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Enhancing spatial accessibility of tourist spots in Al Kharj city through space syntax analysis

تعزير إمكانية الوصول المكاني للمواقع السياحية في مدينة الخرج من خلال تحليل التركيب المكاني

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Abstract

الملخص:

The tourism industry plays a pivotal role in the economic growth and cultural enrichment of cities. Urban regeneration has been considered as a key focus of urban tourism development. This study investigates the application of space syntax as an analytical and design tool in urban regeneration efforts, specifically focusing on Al Kharj City, Saudi Arabia, as a burgeoning tourist destination. The research aims to enhance the spatial accessibility of tourist spots in Al Kharj through space syntax analysis, addressing existing gaps in understanding and optimizing accessibility within the city. By integrating space syntax analysis into urban planning processes, this study seeks to inform stakeholders about the importance of spatial accessibility in enhancing the visitors' experience and fostering sustainable urban development. Through a multi-scale approach and advanced analytical techniques, the study provides insights into the complex relationships between spatial structures, economic activities, and functional distributions, offering recommendations for improving accessibility and optimizing the spatial distribution of tourist services in Al Kharj. Integrating spatial analysis into urban planning, enhancing connectivity and integration, promoting community involvement, addressing spatial disparities, and implementing evidence-based interventions could result in a more accessible and inclusive urban environment for the enhancement of urban tourism.

تلعب صناعة السياحة دورًا محوريًا في النمو الاقتصادي والإثراء الثقافي للمدن. يعتبر التجديد الحضري محورًا رئيسيًا لتنمية السياحة الحضرية. تبحث هذه الدراسة في تطبيق بناء تركيب الفضاء كأداة تحليلية وتصميمية في جهود التجديد الحضري، مع التركيز بشكل خاص على مدينة الخرج، المملكة العربية السعودية، كوجهة سياحية مزدهرة. ويهدف البحث إلى تعزيز إمكانية الوصول المكاني للمواقع السياحية في الخرج من خلال تحليل الفضاء، ومعالجة الفجوات الموجودة في الفهم وتحسين إمكانية الوصول داخل المدينة. من خلال دمج تحليل تركيب الفضاء في عمليات التخطيط الحضري، تسعى هذه الدراسة إلى إعلام أصحاب المصلحة بأهمية إمكانية الوصول المكاني في تعزيز تجربة الزوار وتعزيز التنمية الحضرية المستدامة. ومن خلال نهج متعدد النطاق وتقنيات تحليلية متقدمة، تقدم الدراسة رؤى حول العلاقات المعقدة بين الهياكل المكانية والأنشطة الاقتصادية والتوزيعات الوظيفية، وتقدم توصيات لتحسين إمكانية الوصول وتحسين التوزيع المكاني للخدمات السياحية في الخرج. إن دمج التحليل المكاني في التخطيط الحضري، وتعزيز الاتصال والتكامل، وتشجيع مشاركة المجتمع، ومعالجة التفاوتات المكانية، وتنفيذ التدخلات القائمة على الأدلة يمكن أن يؤدي إلى بيئة حضرية أكثر سهولة وشمولاً لتعزيز السياحة الحضرية.

Keywords: Tourist Spots, Spatial Accessibility, Space Syntax analysis, Al Kharj City, Saudi Arabia.

الكلمات المفتاحية: المواقع السياحية، إمكانية الوصول المكاني، تحليل الفضاء، مدينة الخرج، المملكة العربية السعودية.

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Introduction

The tourism industry is a significant driver of economic growth and cultural exchange, contributing to the development of cities worldwide. Within the realm of urban tourism, urban regeneration has emerged as a prominent focus of numerous urban development projects. This study explores the utilization of space syntax theory as both an analytical and design tool in the context of urban regeneration efforts. Al Kharj, a rapidly growing city in Saudi Arabia, is poised to become a prominent tourist destination due to its historical significance, cultural heritage, and natural attractions. However, the spatial organization and accessibility of tourist spots within the city need to be critically examined to optimize the visitor experience. This research proposal aims to investigate and enhance the spatial accessibility of tourist spots in Al Kharj City through the application of Space Syntax analysis.

The tourism industry in Al Kharj City, Saudi Arabia, is experiencing significant growth and development. However, the spatial accessibility of tourist spots within the city has not been thoroughly analyzed, potentially leading to suboptimal visitor experiences and limited economic benefits. Existing research has explored the use of GIS and in assessing spatial accessibility in various urban contexts, including tourist destinations (Abdelkarim et al., 2022; Alawer, 2018). Moreover, research has also explored the factors influencing shopping malls attractiveness and their impact on shoppers' satisfaction in Saudi Arabia (Al-Medabesh & Ali, 2016). To fill the gap in understanding tourist spot accessibility in Al Kharj City, this study proposes the use of Space Syntax analysis. This tool will allow for a comprehensive assessment of the spatial distribution and organization of tourist spots, as well as identifying accessibility patterns (Shvets et al., 2015). By analyzing the connectivity, integration, and mean depth of spaces, this research aims to provide valuable insights into the current spatial layout configuration and user behavior within these tourist spots. The findings of this study will not only contribute to the knowledge and understanding of tourist spot accessibility in Al Kharj City but also provide practical recommendations for optimizing accessibility and enhancing the overall visitor experience. Moreover, the research aims to inform urban planners, local authorities, and tourism agencies about the importance of considering spatial accessibility in their development plans and strategies. By integrating space syntax analysis

into the planning and design process, these stakeholders can identify potential barriers to accessibility and implement measures to improve connectivity between tourist spots.

Urban tourism and its related elements constitute a burgeoning field of study, with researchers such as Ashworth & Page (2011) and Miller, Merrilees, & Coghlan (2015) shedding light on its complexities. Policy makers, researchers, and practitioners are increasingly striving to gain a deeper understanding of tourism within urban areas (Edwards, Griffin, & Hayllar, 2008). Urban tourism emerged as a distinct and significant research area in the 1990s, following earlier studies in the 1960s which were limited in scope (Pearce, 2001). Lapko (2014) notes its pivotal role as a primary function of cities, particularly evident in the appeal of city centers to both international and local visitors.

