniggia, this tradition focuses on the evolution of building types and urban tissues influenced by cultural, social, and economic factors. By mapping building typologies and plot structures, researchers can uncover the underlying "genetic code" of a city's form (Cataldi, 2003).

These frameworks highlight the multifaceted nature of urban form, which is simultaneously shaped by economic forces, cultural traditions, regulatory policies, and technological innovations. Each morphogenetic dimension influences how residents navigate, experience, and ultimately define the city they inhabit.

3. Quality of Life Indicators in Urban Studies

Research on quality of life (QoL) within urban contexts intersects disciplines such as public health, social work, urban planning, and environmental studies. QoL indicators provide a comprehensive framework to evaluate how urban environments impact the well-being of residents. Commonly cited QoL indicators include:

1) **Access to Essential Services**: This includes the availability and proximity of healthcare facilities, schools, and parks, which are crucial for fostering physical and mental well-being and improving overall livability.
2) **Housing Conditions**: Factors such as affordability, overcrowding, and infrastructure quality determine residential satisfaction and influence socioeconomic stability in urban areas.
3) **Mobility and Transport**: Indicators like travel times, transport mode shares, and accessibility highlight the efficiency of urban mobility systems. These factors play a key role in connecting people to jobs, education, and services while reducing commute stress.
4) **Social Cohesion**: Urban areas are evaluated for their ability to foster community engagement, maintain low crime rates, and build a strong sense of belonging among residents, contributing to social sustainability.
5) **Environmental Health**: Metrics such as air quality, noise levels, and green space coverage are essential for assessing the environmental sustainability of cities. These factors also significantly influence physical health and the urban microclimate.

Organizations like UN-Habitat integrate these QoL metrics into their assessments of sustainable cities. Sustainable Development Goal 11 aims to "make cities and human settlements inclusive, safe, resilient, and sustainable," underscoring the critical connection between urban form and livability (United Nations). This multidimensional approach to QoL indicators serves as a foundation for evaluating urban environments, guiding policymakers and urban planners in designing cities that promote holistic well-being for residents.

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4. Intersection of Urban Morphology and Quality of Life

A robust body of literature points to the notion that urban form can significantly shape the daily experiences, opportunities, and health outcomes of residents (Caniggia & Maffei, 2001). Some well-documented intersections include:

- **Walkability and Physical Health**: Studies frequently show that compact, well-connected neighborhoods encourage walking, cycling, and reduced dependency on private cars, yielding both health (lower obesity rates) and environmental (less carbon emission) benefits.
- **Accessibility and Social Equity**: Morphologically diverse and mixed-use neighborhoods tend to facilitate better access to job opportunities, retail, educational services, and recreational areas, thereby reducing inequality and enhancing overall well-being.
- **Identity and Sense of Place**: Historical districts with distinctive morphological qualities often foster a strong sense of local identity and cultural continuity, which can boost civic pride and social cohesion.

In contexts of rapid modernization, including many Middle Eastern cities, morphological analyses offer critical insights into how transformations in the physical landscape reflect broader social and economic trends (Aljoufie et al., 2013).

5. Urban Morphology in Saudi Arabia and the Middle East

In Saudi Arabia, the large-scale urban expansions of the 1970s and 1980s intersected with new planning regulations, massive infrastructure investment, and a shift toward automobile-oriented layouts. Jeddah represents an important case study due to its coastal location, cultural heritage in Al-Balad, and its status as a gateway for pilgrims traveling to Makkah (Hegazy et. al., 2021). Researchers have examined Jeddah's growth patterns primarily through spatial analyses and demographic studies, highlighting stark distinctions between the dense historical core and sprawling new developments (Aljoufie et al., 2013). However, while these studies provide a solid foundation, direct correlations between morphological attributes and quality-of-life outcomes remain underexplored.

In summary, a deeper, context-specific morphological investigation can clarify how the built environment influences daily experiences in Jeddah. By tapping into a wide range of secondary data sources, from official city plans to academic critiques, this study enriches our understanding of urban form's consequences for livability.

