*Research Paper*

# From Residential Village to Heritage Marketplace:

## Evaluating morphological transformations and their use consequences over time in the historic settlement of Al-Wakrah, Qatar

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### Abstract

*Many people consider Al Wakrah to be a distinctive settlement for cultural heritage in the State of Qatar. Based on archaeological evidence, the area of Al Wakrah was perhaps the first urban center of Qatar. Originally a fishing and pearling village like the capital city of Doha, globalization and rapid urbanization also characterized the development of Al Wakrah over the last half-century, leading to a remarkable transformation in the morphology of the settlement. The paper studies this morphological transformation of Al Wakrah and the consequences for socio-economic and functional use. In doing so, the paper offers some clarity about the identity and dynamics of Al Wakrah as a traditional heritage district today; specifically, Souq Al Wakrah. We explore this within the context of traditional marketplaces in general, and souqs in the Arab States of the Gulf Cooperation Council (GCC) region in particular. The study explores the symbiotic relationship between urban morphology, land use, and function in settlement form. The purpose is to develop a deeper understanding of urban changes and expansion on the use and experience of Souq Wakrah as a public place today. Researchers apply several representational techniques standard in morphological studies, including analysis of urban spatial networks using space syntax. The findings of the paper indicate the design and planning nature of Souq Wakrah as a contemporary heritage re-creation. It contrasts with more straightforward examples of historic preservation and restoration in other traditional marketplaces of Qatar itself and elsewhere in the world. This situation arose due to the near-complete demolition of most historic structures in Al Wakrah during the recent past, except for a few isolated examples. However, a few important 'traces' of Al Wakrah's morphological history remain consistent over time, despite the dramatic transformations in the rest of the settlement over time. The paper concludes by discussing the potential implications for design and planning policy in the protection and preservation of historic resources in the State of Qatar. It argues for the critical importance of developing a clear understanding of the relationship between form, function, and the urban context of such places in future preservation projects.*

### Keywords

*Heritage, Market, Morphology, Public realm, Space syntax, Urban*

## 1. Introduction

Urban public spaces are a mirror of collective human thoughts, beliefs, and insights. A differentiation appears in the dialogue between urban public spaces where a distinct character emerges to symbolize the nature of the people who live, work, and play there. However, the urban image and identity of such public spaces have undergone a dramatic transformation in many countries around the world over the last few decades. Like others, rapid development and urbanization in the State of Qatar have affected this continual dialogue between urban space and culture, and the shape and form of its urban spaces. Significant economic growth and contemporary globalization have had a dramatic impact on several different aspects of Qatari society, including massive population growth, development of critical infrastructure, transportation, housing, and concerns about the preservation of historical heritage.

As a result, many traditional, narrow streets of Middle Eastern settlements, known as *sikkas*, have been transformed into wide roads by modern transportation planning measures (Major et al., 2019).[1] The traditional courtyard houses of the region have transformed into modern housing and contemporary villa models (Al-Mohannadi et al., 2019). Economic development has led to the establishment of new, high-rise business districts (Salama & Wiedmann, 2013; Furlan et al, 2018; Suneson, 2019) (**Figure 1**). The loss of significant cultural heritage and the identity of urban places by the demolition of a large number of Qatari historical areas for the sake of economic development has become a mounting concern for many people. It has led to a counter-reaction and movement to preserve and renovate Qatari heritage sites to maintain some semblance of cultural image and identity tied to the past of the country and the people who inhabit it (Boussaa, 2016).

**Figure 1. A 2018 view of the high-rise West Bay Business District in Doha with traditional Qatari boats in the foreground. Source: Authors.**

Souk Waqif in old Doha is the most important heritage site in Qatar and became a model for future preservation and renovation projects (Radoine, 2010; Alraouf, 2012). The souq dates back to the 18th century, including private homes, which were usually single- story traditional courtyard houses (Jaidah & Bourennane, 2010; Al-Mohannadi et al., 2019). In the late 20th century, Souk Waqif began to deteriorate as Qataris abandoned old Doha for contemporary villas located in new suburban residential areas served by large modern shopping malls. After a fire destroyed several buildings of Souk Waqif in the early 21st century, the Qatari royal family acknowledged the cultural importance of the traditional marketplace and funded the 2004-2008 restoration project (Salama & Wiedmann, 2013). The project included preservation efforts to maintain the oldest buildings, demolition of all buildings constructed after 1950, and the elimination of most surface parking spaces for underground parking. Newly built structures