City centers, with their diverse attractions and focused locations, offer unique opportunities for visitors seeking social or institutional engagements, whether for business, leisure, or personal reasons (Vandermeij, 1984). The potential of urban tourism to facilitate connections between people, cultures, and consumption experiences fosters an exciting exploration for visitors (Edwards, Griffin, & Hayllar, 2008).

Originating in Britain as resort morphology, the study delves into the relationship between urban tourism and urban morphology, as proposed by Gilbert (1949) and expanded upon by Ashworth (1989). Ashworth outlined four approaches to understanding urban tourism, emphasizing spatial analysis, ecological considerations, user perspectives, and policy implications. Gospodini (2001) explored how urban morphology, encompassing spatial and formal patterns, influences urban tourism. Despite some documentation of spatial aspects in urban tourism literature, there remains a dearth of studies examining the relationship between urban tourism and the spatial and formal dimensions of urban environments—urban space morphology—particularly in research since 2001. This study aims to analyze the existing spatial structure of Al Kharj City, KSA for the enhancement of spatial accessibility of tourist spots through space syntax analysis, addressing existing gaps in understanding and optimizing accessibility. The Specific objectives include:

- To assess the spatial distribution of tourist spots in Al Kharj City.
- To analyze the spatial configuration and organization of tourist spots in Al Kharj City using Space Syntax methodology.
- To identify spatial patterns and connections that influence the accessibility of tourist destinations.
- To identify potential barriers or challenges affecting spatial accessibility.
- To propose recommendations for optimizing the spatial organization to improve tourist spot accessibility in Al Kharj City.

Literature Review

Tourism has emerged as a significant contributor to economic growth, cultural exchange, and social development globally (Telfer & Sharpley, 2015). As cities strive to leverage their tourism potential, understanding the spatial accessibility of tourist destinations becomes crucial for sustainable development and effective planning (Della et al., 2017). The tourism industry has gained increasing attention due to its potential to stimulate economic growth, generate employment opportunities, and foster cultural exchange. Numerous studies have highlighted the positive impact of tourism on local economies (Dwyer et al., 2019). In rapidly developing cities like Al Kharj, Saudi Arabia, tourism serves as a catalyst for economic diversification and urban development (Sharpley, 2002). Consequently, understanding the spatial distribution and accessibility of tourist spots is crucial for optimizing tourism-related infrastructure and enhancing the visitor experience.

Spatial accessibility refers to the ease with which individuals can reach various destinations within a geographical area. In the context of tourism, spatial accessibility plays a critical role in determining the attractiveness and competitiveness of destinations (Li et al., 2019). Studies have shown that improving spatial accessibility to tourist attractions can increase visitor numbers, prolong stay durations, and enhance overall satisfaction (Mohammed et al., 2024; Mao et al., 2021). Therefore, assessing and enhancing spatial accessibility have become key priorities for destination management organizations and urban planners.

Since the mid-1980s, tourism has increasingly become a significant aspect of urban economies, often playing a central role in urban regeneration projects (Hall & Page, 2009). Owens (2008) examines the role of tourism in urban

regeneration through case studies, highlighting its potential to drive fundamental changes in urban areas undergoing transition. Urban regeneration, particularly in relation to tourism, has been a focus of research, with urban tourism research identifying urban regeneration as a primary sub-theme (Ashworth & Page, 2011).

City morphology and accessibility are crucial factors in urban tourism (Gospodini, 2001; Safari & Moridani, 2017), with accessibility deemed essential for tourists (Toth & David, 2010). Wayfinding, defined as purposeful movement to a specific destination, is another key consideration for urban visitors (Golledge, 1999).

Various urban theories have been proposed to assist urban tourism and regeneration, including the analytical method theory (Collins et al., 2006; Welter & Whyte, 2003). Space syntax, a methodology proposed for urban design, offers an analytical framework connecting urban space with people's behavior and addressing accessibility and wayfinding concerns (Karimi, 2016). Studies have shown that space syntax can influence people's behavior and wayfinding in urban spaces (Hillier, 2007; Dalton, 2003), making it a valuable tool for improving urban tourism accessibility. Liu et al., (2018), found that the distribution of scenic spots has a significant impact on tourist flow and visitors' choices of entrance to the mountain; the volume of online sign-ins is highly correlated with landscape attention, axial control values and the local integration value of the trails.

Space Syntax analysis offers a theoretical framework and analytical tools for understanding the spatial configuration of urban environments (Hillier & Hanson, 1989). By examining the connectivity and integration of streets and spaces, Space Syntax analysis helps identify spatial hierarchies, patterns of movement, and points of attraction within cities (Penn et al., 1998). In the context of tourism, Space Syntax analysis can provide valuable insights into the accessibility and visibility of tourist destinations (Giseop et al., 2019). By assessing the spatial layout and connectivity of urban spaces, Space Syntax analysis informs decision-making processes aimed at enhancing the pedestrian experience and optimizing urban design.

In rapidly developing countries like, Malaysia (Safari et al., 2018; Safari & Moridani, 2017; Mansouri & Ujang, 2017), India (Chakravarty, 2023), China (Qin et al., 2023; Wang et al., 2022; Zuo et al., 2021; Li, et al., 2016), UAE (Kubat, et al., 2012) and Qatar (Mansour et al., 2022;

Tannous et al., 2021); space syntax tools and methodologies are being used for the understanding and enhancement of tourism. There remains a dearth of research, particularly in the context of rapidly developing cities such as Al Kharj, Saudi Arabia about the application of space syntax and tourism.

The literature review emphasizes that tourism is crucial for global economic growth, cultural exchange, and social development. Understanding the spatial accessibility of tourist destinations is vital for sustainable development and strategic planning. Tourism significantly stimulates economic growth, creates jobs, and promotes cultural exchange, especially in rapidly developing cities like Al Kharj, Saudi Arabia,

where it aids economic diversification and urban development. Enhancing spatial accessibility, which influences the attractiveness and competitiveness of tourist spots, is essential for optimizing tourism infrastructure and improving visitor experiences. Research shows that better spatial accessibility increases visitor numbers, extends stays, and improves satisfaction. Urban regeneration, often driven by tourism, has been a key research area, focusing on how urban morphology and accessibility affect tourism. Space Syntax analysis, which studies urban space connectivity and integration, offers insights into urban design and tourism accessibility. However, there's limited research on applying Space Syntax in cities like Al Kharj to boost tourism development.