6. Conceptual Framework

6.1 Urban Form and Quality of Life

Building on existing literature, this research employs a conceptual framework that links morphological elements—such as street configuration, land-use mix, and building typologies—to quality-of-life dimensions, including access to services, environmental quality, and social cohesion. The central premise is that urban morphology creates "platforms" that either facilitate or hinder various aspects of daily life, including mobility, social interaction, and economic activities. This perspective aligns with studies emphasizing the impact of urban form on residents' well-being (Cabrera-Barona & Merschdorf, 2017).

6.2 Key Variables and Hypothesized Relationships

1) **Density**
- *Hypothesis*: Higher density can improve access to services and create vibrant neighborhoods but may also exacerbate traffic congestion and strain infrastructure if not well-managed.
- *Indicator*: People per hectare (or population density as per census data), housing density.

2) Connectivity
- *Hypothesis:* More connected street networks reduce travel times and promote walkability, thus contributing positively to overall well-being.
- *Indicator*: Number of junctions, presence of arterial roads, distribution of services.

3) Mixed-Use Development
- *Hypothesis:* Neighborhoods that integrate residential, commercial, and recreational uses can reduce commuting times and reinforce local economies, enhancing residents' quality of life.
- *Indicator*: Land-use composition documented in planning reports.

4) Public Spaces
- *Hypothesis*: Adequate public spaces—such as parks, plazas, and waterfront promenades—bolster social interaction, leisure activities, and environmental health, leading to improved quality of life.
- *Indicator*: Amount of land designated as public open space, as recorded in official data.

By examining these variables alongside documented infrastructural and socioeconomic factors, the study aims to create a comprehensive view of Jeddah's morphological matrix and its intersection with everyday well-being.

6.3 Analytical Framework

This study adopts a multi-dimensional approach. First, morphological characteristics are identified from city plans, zoning regulations, and population data. Second, existing quality-of-life metrics—such as housing satisfaction, commute times, and accessibility to educational and healthcare services—are collated from government and research publications. Finally, a comparative analysis examines these morphological elements relative to quality-of-life outcomes, drawing inferences about cause and effect within Jeddah's urban environment. This methodology is informed by frameworks that assess urban quality of life through spatial and social dimensions (Cabrera-Barona & Merschdorf, 2017).

7. Case Study: Jeddah, Saudi Arabia

7.1 Historical Context and Evolution

Jeddah has a rich history as a port city on the Red Sea, long serving as a gateway for pilgrims end route to the holy cities of Makkah and Madinah (SCTH, 2021). This strategic maritime position spurred its growth into a significant trading hub, creating a cultural and architectural tapestry that sets Jeddah apart from other Saudi cities (Aljoufie et al., 2013). Over the centuries, Jeddah's historic district, known as Al-Balad, evolved into a tightly knit urban fabric. Its buildings, often constructed using coral from the Red Sea, featured wooden lattices ("Roshan") that allowed airflow and provided privacy—an example of climate-responsive architecture (SCTH, 2021).

7.1.1. Pre-1970s Layout

The pre-1970s layout of Jeddah, exemplified by Al-Balad, prioritized a compact and walkable urban form. The labyrinthine streets and mixed-use structures supported pedestrian movement and social interactions, fostering a strong sense of community. This design also enabled socioeconomic integration, with merchant families often residing near or above their shops, reinforcing economic vitality in the city's heart (Conzen, 1960).

7.1.2. Post-1970s Expansion

The oil boom of the 1970s marked a significant turning point in Jeddah's urban development, as shown in Figure 1. To accommodate the city's rapid population growth, new districts were planned around wide arterial roads, emphasizing automobile dependency. This reshaped travel behavior, promoting car ownership as a primary mode of transport.

Urban planning shifted away from the mixed-use traditions of Al-Balad to a zoning-based approach. Residential, commercial, and industrial functions were separated into distinct enclaves, resulting in increased travel distances and reduced land-use efficiency (Hegazy et. al., 2021).

Figure 1 highlights the steady and rapid growth in Jeddah's built-up area, increasing from approximately 100 km² in 1970 to over 600 km² by 2023, illustrating the shift towards sprawling suburban developments.

Over time, Jeddah came to represent two distinct morphological identities (Table 1):
1) The dense, historically rooted core that emphasizes cultural heritage.
2) The suburban outskirts, characterized by larger plot sizes, modern infrastructure, and car-centric planning.