[1] A *sikka* is a narrow alleyway in residential clusters to connect a main road or the city center to the surrounding areas, commonly used in Arab cities of the past and a prominent feature of historic districts in Arab cities today.

adhere to or modernize the local Qatari architectural style, many using traditional methods of construction during the early 20th century to reflect the cultural heritage origins of Doha. It includes thick masonry walls, mangrove roofs, use of natural stone, and bamboo poles, which collectively act as insulation against the hot desert climate of the country. The restored souk also features low-rise building elevations, usually 2-3 story in height, though there 5-story boutique hotels in peripheral locations. A series of pedestrian routes, including narrow alleyways, separate these buildings, replicating the traditional sikka morphology (Tannous, 2020). As a consequence, the State of Qatar identified several other valuable historic sites in the country for the goal of preservation and renovation, one of which was Al Wakrah (**Figure 2**).

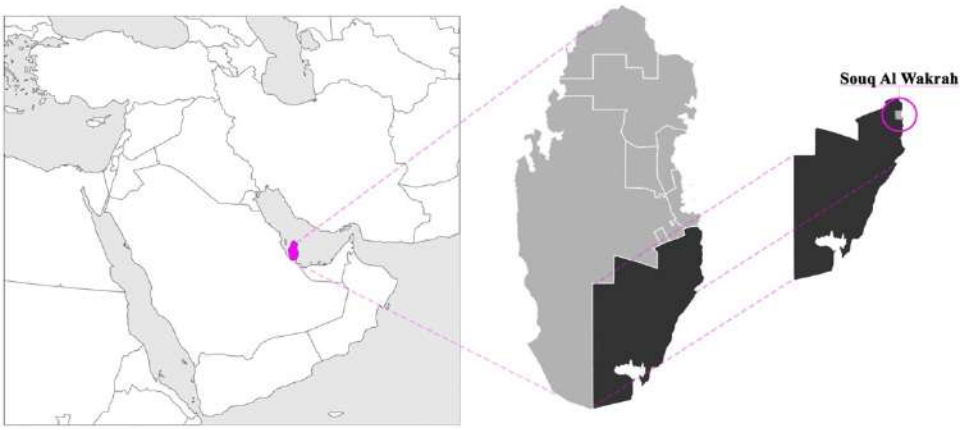


**Figure 2. The location of: (left) the State of the Qatar on Qatari Peninsula attached to the larger Arabian Peninsula on the Arabian/Persian Gulf; and (right) Souq Al Wakrah, and municipal boundaries in the State of Qatar. Source: Authors.**

Like Doha, Al Wakrah was originally a small fishing and pearling village dating back to the early 20th century. However, there is some evidence for human habitation in the area dating much farther back in time (Jaidah & Bourennane, 2010). With the beginning of the economic boom arising from the exportation of natural gas and petroleum reserves in the country, most of the citizens of Al Wakrah migrated north to the capital city of Doha in search of job opportunities and a better lifestyle. Much of the historic fishing village became abandoned, with many historic structures becoming the subject of demolition, especially in the late 1990s. Since then, there has been a project to reconstruct the area of the original fishing village, and the large settlement surrounding it (contemporary Al Wakrah) expanded to become the second-largest city in the country as a satellite settlement of the Doha itself.

The paper reviews a study about the morphological transformations of Al Wakrah settlement over time, and its consequences for socio-economic and functional us. The result of this analysis helps to clarify its identity and dynamics as initially a predominantly residential area of the past into a traditional marketplace and heritage district today. The study explores the symbiotic relationship between urban morphology, land use, and function in the Al Wakrah settlement to develop a deeper understanding of the impact of urban changes and expansion on the use and experience of Souq Al Wakrah as a public space today. In doing so, it helps to identify the potential for enhancements of the heritage district in the future.