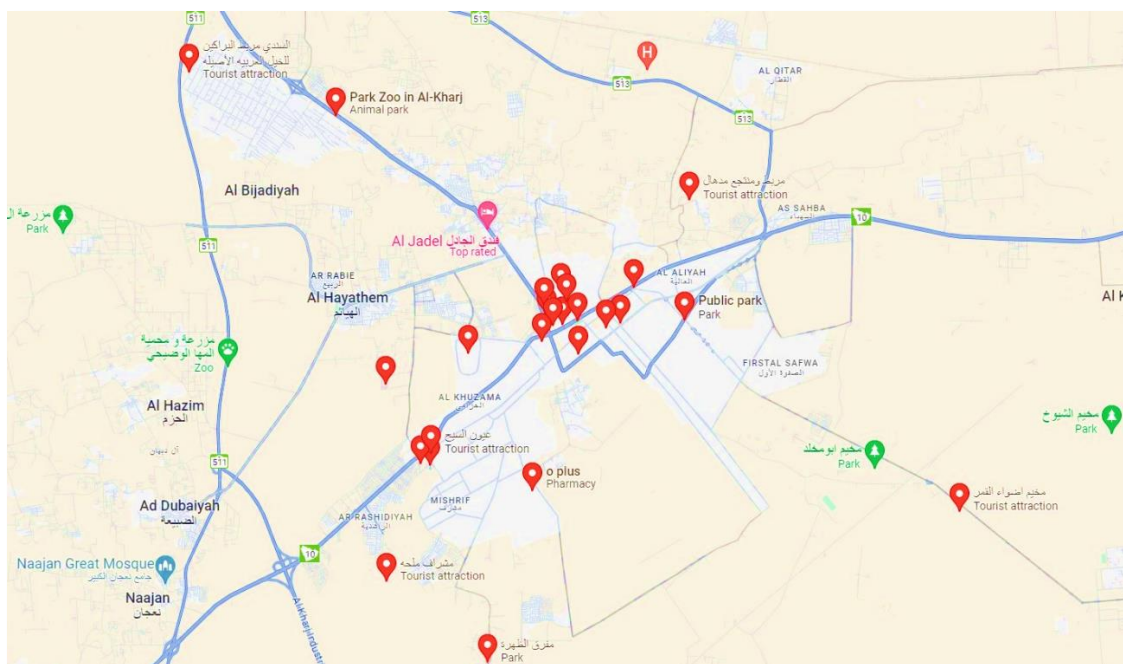


Fig. 1. Map of the study area, Al Kharj KSA.
Source: Google map

Materials and Methods

This research is based on case studies and combined strategies method. The Map Al Kharj, KSA with immediate surroundings was analyzed through depthmapX, space syntax software. The measures of integration, step depth, choice, and connectivity values were calculated. In an urban layout, an axial line surrounds every block and every street node is considered an intersection of an axial line. Therefore, the axial configuration is regarded as an objective record of the urban grid structure. The most significant measure of an axial map is integration, which measures how deep each location is to all others. Well-integrated locations are colored red, while the

poorly integrated ones are blue.

The theory of natural movement (Hillier et al., 1993), states that integrated spaces play a significant role in the urban environment. These integrated spaces are not only frequently used or visited but also better known because of their suitable location within the people's daily movement pattern (Stähle, 2005). The integration values are ranked from most integrated to segregated to indicate how easily one can reach a specific street or a line on the axial map. The number of alternative visible routes a public space offers from one point to another is defined as the permeability of that space (Alcock, 1987). The choice value (global measure) and

connectivity (local measure) of each link determine the entry points for stability between the city-wide and local scale accessibility.

Study Area and tourist attractions:

Al Kharj, situated within the Riyadh Province in the heart of Saudi Arabia, stands as a testament to the nation's rich heritage, blending agricultural prowess with a significant military presence. Historically, this region has served as a vital waypoint owing to its strategic location and ample water resources, offering respite to traders and travelers traversing its arid landscapes.

In modern times, Al Kharj has evolved into a hub of agricultural innovation, boasting expansive farms and flourishing date palm plantations. Its fertile soils, coupled with favorable climatic conditions, provide an ideal environment for cultivating a variety of crops, from succulent dates to nutritious vegetables and grains. Embracing modern farming techniques and sophisticated irrigation systems, Al Kharj epitomizes agricultural excellence in the region.

Beyond its agricultural endeavors, Al Kharj caters to the diverse needs of its residents and visitors alike, offering a range of amenities such as educational institutions, healthcare facilities, shopping centers, and recreational spaces.

Tourist Places in Al Kharj:

Amidst its agricultural and military prominence, Al Kharj conceals a treasure trove of natural wonders and cultural landmarks, beckoning travelers to explore its hidden gems. From historic edifices like the iconic King Abdulaziz Palace to captivating natural attractions such as Ayun Al Seih and Al Heet Cave, the city promises an enriching experience for discerning adventurers.

One of the notable attractions in Al Kharj is the Al Kharj Zoo, nestled along the Riyadh-Al Kharj highway. Home to a diverse array of animals, birds, and reptiles, the zoo offers a captivating glimpse into the kingdom's rich biodiversity. Visitors can also bask in the serene ambiance of lush greenery within the zoo premises, providing a tranquil retreat from the bustling city life.

For aficionados of history and culture, the Al Kharj Museum serves as a repository of artifacts and exhibits, offering insight into the city's illustrious past. Meanwhile, nature enthusiasts can immerse themselves in the scenic beauty of Wadi Hanifah, a verdant valley adorned with

parks, walking trails, and cycling tracks, offering respite amidst nature's embrace.

Adventurous souls can embark on a journey to explore the ancient fortifications of Al Kharj Castle, steeped in centuries-old history and architectural grandeur. Alternatively, visitors can marvel at the natural wonders of Ayun Al Seih, once teeming with cool, crystalline waters that beckoned travelers from far and wide.