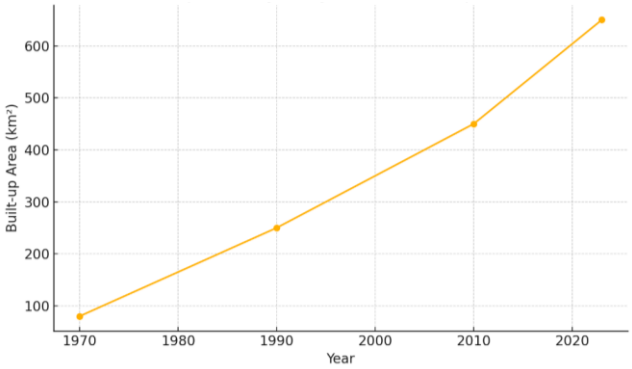

Figure 1: Temporal Analysis of Jeddah's Urban Expansion.

Table 1: Morphological Attributes of Al-Balad vs. Suburban Districts

Feature	*Al-Balad (Historic Core)*	*Suburban Districts*
Street Network Configuration	Irregular, fine-grained, pedestrian-friendly streets.	Wide, automobile-oriented roads; sparse pedestrian infrastructure.
Building Typologies	Multi-story coral stone buildings with Roshan lattices; climate-adaptive features.	Modern villas and mid-rise apartments; standardized, less diverse styles.
Land-Use Distribution	Mixed-use (residential, commercial, and religious) within close proximity.	Single-use zoning with residential, commercial, and industrial areas segregated.
Public Spaces	Traditional squares and mosque courtyards as communal gathering spots.	Modern parks and promenades; accessibility to public spaces is uneven.
Transportation Patterns	Primarily pedestrian-based with limited vehicular access.	Heavily car-dependent with long commute times to city centers.
Environmental Considerations	Better natural ventilation; less urban heat island effect due to compact form.	Urban sprawl contributes to heat island effect; limited vegetation.

7.2. Contemporary Urban Dynamics

1) **Population Growth and Demographics**
According to the General Authority for Statistics in Saudi Arabia, Jeddah's population has grown considerably in the last four decades, currently surpassing four million residents (GASTAT, 2021). This swelling population has diversified the city, attracting both internal migrants from rural areas and international expatriates seeking economic opportunities (Hegazy et. al., 2021).
2) **Urban Sprawl and Peripheral Development**
Jeddah's outward expansion often takes the form of large-scale gated communities and suburban layouts. Developments along the northern coastline boast high-end residential complexes and commercial districts, while mid- to lower-income populations increasingly reside in the southeast suburbs (Aljoufie et al., 2013). This pattern of uneven growth contributes to:
3) **Infrastructure Disparities**: Wealthier, newly developed districts tend to have better roads, utility networks, and amenities, whereas poorer or older areas see underinvestment.
4) **Extended Commuting**: The city's main economic and social hubs remain closer to the historic center and along principal coastal arteries, increasing commuting times for suburban residents.
5) **Infrastructural Overload**
Rapid expansion coupled with limited public transportation places enormous strain on the road network, water supply, and sewage systems. While there have been plans to implement a comprehensive bus system and a possible light-rail network, these projects face budgetary, administrative, and cultural challenges (Hegazy et. al., 2021).
6) **Socioeconomic Inequalities**
A divergence in housing affordability and access to public services has emerged in different parts of Jeddah. In older areas like Al-Balad, infrastructure can be dated, leading to issues such as outdated sewage systems, while newer districts sometimes remain underserviced due to delayed utility rollouts. Consequently, residents' quality of life can vary significantly between neighborhoods (Aljoufie et al., 2013).

7.3. Policy Environment and Governance

Jeddah's morphological evolution is influenced by overlapping policy frameworks. Key stakeholders include the Ministry of Municipal and Rural Affairs, Jeddah Municipality, and private developers. Under the Saudi Vision 2030 blueprint, the city is expected to diversify its economy, enhance cultural preservation (particularly in the historic core), and embrace sustainable urban practices (Vision 2030, 2021). Major policy instruments encompass:

- **Jeddah Comprehensive Plan**: Outlines overarching goals for land use, transportation networks, and economic development. While it advocates for mixed-use corridors and public transport enhancements, enforcement has been patchy (Hegazy et. al., 2021).
- **Heritage Preservation Initiatives**: The Saudi Commission for Tourism and National Heritage (SCTH) works to safeguard Al-Balad's unique historical features while upgrading infrastructure for residents and tourists (SCTH, 2021). Balancing heritage conservation with modernization remains an ongoing challenge.