## 2. Literature Review

In simple terms, urban morphology is a study of city form focusing on its genesis, evolution, and transformation over time. Researchers define urban morphology as the study of spatial patterns at different scales of the city. It can also help to promote sustainable urban development by highlighting physical characteristics demonstrating the potential for urban interventions (Chen, 2014). Other scholars identify urban morphology as a study of physical and special components at a different scale in light of

land use, building footprint, block patterns and size, and street networks (Kankol, 2015). Some argue that urban morphology represents a critical tool for understanding the physical formation and changes of settlements over time (Ahmadi et al., 2012).

Industrialization of the 19th century brought many changes to modern life in many older Arab capitals. Many of these changes followed the Western style of urban development of Europe and the United States. The physical transformation of Arab cities is a distinctive characteristic of such changes in the modern lifestyle. Many traditional urban models of the Middle East struggled to respond to the needs of citizens. For example, the transformation of an Islamic city for the proposed 1968 master plan of Damascus, Syria (Kiet, 2011). Another example includes the adaptation of the 19th century Haussmann model for Paris, France – after a visit to the World's Fair in that city – for the subsequent transformation of Cairo, Egypt in 1967 (Lapidus, 1969). Generally, the development of urban components and their transformation in the Middle East arose as a result of economic globalization, industrial modernization, and rapid urbanization trends common around the world in developing nations.

The Arabian Peninsula experience three distinct stage of urban transformation across different times associated with the pre-oil era, oil discovery and rapid growth, and the emerging post-oil city (Salama & Wiedmann, 2013; Tannous, 2020) (**Figure 3**). In the pre-oil period, settlements of Gulf region bears of the hallmarks of direct relations to the needs of citizens, principally in their coastal locations since the sea was the source of food and water-based commerce connecting most citizens. There was also be a nearby source for freshwater, usually wells accessing the aquifer in the case of Qatar. Minimum building heights, urban form adapted to religious regulation such as gender segregation, linearly- connected shops, courtyard houses, and a Friday mosque, which served as a centralized landmark and a public space for community meetings and social gatherings, characterized these early Qatari settlements.

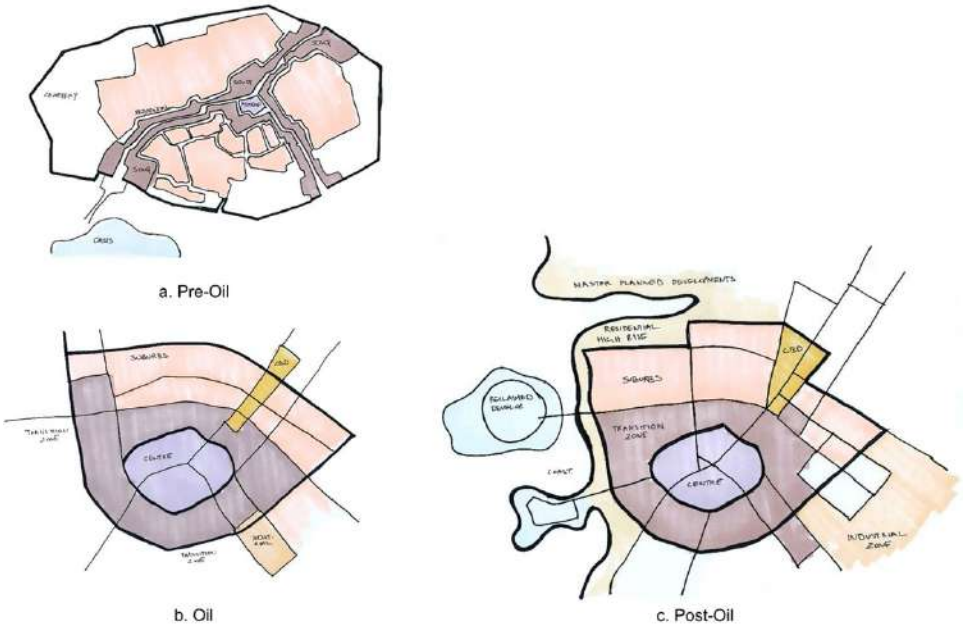


**Figure 3. Sketches of the urban form in the (a) pre-oil settlement (three times the scale relative to the other sketches), (b) oil city, and (c) post-oil metropolis of the Arabian Peninsula. Source: Drawing by Tannous, 2020 after Salama and Wiedmann, 2013.**