In addition to these attractions, Al Kharj boasts modern recreational facilities such as the Al Baijan Amusement Park and the King Salman Walkway, catering to the leisure needs of visitors of all ages. Moreover, culinary enthusiasts can savor a panoramic view of the city from the Al Kharj Water Tower while indulging in a romantic dinner under the starlit sky.

In essence, Al Kharj epitomizes the harmonious blend of tradition and modernity, offering a myriad of experiences for intrepid travelers. Whether exploring its ancient heritage or basking in the tranquility of its natural landscapes, visitors to Al Kharj are sure to be captivated by the city's timeless allure. With its diverse array of tourist attractions and warm hospitality, Al Kharj beckons travelers to embark on a journey of discovery and enlightenment amidst the splendor of Saudi Arabia's heartland.

Analysis

The study examined the tourist attractions of Al Kharj, Saudi Arabia. It assessed various factors including accessibility, integration, step depth, choice, connectivity, and accessibility ratings using space syntax analysis.

Integration measures the connection between a park and its surroundings, with values closer to 1 indicating high integration and values below 1 indicating segregation. Step depth refers to the number of typological steps required to access a specific location, with lower values indicating easier accessibility.

Choice evaluates the likelihood of traversing an axial line or street segment along the shortest routes between spaces in the system or within a predetermined radius. Connectivity measures the number of connections between the park and its surrounding areas.

The concept of accessibility, essential in physical and urban planning, has been defined and explored in various studies (Chen & Yeh, 2019; Geurs & van Wee, 2004; Handy & Niemeier,

1997; Hansen, 1959; Markovich, 2013). It encompasses the relative proximity of places and persons, including opportunities and activities, with profound implications for functional, economic, and social aspects (Erkut & Özgen, 2003). Road networks serve as fundamental elements facilitating accessibility across different scales, from neighborhood to national levels (Parham et al., 2017; Serra & Pinho, 2013).

Cities are integral components of regional and national systems, influencing their functional potential (Law & Versluis, 2015; Serra, Hillier, & Karimi, 2015). Economic theories dating back to the mid-19th century have emphasized the spatial organization of economic activity, highlighting the significance of accessibility and proximity to populated centers (Portugali, 2011). While traditional studies lacked resolution and comprehensive data, modern Geographic Information (GI) technologies enable detailed analyses of accessibility at national scales (Law & Versluis, 2015; Serra et al., 2015).

Recent studies have explored accessibility at

unprecedented national scales, leveraging advanced methodologies such as Space Syntax analysis (Law & Versluis, 2015; Serra et al., 2015). However, these analyses have primarily focused on specific countries, such as the United Kingdom, overlooking transitions between functional systems across different scales. It is suggested that economic activities shape national spaces into core and peripheral regions, influencing population distribution and economic activity. Yet, the dichotomy between core and periphery may oversimplify the spatial structure, as multiple economic concentrations and functional attractors may exist (Krugman, 1999).

To address these complexities, a multi-scale approach to accessibility analysis is proposed, integrating network analysis methodologies with functional indicators (Law & Versluis, 2015; Serra et al., 2015). This approach considers spatial accessibility's correlation with various socio-economic factors across different scales, revealing intricate relationships between spatial structures and functional distributions.

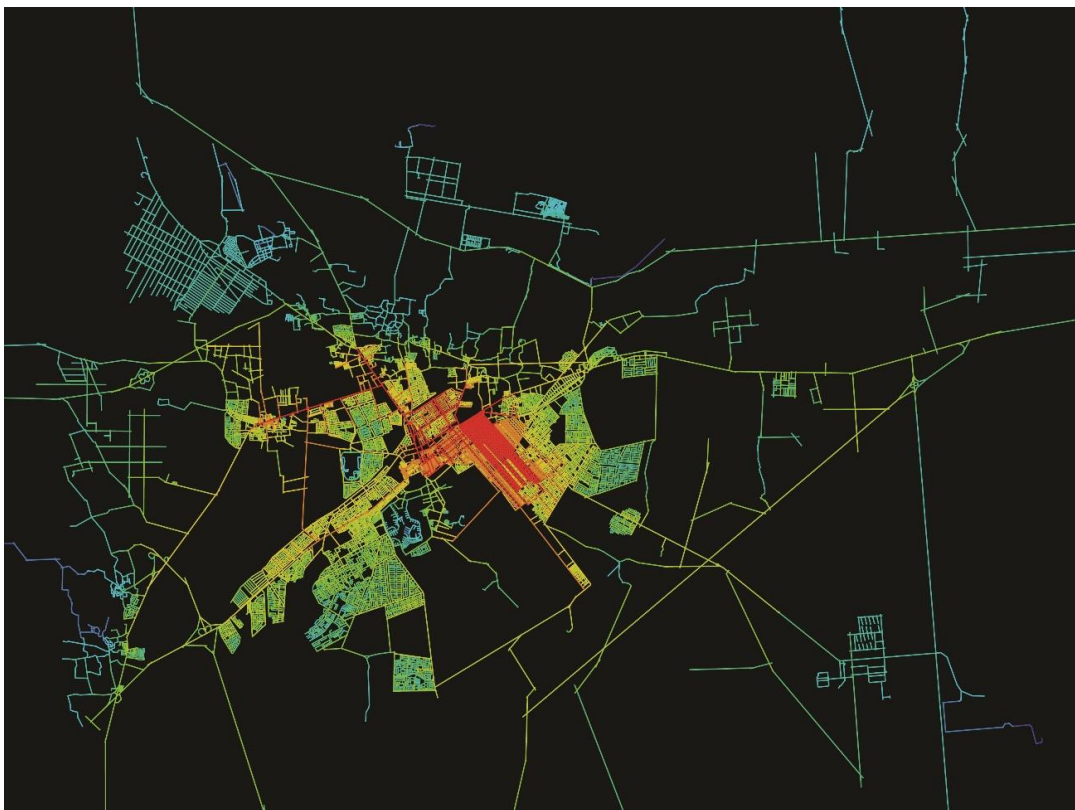


Fig. 2. Integration Map, Al Kharj KSA.

Source: Author.