Overall, Jeddah stands at an urban crossroads, embodying both historic charm and modern sprawl. Its planning trajectory sheds light on how morphological factors—ranging from street patterns to zoning regulations—shape everyday life in a rapidly evolving Middle Eastern metropolis.

8. Analysis and Findings

8.1. Morphological Characteristics

A review of official planning documents (e.g., Jeddah's Comprehensive Plan), census data, and peer-reviewed

studies reveals several defining morphological traits in Jeddah:

8.1.1. Street Network Configuration

The aerial imagery (Figure 2) clearly showcases the irregular, fine-grained street fabric of Al-Balad, optimized for pedestrian movement in the pre-automobile era. Narrow alleys and compact layouts create a sense of intimacy and facilitate walkability, enabling efficient access to homes, markets, and communal spaces. The dense street network also reflects the historical urban design, which prioritized proximity and social cohesion.

In contrast, the lower panels in Figure 2 illustrate the wide, automobile-oriented street networks typical of suburban districts. These areas feature multi-lane roads with sparse pedestrian infrastructure, creating environments that inherently favor automobile use. The grid-like patterns, while orderly, lack the human-scale design found in Al-Balad, discouraging walking and cycling. This stark difference highlights the transition to car-dependent urban layouts post-1970s.

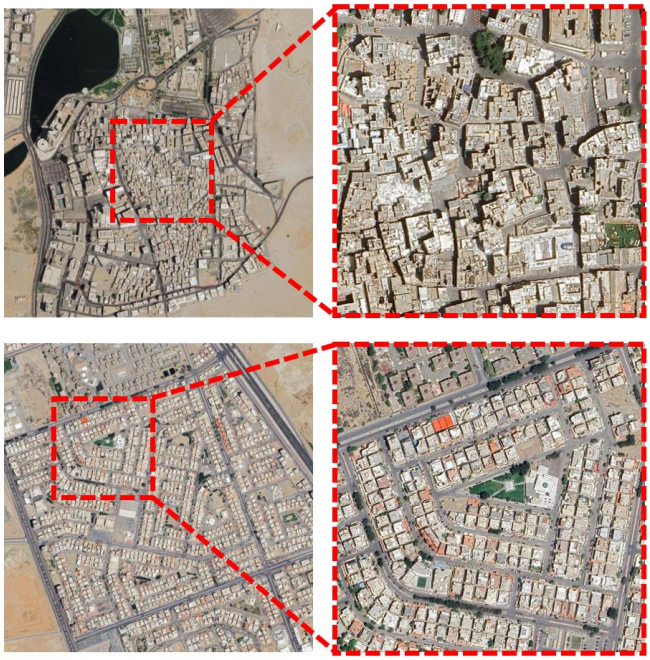

Figure 2: Comparison of Street Network in Al-Balad and Suburban Districts

8.1.2. Building Typologies

The photograph of Al-Balad (Figure 3) captures the multi-story coral stone buildings, a hallmark of Hijazi architecture, designed with Roshan wooden lattices to enhance airflow while ensuring privacy. These buildings, combined with courtyard houses, reflect an adaptive response to Jeddah's hot and humid climate. The layout and construction materials promote communal family living, embodying the region's cultural and environmental heritage.

In contrast, suburban districts, as depicted in Figure 3, feature modern mid-rise apartments that adhere to standardized building regulations. These structures prioritize functionality and efficiency over architectural diversity, resulting in a more uniform urban landscape. Villas on sizable enclosed plots further characterize suburban developments, underscoring the shift toward car-centric living and private spaces.