Subsequently, in the 1960s and 1970s, after the initial discovery of oil in the 1940s, Qatar experienced dramatic social, economic, and physical changes. Oil exportation revenues drove economic growth and expansion in the country, which led to many job opportunities, subsequent population growth (especially of expatriate citizens), and urban development to accommodate these populations. It was a turning point in the urban transformation of Qatari settlements from their traditional coastal settings to wealthy oil-exporting ones accommodating principally the automobile. It led to the radial growth of ring-road

systems and connections outward to the expanding edge of the city. Later, the period of post-oil, Qatar began the process of economic diversification, which focused on education, financial service trading, recreation, and sporting activities, and, most importantly, tourism (Al-Marri, 2017). The State of Qatar began investing in large-scale real estate development and mega-projects as well as cultural and historical preservation of what historic resources remained in the country.

## 3. Research Methodology

The study takes a holistic approach to the literature review by briefly discussing the multidisciplinary perspective for the investigation of different aspects of urban morphology and the transformation of settlement form. Additionally, we provide a brief historical overview of the case study in examining the morphological modifications of the Al Wakrah settlement over time and probable consequences for socio-economic and functional use. We utilize this analysis to clarify the urban dynamics of Al Wakrah, initially as a village in the past and the basis for its transformation into its identity as a marketplace and heritage district today. In this sense, the close relationship between function, land use, and urban morphology serves as a basis to understand the impact of urban growth and recent changes on the user experience of it today as a place to visit.

The research applies several representational techniques common to morphological studies in the field today including analysis of urban spatial networks using space syntax (Hillier and Hanson, 1984; Hillier, 1996; Major et al, 2019; Tannous, 2020; Tannous & Major, 2020). Space syntax is a theory and a series of methods for the quantitative analysis of spatial networks from a scale of a single house to the entire city (Dursun, 2007; Nourian, Rezvani, & Sariyildiz, 2013). Space syntax analysis is typically represented in descriptive color-coded mapping of spatial networks in a range from red through orange, yellow, green, light blue to dark blue and purpose for various measures. Urban analysis tends to focus on the axial map, which is composed of the longest and fewest (or most strategic) lines of sight and movement called axial lines. Several decades of research highlight the importance of the axial structure in settlement form for understanding the city's planning over time as well as patterns of movement for pedestrians and vehicles (Hillier, 1996; Hillier & Hanson, 1984; Hillier, et al., 1993; Major, 2018; Penn, et al., 1998).

Space syntax is an international research program of academics and practitioners scientifically investigating spatial networks from the single building to entire metropolitan regions to better understand the role of built space in society (Hillier & Hanson, 1984; Hillier, 1996; Hanson, 1998; Major, 2018). Founded in the late 1970s and early 1980s by Bill Hillier, Julienne Hanson, John Peponis, Alan Penn, and many others in The Bartlett at University College London, space syntax has developed a set of techniques for the simple representation and mathematical measurement of architectural and urban space over the last 40 years (Benedikt, 1979; Hillier & Hanson, 1984; Hillier et. al, 1987a-b; Hillier, 1989; Hillier et. al., 1993; Penn et. al, 1998; Turner et. al, 2001). Today, the international space syntax community composes hundreds of researchers and practitioners in more than forty countries around the world.

Representations in space syntax are usually plan-based using objective, easily understood constraints of the built environment for the most generic of human uses such as movement, occupation, and visibility because we are forward-facing, bipedal creatures normally bound by gravity (Hillier, 1996; Major, 2018) (**Figure 4**). A point in space is the simplest notion on which to build a geometry with no size, only position. The number of points in any space will be infinite without a resolution – defining the bounds of a space and 'size' for the points – such as the average standing area of a normal human being (0.28m2).