Table 1.
Summary of Integration values of Al kharj

AVG.	Min	Max	Std. Dv	Count	Less than 0.30	0.30-0.38	0.38-0.46	0.46-0.54	0.54-0.62	0.62-0.69	0.69-0.77	0.77-0.85	0.85-0.93	Above 0.93
0.65	0.22	1.01	0.13	9431	45	143	724	1044	1901	2329	1710	1010	455	70

Source: Author

The integration value above 1 shows strong integration, while the value below 1 indicates segregation. In the case of Al Kharj City Highest integration of 1.01 was observed. The mean integration for the study area is 0.65 and minimum is 0.22 as shown in table 1.

The heat scale shows the highest values as red, then orange, followed by yellow, and then green, i.e., the highest values colored in hot, and as the value decreases the color becomes cooler.

Results

Figure 1 illustrates the map of Al Kharj

pinpointing its tourist attractions. These attractions exhibit a centralized spatial distribution. The map underwent digitization using AutoCAD software, as well as GIS. Subsequently, the author employed Depthmap X software to conduct axial analysis, resulting in the creation of an axial map. Figure 2 depicts the integration of Al Kharj as analyzed by Depthmap. The average integration was determined to be 0.65, with the highest recorded value being 1.01 and the lowest 0.22 for Al Kharj. Additionally, the difference factor for these integration values was computed as 0.65, indicating significant disparities among various movement routes, as detailed in Figure 3 and Table 1.

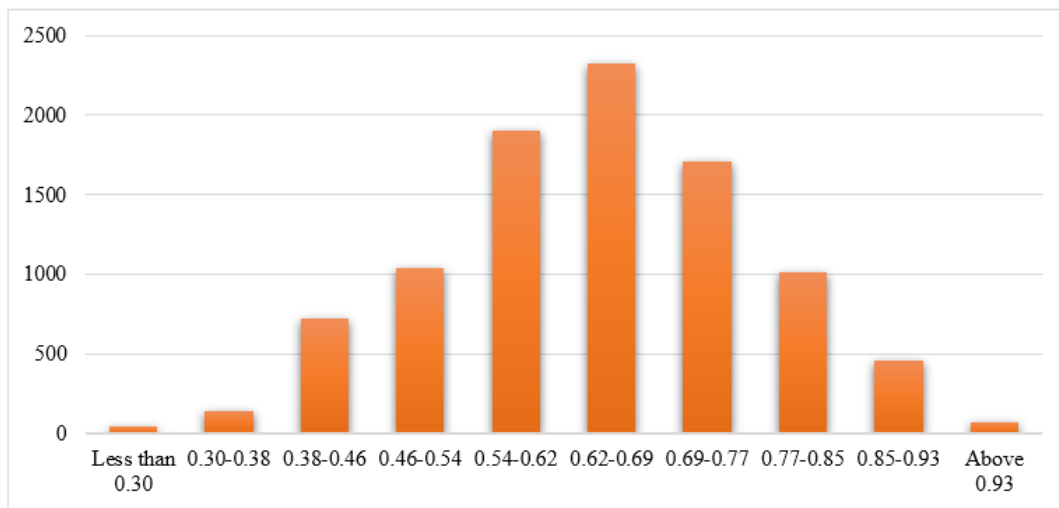


Fig. 3. Distribution of integration, Al Kharj KSA.
Source: Author



Fig. 4. Step depth from the most integrated routes.

Source: Author

Table 2.

Summary of Step depth values of Al Kharj.

AVG.	Min	Max	Std. Dv	Count	Less than 4.40	4.40-8.80	8.80-13.20	13.20-17.60	17.60-22.0	22.0-26.40	26.40-30.80	30.80-35.20	35.20-39.60	Greater than 39.60
11.48	0	44	5.23	9431	661	2016	4246	1338	751	314	51	37	9	8

Source: Author

The most integrated routes were found in the central park of the city, where most of the tourist spots are located. The central area of Al-Kharj City, particularly in the Al-Salam and Al-Wurud neighborhoods, exhibits a notable concentration of parks, with a density exceeding 0.47 parks per square kilometer. In the Tawiq and Mushrif neighborhoods, park density ranges from 0.24 to

0.46 parks per square kilometer. Conversely, park density in the Al-Afja neighborhood varies from 0.04 to 0.05 parks per square kilometer. As one moves away from the center of Al-Kharj, the density of parks gradually decreases, reaching its lowest levels in the northeast, east, south, and southwest areas of the city, with densities falling below 0.003 parks per square kilometer.

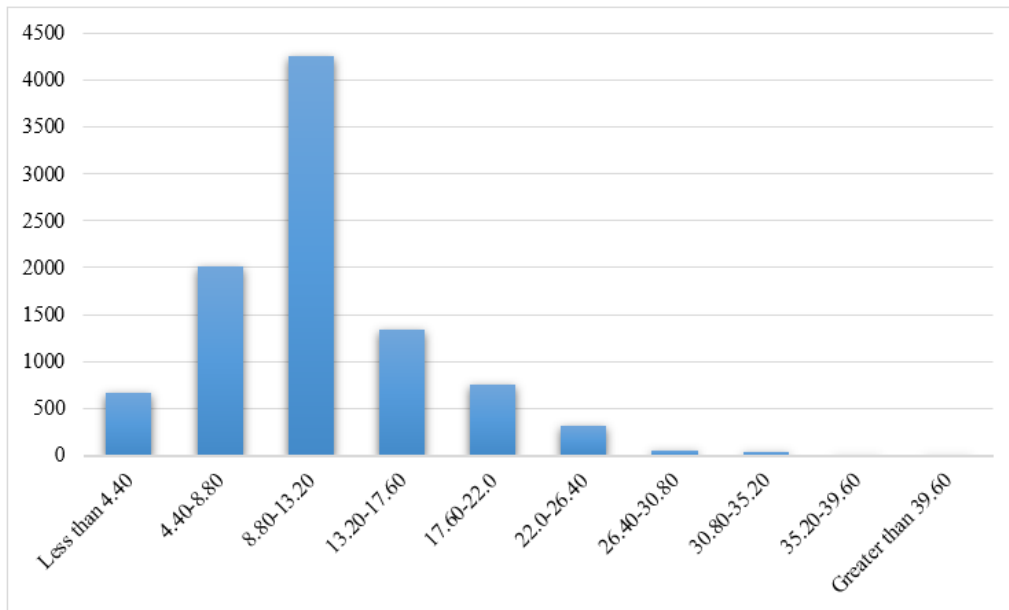


Fig. 5. Distribution of Step Depth.
Source: Author

The distribution of parks primarily in the central area of Al-Kharj City significantly influences access times to these recreational spaces. The range of access times varies considerably, with the shortest recorded time being less than 0.16 minutes and the longest reaching 56.3 minutes. Notably, neighborhoods such as Al-Salam, Al-Aaliyah, and Al-Faisal enjoy swift access to parks, with times of less than 3 minutes. Conversely, on the city's outskirts, neighborhoods like Al-Sahba, Al-Basatin, and