Historic Hijazi Architecture in Al-Balad *Contemporary Apartment Blocks in Suburban Jeddah*

Figure 3: Contrasting Urban Morphologies in Jeddah: Traditional Hijazi Architecture vs. Contemporary Suburban Development

8.1.3. Land-Use Distribution

It is highlighted that the dominance of single-use zoning in suburban districts, where residential areas account for 60% of the land, while mixed-use areas remain limited to only 10% (Figure 4). This zoning approach, shaped by post-1970s regulations, has contributed to urban fragmentation and long travel distances for essential activities such as shopping, work, and leisure.

In contrast, the figure illustrates that 50% of land in Al-Balad is allocated for mixed-use purposes, reflecting its historical and compact urban fabric. Despite efforts in the last decade to incorporate mixed-use corridors in suburban areas—particularly along the city's northern waterfront—such projects remain isolated, failing to establish a citywide norm.

8.1.4. Green and Public Spaces

Traditional squares and mosque courtyards in historic districts like Al-Balad serve as vital communal gathering spaces. However, as illustrated in the attached figure, public space availability in Al-Balad is constrained to approximately 10 m² per person.

This limitation reflects the district's compact urban fabric, characterized by dense, mixed-use development. In contrast, suburban areas feature more expansive public parks and waterfront promenades, offering up to 20 m² of public space per person, as depicted in the figure. Despite this, the distribution of accessible green spaces remains uneven, leaving certain suburban neighborhoods underserved.

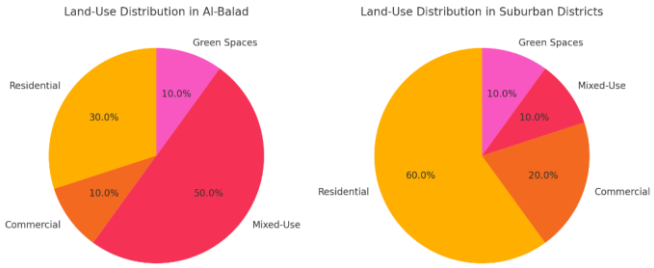

Figure 4: Land-Use Distribution in Al-Balad and Suburban Districts

Figure 5 further highlights the disparity in green space provision, with Al-Balad offering only 5 m² per person, compared to 15 m² per person in suburban districts. This significant contrast underscores the need for targeted urban greening initiatives in historic areas to mitigate environmental challenges and enhance overall livability.

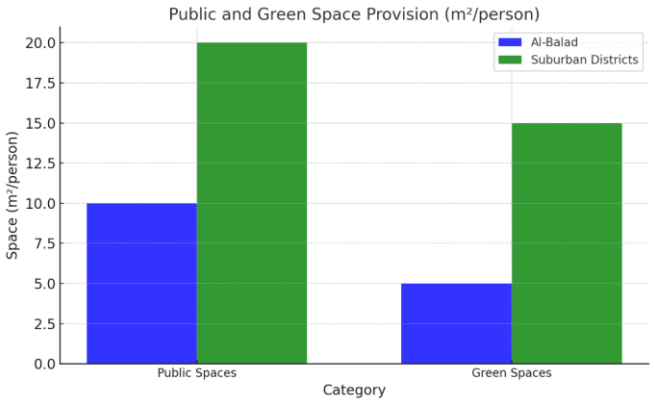

Figure 5: Public and Green Space Provision in Al-Balad and Suburban Districts

8.2. Quality-of-Life Indicators

Drawing on **census records** and **municipal reports**, the following quality-of-life indicators emerge prominently in the Jeddah context:

8.2.1. Mobility and Transport

As shown in Figure 6, suburban districts exhibit significantly higher car ownership rates (80%) compared to Al-Balad (50%). This disparity reflects suburban residents' heavy reliance on private vehicles due to limited public transportation options and the sprawling nature of these areas. In contrast, Al-Balad's compact urban form and pedestrian-friendly infrastructure promote alternative mobility options, reducing car dependency.

The predominance of private vehicles in suburban districts contributes directly to traffic congestion, particularly during peak hours and religious tourism seasons. The limited arterial road networks connecting suburban areas to the city core further exacerbate commute times. As depicted in the bar chart, suburban commuters face an average travel time of 45 minutes, whereas in Al-Balad, the figure is significantly lower at just 20 minutes.