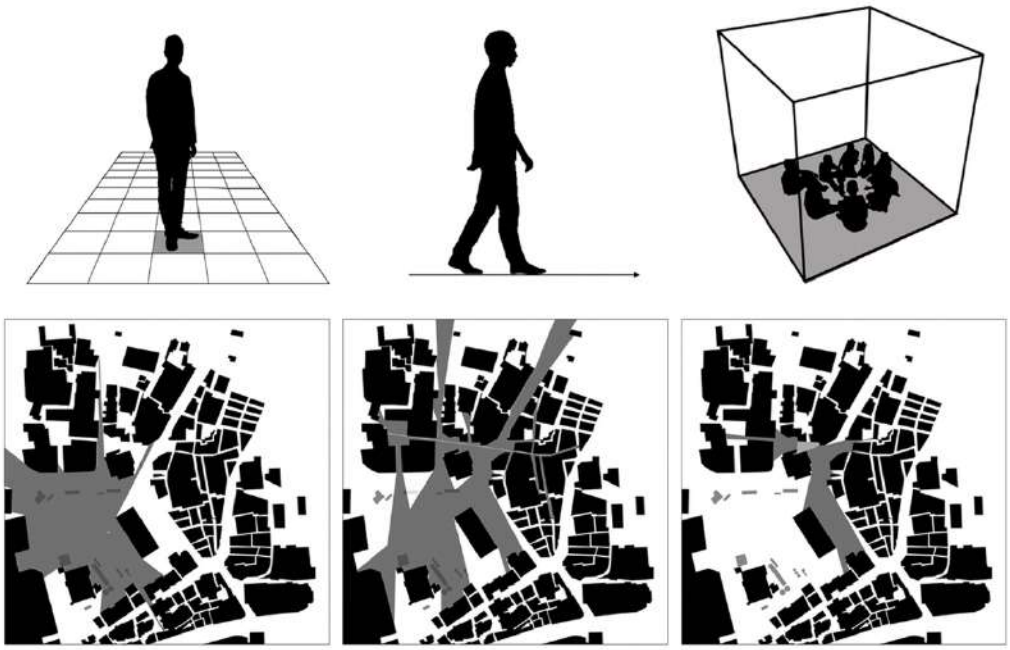

**Figure 4. Representing (top, left to right) a point, line, and convexity ('the quality or state of being convex') in space syntax and (below, left to right) a visual field (in dark grey) from a point, line, and convex space (in light grey) in the plan of Souq Waqif in Doha, State of Qatar. NOTE: Plan elements in the large open plaza towards the lower left represents impediments to movement but not visibility, i.e., a normal human being can see over the top of these elements. Source: Mark David Major/Heba O. Tannous.**

Movement tends to be linear. The axis or line of sight and movement (e.g., axial line) represents an idealization because a line is a set of points having a length but no width or depth. The matrix of longest and fewest (i.e., most strategic) lines of sight and access completely covering all spaces of a built environment as defined by its built surfaces (walls or facades) is the axial map (Hillier & Hanson, 1984). The axial map is the most common reference to a 'space syntax model' for forecasting (60%-80% accuracy) of pedestrian and vehicular movement in the urban environment (Hillier et. al., 1993; Penn et. al, 1998). The occupation of space tends to be convex where everyone can see and be seen by everyone else such as a group of people gathered in a circle or a room. All points are visible to all other points in a convex space. The collection of all convex spaces composing a built environment is the convex map, which tend to be more useful for the analysis of buildings (Hillier et. al, 1987; Hillier, 1996). The potential for seeing and moving is a visual field, which is all visible and accessible space from which we might see or move as defined from a point or set of points such as a line of sight and movement or convex space. The matrix of all visual fields from a gridded set of points to all others in a built environment is a visibility map. Space syntax uses combinations of these simple descriptions to create layered representations of the built environment.

We can measure the matrices of these representations using topological graph theory to mathematically quantify the configurational relationship of all spaces to all others or within a set range. Configuration is a relational system where any local change in a system can have global effects across that system to varying degrees dependent on the size of the system relative to the significance of the change itself within that system (Hillier, 1996). We utilize some specific space syntax measures for the urban analysis of Al Wakrah. These are connectivity and mean depth, global integration, and global choice.