Mushrifah exhibit access times ranging from 8 to 9 minutes. However, in the eastern and southern sectors of the city, including Al-Rihan, Najd, Ahad, Al-Arid, and Al-Narjis neighborhoods, access times increase substantially to approximately 15–22 minutes. The highest access times were observed in the southern and southeastern regions of Al-Kharj City, particularly in neighborhoods such as Al-Sharq, Al-Naseem, Al-Waha, and Al-Rahab.



Fig. 6. Choice Map.
Source: Author.

Table 3.
Summary of Choice values of Al kharj

AVG.	Min	Max	Std. Dv	Count	Less than 0.072	0.072-0.145	0.145-0.218	0.218-0.290	0.290-0.363	0.363-0.436	0.436-0.509	0.509-0.581	0.581-0.654	Greater than 0.654
0.004	0	0.73	0.019	9431	9343	53	21	7	5	0	0	0	0	2

Source: Author

Al Kharj exhibited a maximum step depth of 44, with an average step depth calculated at 11.48. This indicates that, on average, navigation within the city requires approximately 11.48 or 12 turns. Figure 5 displays the distribution of step depth, highlighting a greater frequency of routes with step depths of less than 9. Further details are presented in Table 2.

Figure 6 depicts the choice map of Al Kharj, with the highest choice value recorded at 0.73 and the

lowest at 0. The average choice value for Al Kharj was determined to be 0.004. Meanwhile, Figure 7 illustrates the distribution of choice values, indicating that the majority of routes possess choice values below 0.072.

The distance to tourist spots in Al-Kharj spans from a maximum of 64.4 kilometers to a minimum of less than a quarter kilometer. Conversely, the longest recorded travel time to residential centers stands at 86.3 minutes.

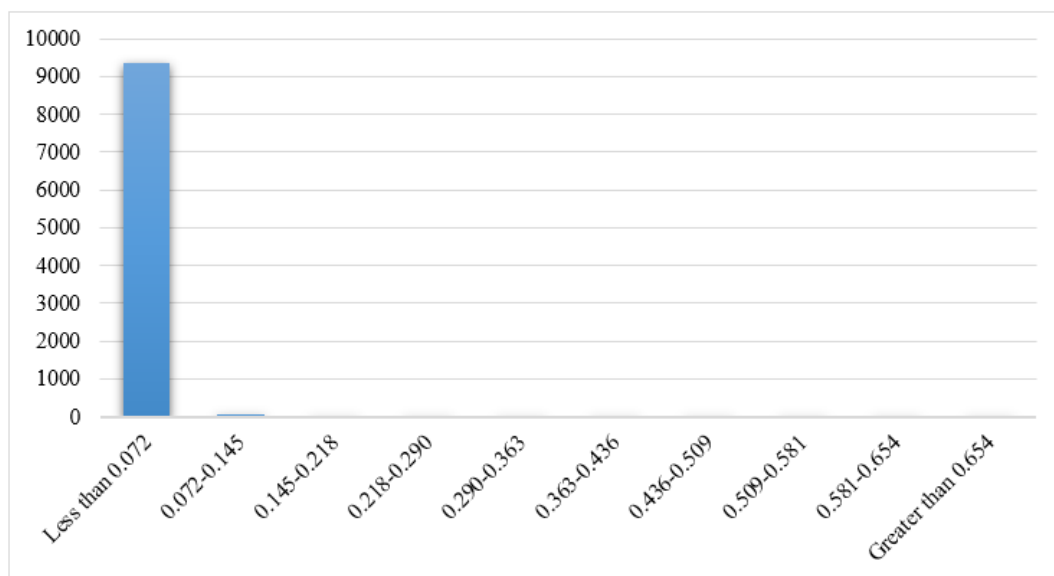


Fig. 7. Distribution of Choice values.
Source: Author.

Notably, restaurants and cafes are predominantly concentrated in the central area of Al-Kharj, resulting in relatively short travel times, with durations of less than one minute (3 minutes) in neighborhoods such as Al-Wurud, Al-Salam, Al-Nasifa, Al-Faisalía, and Al-Khalidiya.

Conversely, in the western outskirts, travel times to these amenities slightly increase, ranging from 6.6 to 9.9 minutes in neighborhoods like Al-Rafaia and Al-Rafi, situated northwest of the study area, as well as in Al-neighborhood.