The Transportation Modes pie charts (Figure 7) further illustrate these contrasts. In Al-Balad, 50% of trips are conducted on foot, benefiting from its high-density urban fabric and close proximity to essential services. In suburban districts, however, private cars dominate, accounting for 80% of all trips, while walking, cycling, and public transport collectively make up only 20%. This stark disparity highlights the pressing need for multimodal transportation solutions to enhance accessibility and promote sustainable mobility in suburban areas.

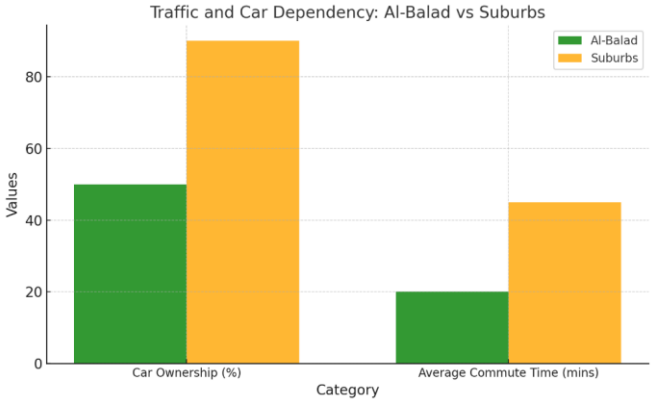

Figure 6: Traffic and Car Dependency in Al-Balad and Suburban Districts

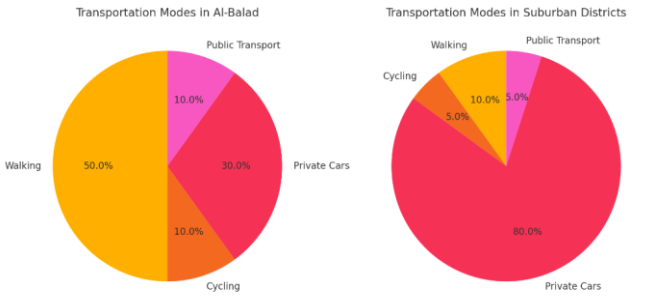

Figure 7: Transportation Modes in Al-Balad and Suburban Districts

8.2.2. Housing Affordability and Livability

Al-Balad, the historical core of Jeddah, offers lower property values compared to newer districts. However, many buildings suffer from poor maintenance reflecting the aging infrastructure and the absence of modern amenities. Residents in Al-Balad often face challenges such as inadequate water supply, outdated sewage systems, and insufficient utilities. Despite these shortcomings, the area's affordability continues to attract lower-income families and those who value proximity to cultural and historical landmarks.

In contrast, suburban districts exhibit a broad range of housing affordability. High-end gated communities offer modern amenities, including private security, landscaped spaces, and advanced infrastructure. However, these upscale developments are often priced beyond the reach of middle-income families, contributing to socioeconomic segregation. More affordable housing options, such as mid-rise apartments, are available in less-developed suburban areas, but these often lack adequate public services and connectivity.

8.2.3. Access to Services

Central districts, including Al-Balad, benefit from a higher concentration of public and private institutions, as illustrated in Figure 8. Al-Balad achieves a score of 8 out of 10, reflecting its proximity to essential healthcare and educational services. In contrast, peripheral areas such as the Southeastern Suburbs score as low as 4 out of 10, indicating limited availability of these critical facilities.

Recreational and cultural facilities show an uneven distribution across the city. Seaside promenades, upscale shopping centers, and entertainment venues are concentrated along the Corniche, primarily serving northern suburban areas. Meanwhile, older districts like Al-Balad often lack equivalent leisure options, particularly for youth. This disparity further widens the gap in livability and accessibility between different districts.