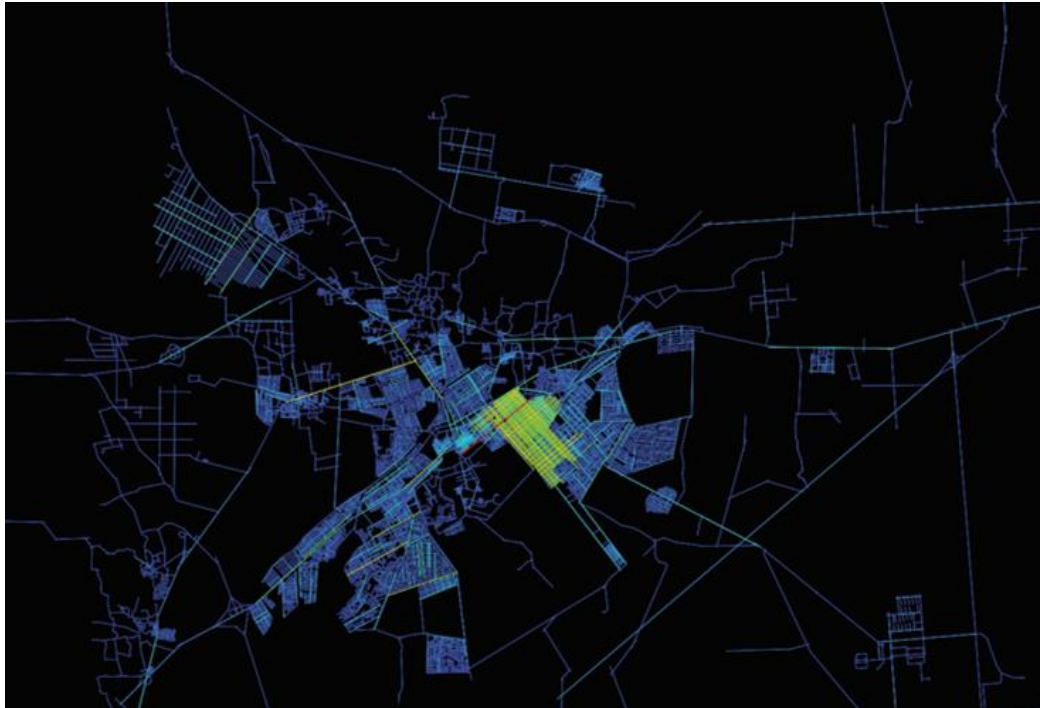


Fig. 8. Connectivity map of Al Kharj City.
Source: Author.

Table 4.
Summary of Connectivity values of Al kharj

AVG.	Min	Max	Std. Dv	Count	Less than 6.1	6.1-12.2	12.2-18.3	18.3-24.4	24.4-30.5	30.5-36.6	36.6-42.70	42.70-48.80	48.80-54.90	Greater than 54.90
3.61	0	61	3.57	9435	8614	628	94	27	21	34	10	6	0	1

Source: Author

Moving towards the northern, northeastern, and southern parts of the central area, travel times to reach restaurants and cafes extend to approximately a quarter of an hour (14.9–22.3 minutes). Further east and south, these travel times increase, reaching around half an hour

(22.3–30 minutes) in neighborhoods such as Al-Rayah and Al-Qairawan. Finally, in the southernmost and easternmost regions of the study area, travel times exceed half an hour (30 minutes) in neighborhoods like Al-Rahab, Al-Naseem, Al-Waha, Al-Nakhl, and Al-Sharq.

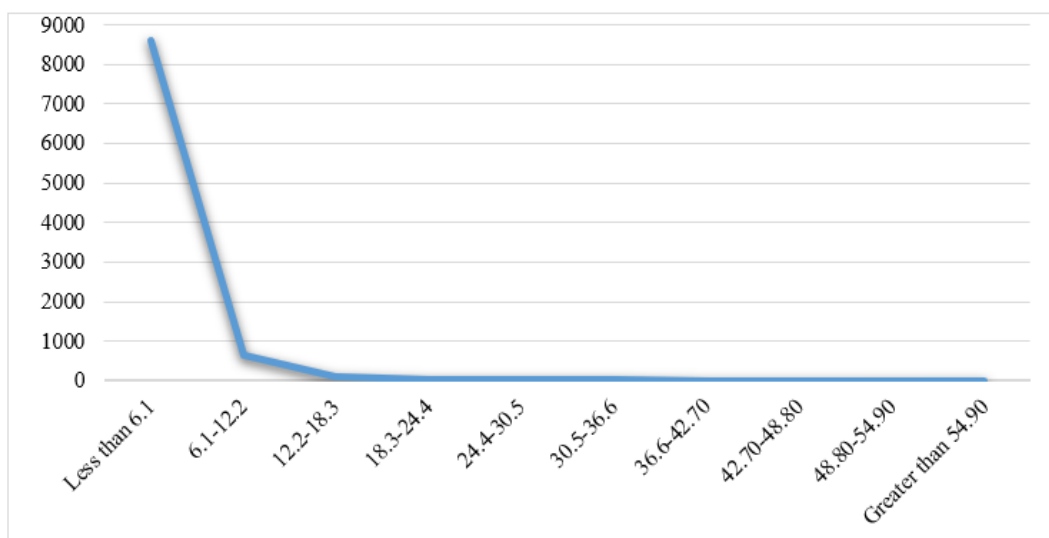


Fig. 9. Distribution of Choice Values.

Source: Author.

Figure 8 presents the connectivity analysis of Al Kharj, Kingdom of Saudi Arabia (KSA). The average connectivity was computed to be 3.61, with the highest value reaching 61, denoted by red lines on the connectivity map, representing the intensity through a heat scale. Conversely, the lowest connectivity value was recorded at 0, indicated by purple lines in Figure 8's connectivity map. These values are further detailed in Table 4. Figure 9 illustrates the distribution of connectivity values for Al Kharj KSA, revealing that 8614 routes have connectivity values less than 6.1.

Discussion

The study delved into an extensive examination of Al Kharj's tourist attractions in Saudi Arabia, employing a multifaceted analysis that encompassed various factors including accessibility, integration, step depth, choice, and connectivity, utilizing space syntax analysis. Accessibility, a cornerstone in physical and urban planning, has garnered significant attention in scholarly discourse due to its implications for functional, economic, and social aspects (Chen & Yeh, 2019; Geurs & van Wee, 2004; Handy & Niemeier, 1997; Hansen, 1959; Markovich, 2013). The intricate interplay between accessibility and spatial structures has been a subject of interest, particularly concerning road networks that serve as fundamental conduits facilitating mobility across different spatial scales, ranging from neighborhoods to national levels (Parham, Law, & Versluis, 2017; Serra & Pinho, 2013).

Cities, as pivotal components of regional and national systems, exert considerable influence on functional dynamics and economic potentials, shaping population distribution and economic activities (Law & Versluis, 2015; Serra, Hillier, & Karimi, 2015; Portugali, 2011). However, conventional studies often lacked the depth and comprehensive data to unravel the intricate spatial patterns. With the advent of modern Geographic Information (GI) technologies, particularly Geographic Information Systems (GIS), scholars have been empowered to conduct detailed accessibility analyses at national scales, facilitating nuanced insights into spatial distributions and dynamics (Law & Versluis, 2015; Parham et al., 2017; Serra et al., 2015).