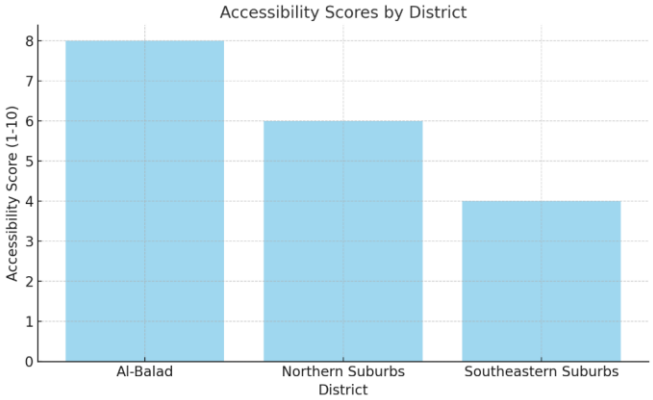

Figure 8: Accessibility Scores by District

8.3. Environmental Conditions

8.3.1. Air Quality

The southern regions of Jeddah experience significant air quality challenges due to the concentration of industrial zones and heavy traffic congestion. These factors contribute to high pollutant emissions, negatively impacting both environmental conditions and public health. The situation is further aggravated by dusty desert winds, which transport particulate matter across the city, particularly during sandstorm seasons. These winds not only worsen air pollution but also reduce visibility and heighten respiratory health risks for residents.

Addressing Jeddah's air quality issues requires a multifaceted approach targeting both human-made and natural contributors. Efforts should focus on stricter industrial emission regulations, enhanced vehicle pollution controls, and urban greening initiatives to mitigate airborne pollutants. Additionally, expanding public transportation networks to reduce car dependency can play a crucial role in improving air quality and fostering a healthier urban environment.

8.3.2. Urban Heat Island Effect

The attached Urban Heat Island (UHI) maps (Figure 9) provide a detailed visualization of heat retention patterns across Jeddah:

- **Panel (a)**: Suburban districts experience high heat intensity, largely due to low vegetative cover and the prevalence of sprawling urban layouts. These areas are heavily car-dependent, contributing to increased heat accumulation through vehicular emissions and asphalt-covered surfaces.
- **Panel (b)**: Mixed-use areas demonstrate moderate heat levels, owing to the presence of green cover and better land-use integration. These zones showcase a balance between urban development and environmental considerations, leading to improved thermal conditions.
- **Panel (c)**: The historic core (Al-Balad) exhibits significant heat retention, attributed to its dense built forms and compact urban layout. While this design promotes walkability, it also intensifies the urban heat island effect, particularly during the summer months, due to limited airflow and shaded green areas.

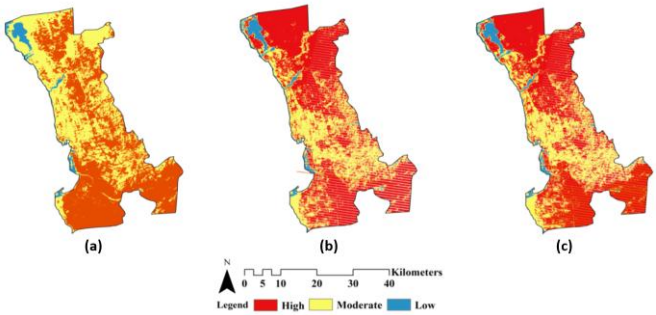

Figure 9: Urban Heat Island Intensity in Jeddah.

9. Discussion and Recommendations

The findings of this study illustrate the profound influence of urban morphology on Jeddah's quality of life, highlighting the stark contrasts between the city's historical core and its sprawling suburban districts. The spatial configuration of Jeddah, shaped by decades of urban expansion and evolving planning paradigms, has resulted in diverse urban typologies that impact accessibility, environmental sustainability, and social cohesion.

The historical core of Al-Balad embodies a compact, pedestrian-friendly urban form that fosters high levels of walkability, socio-spatial integration, and cultural identity. However, the aging infrastructure, inadequate public spaces, and limited green areas present challenges that affect residents' well-being. While Al-Balad retains a strong sense of place, its deteriorating urban fabric underscores the need for strategic interventions to balance heritage conservation with modernization.

In contrast, suburban districts exhibit a more automobile-dependent, low-density urban form that prioritizes private vehicle use over public transit and pedestrian infrastructure. The separation of land uses, characterized by single-use zoning, has contributed to urban fragmentation, increased commuting times, and limited access to essential services in peripheral areas. While these districts provide modern housing options, they often lack the social vibrancy and mixed-use environments that enhance urban livability.

A key takeaway from the analysis is the role of morphological fragmentation in shaping disparities across Jeddah's urban districts. The city's post-1970s expansion

has resulted in a dual urban identity—one that juxtaposes traditional compact forms with sprawling suburban developments. This divergence has direct implications for mobility, environmental sustainability, and socioeconomic inclusivity.

Furthermore, environmental concerns, such as the urban heat island (UHI) effect and air pollution, underscore the pressing need for climate-sensitive urban planning. The analysis indicates that both Al-Balad and suburban districts face thermal stress due to insufficient green infrastructure, impervious surfaces, and inefficient building designs. Without targeted mitigation strategies, rising temperatures and pollution levels could further degrade urban livability.

From a policy standpoint, Jeddah's urban evolution must align with Saudi Vision 2030, which emphasizes sustainable, livable cities. Addressing the city's morphological challenges requires a multidimensional approach that integrates compact urban growth, efficient mobility networks, and environmentally responsive design strategies.

10. Conclusion

This study underscores the profound influence of urban morphology on Jeddah's quality of life, particularly in mobility, environmental sustainability, and socio-economic inclusion. The city's dual urban structure, shaped by historic core areas and suburban expansion, presents both challenges and opportunities for sustainable development. Al-Balad, with its compact, pedestrian-friendly layout, fosters walkability, cultural vibrancy, and social cohesion. However, aging infrastructure, inadequate public spaces, and deteriorating housing conditions hinder its livability. In contrast, suburban districts prioritize automobile-oriented development, leading to longer commutes, land-use fragmentation, and disparities in service accessibility.

The study also highlights significant environmental concerns. While Al-Balad's dense fabric experiences overheating and ventilation issues, suburban districts contribute to urban heat island (UHI) effects due to excessive asphalt surfaces and sparse greenery. The lack of climate-responsive planning exacerbates these conditions, underscoring the need for adaptive urban strategies that enhance thermal comfort and environmental resilience.

To address these challenges, a comprehensive, multi-faceted approach is essential. The following key policy recommendations can help Jeddah transition into a more livable and sustainable city:

- **Promoting Mixed-Use and Transit-Oriented Development (TOD):** Encouraging higher-density, walkable neighborhoods near public transportation hubs can enhance accessibility, reduce car dependency, and improve urban efficiency.
- **Strategic Regeneration of Al-Balad:** Infrastructure upgrades, adaptive reuse of heritage buildings, and economic incentives for small businesses can preserve the district's cultural identity while modernizing essential services.
- **Enhancing Public Transportation and Walkability:** Expanding multimodal transport options, including bus rapid transit (BRT), metro services, and pedestrian-friendly pathways—can alleviate traffic congestion and reduce environmental strain.
- **Mitigating the UHI Effect and Improving Climate Resilience:** Implementing urban greening initiatives, permeable pavement designs, and sustainable building materials can help counteract the heat island effect and improve air quality.
- **Ensuring Equitable Public Space Distribution:** Increasing investment in parks, community plazas, and waterfront promenades, especially in underserved districts, can foster social interaction, recreation, and mental well-being.
- **Strengthening Urban Governance and Policy Implementation:** Establishing coordinated planning frameworks, data-driven decision-making, and participatory urban policies can align development efforts with Vision 2030's sustainability objectives.

While this study provides critical insights into Jeddah's urban morphology, further research is needed to refine urban policies and sustainable planning strategies. Key areas for future investigation include:

- Longitudinal studies on urban transformation to track how Jeddah's evolving policies impact quality of life over time.
- Comparative studies with other Saudi cities, such as Riyadh and Dammam, to identify best practices in sustainable urban planning.
- Smart technologies in urban development, including digital twins, big data analytics, and AI-driven spatial planning, to optimize land use and infrastructure efficiency.
- Climate-adaptive urban design strategies, such as cool roof technologies, passive cooling techniques, and green building solutions, to combat extreme heat and improve environmental performance.

Jeddah stands at a critical juncture in its urban development, balancing rapid modernization with sustainability and cultural preservation. The findings of this study reinforce the need for integrated, human-centered urban planning that prioritizes walkability, transit accessibility, environmental resilience, and inclusive public spaces. By leveraging smart planning strategies and adopting policies that harmonize heritage with modernity, Jeddah can emerge as a model for sustainable urbanism in the Middle East.

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