Recent studies have ventured into exploring accessibility on unprecedented national scales, leveraging advanced methodologies such as Space Syntax analysis. However, these analyses have predominantly focused on specific countries, potentially overlooking the transitions between functional systems across different scales (Law & Versluis, 2015; Serra et al., 2015). It's acknowledged that economic activities play a pivotal role in shaping national spaces, often manifesting in core-periphery dynamics that influence population distribution and economic activities (Krugman, 1999). However, the oversimplification inherent in the core-periphery dichotomy fails to capture the complexity of spatial structures, as multiple economic concentrations and functional attractors may coexist within a region.

To address these complexities, the study proposes a multi-scale approach to accessibility

analysis, integrating network analysis methodologies with functional indicators, allowing for a nuanced examination of the correlation between spatial accessibility and various socio-economic factors across different scales, thereby revealing intricate relationships between spatial structures and functional distributions. The integration values obtained indicate strong connectivity within Al Kharj, particularly highlighted by the highest integration value of 1.01. This indicates a robust connection between the parks and their surroundings, signifying high integration. Conversely, values below 1 suggest segregation.

The distribution of tourist attractions within Al Kharj displays a centralized spatial pattern, notably concentrated in the central area, particularly in neighborhoods like Al-Salam, Al-Wurud, Al-Nasifa, Al-Faisalia, and Al-Khalidiya. Accessibility to these attractions varies across different regions of the city, with travel times extending from mere minutes to over half an hour, influenced by factors such as park density and spatial connectivity. The connectivity analysis further highlights spatial disparities, with central areas exhibiting higher connectivity compared to peripheral regions.

Conclusions

In conclusion, the comprehensive analysis of Al Kharj's tourist attractions offers valuable insights into the spatial dynamics of the city, emphasizing the importance of accessibility in shaping urban landscapes. By adopting a multi-scale approach and integrating advanced analytical techniques, the study provides a nuanced understanding of the intricate relationships between spatial structures, economic activities, and functional distributions, thereby informing more effective urban planning strategies aimed at enhancing accessibility and optimizing the spatial distribution of tourist services within Al Kharj. This study sheds light on the complex interplay between spatial configuration and park accessibility in urban environments. Through a comprehensive analysis incorporating space syntax techniques and user feedback, the research identified key spatial attributes influencing accessibility in Al Kharj, KSA.

The results highlight how crucial it is to carefully consider spatial integration, choice, and connectivity when to improve accessibility and utilization. Nevertheless, the research also uncovered disparities between objective geographical metrics and subjective user assessments of accessibility, highlighting the

necessity of a comprehensive strategy that incorporates both quantitative spatial analysis and qualitative user input in design and administration.

In order to improve accessibility, encourage community involvement, and promote well-being in urban settings, evidence-based interventions can be informed by addressing these gaps and utilizing spatial insights.

Despite the comprehensive nature of this study, several limitations should be acknowledged. Firstly, the geographical scope of the study, which is focused solely on Al Kharj, Saudi Arabia. While this focus provides detailed insights into this specific urban context, it limits the generalizability of the findings to other cities with different socio-economic, cultural, and spatial characteristics. Future research could benefit from comparative studies across diverse urban environments to validate and extend the applicability of the findings.

Secondly, the integration of advanced analytical techniques enriches the study, the complexity and technical nature of these methods might limit their accessibility to urban planners and policymakers who may lack specialized training. Therefore, intuitional trainings and education of the same is recommended for future work and applications.

The comprehensive analysis of Al Kharj's tourist attractions offers valuable insights into the spatial dynamics of the city, emphasizing the importance of accessibility in shaping urban landscapes. By adopting a multi-scale approach and integrating advanced analytical techniques, the study provides a nuanced understanding of the intricate relationships between spatial structures, economic activities, and functional distributions. This knowledge informs more effective urban planning strategies aimed at enhancing accessibility and optimizing the spatial distribution of tourist services within Al Kharj. The study highlights the complex interplay between spatial configuration and accessibility in urban environments, underscoring the importance of considering both quantitative spatial analysis and qualitative user input in urban design and management. Addressing these limitations and leveraging spatial insights can inform evidence-based interventions to improve accessibility, foster community engagement, and enhance well-being in urban settings.

Recommendations

Based on the comprehensive analysis conducted in this study, several recommendations emerge for improving accessibility and optimizing the spatial distribution of tourist services within Al Kharj:

Integrate Spatial Analysis into Urban Planning: Incorporate spatial analysis, particularly space syntax techniques, into urban planning processes to enhance the understanding of spatial dynamics and optimize the layout of tourist attractions and amenities within the city.

Consider Multiscale Approach: Adopt a multiscale approach to accessibility analysis, integrating network analysis methodologies with functional indicators, to capture the intricate relationships between spatial structures, economic activities, and functional distributions across different scales.

Enhance Connectivity and Integration: Focus on enhancing connectivity and integration within Al Kharj by investing in infrastructure development, improving road networks, and creating pedestrian-friendly environments to facilitate seamless movement between tourist attractions and amenities.

Promote Community Involvement: Encourage community involvement in urban planning processes to ensure that the spatial layout of tourist services aligns with the needs and preferences of residents and visitors. Solicit user feedback to supplement quantitative spatial analysis and inform decision-making.

Address Disparities: Address spatial disparities in accessibility by targeting interventions in areas with lower connectivity and integration, particularly peripheral regions of the city. Implement measures to improve access to tourist attractions and amenities in these areas to promote inclusivity and equitable access for all residents.

Utilize Evidence-Based Interventions: Implement evidence-based interventions informed by spatial insights and user feedback to enhance accessibility, encourage community engagement, and promote well-being in urban settings. This may include targeted investments in infrastructure, public transportation, and green spaces to improve overall accessibility and quality of life.

By implementing these recommendations, urban planners and policymakers can work towards creating a more accessible, inclusive, and vibrant urban environment in Al Kharj, Saudi Arabia, thereby enhancing the overall tourist experience and contributing to the city's socio-economic development.

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