"Depth exists wherever it is necessary to go through intervening spaces to get from one space to another" (Hillier & Hanson, 1984; 108). Mean depth is defined in topological terms based on the smallest number of steps necessary to reach from one space to another in terms of changes of direction. Mean depth in space syntax is relativized for probability factors (relativized mean depth) based on connectivity. It is the simplest measure concept in space syntax based of how many other spaces does a single space

immediately connect to within the network. If you can move or see from one location, space, or street to another without accessing an intermediary one, they are connected (Major, 2018). Integration is the relativized mean depth of a space in relation to all other spaces in a network based on changes of direction using connectivity. It represents how integrated/shallow or segregated/deep is a space within a spatial network. It demonstrates the pattern of 'to- movement' for those spaces most likely used for journeys from anywhere to everywhere else in the spatial network. Researchers can set the radii of integration measures based on specified parameters such as global integration (radius=n) and local integration (radius=3). As Szczepańska (2011) mentions, the stronger correlation of integration, the better movement of users in urban space and their ability to identify their location within the context of the entire city. In this case, these highly integrated spaces are not only highly visited spaces or destinations, they are also more intelligible for movement through during our everyday routine.

Global choice is a measurement of 'through-movement' based on giving every space in the spatial network (however represented) a value of 1, then proportionally sharing that value amongst all its immediate connections. The shared values for every space are then added up to provide a measurement for the degree of importance of that street within the spatial network. Choice measures how likely a space it is to be passed through on all shortest routes from all spaces to all other spaces in the entire system or within a predetermined distance (radius) from each segment (Hillier et. al., 1987). Global choice tends to highlight the primary transportation routes within an urban spatial network and spaces facilitating some degree of social control in buildings. Finally, researchers can also set the radii of various configurational measurements based on metric parameters. Despite this innovation, researchers consistently find that the correlation with configurational measures tends to be more significant for understanding the 'social logic of space' than metric ones (Hillier & Vaughan, 2007).

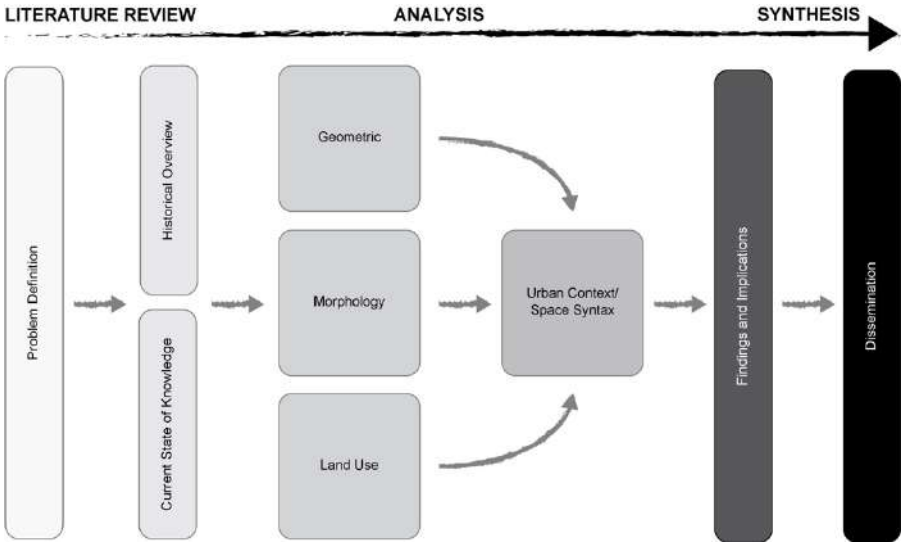


**Figure 5. Diagram summarizing the methodology of the study. Source: Authors.**

We also conduct more typical morphological analysis using figure ground representations, pedestrian sheds based on set radii (300 meters and 400 meters), rank ordering of block sizes and shapes, illustrations of the geometrical composition of the urban pattern, illustration of morphogenesis and evolution over time, land use maps, and the mapping of active and passive building frontages. The aim is to understand the effects of urban morphology on the dynamics of the contemporary souq as a cultural, social, and economic object (**Figure 5**). The paper attempts to answers two questions: What is urban morphology's role in supporting the distinctive identity of the souq as public space and cultural district today, and what might this mean for traditional marketplaces in other Arabian cities of the Middle East? The paper attempts to answer these questions by representing the locational value and analysing tangible and intangible aspects of the case study. In doing so, we hope to evolve the appreciation and

awareness of urban heritage and Qatari architecture for the local, regional, and international community and expand our knowledge about the urban morphology of Arabian settlements.

**Figure 6. Bird's eye views of the urban fabric of (left) Souq Al Wakrah roundabout and the stadium of Al Wakrah in the background and (right) Souq Al Wakrah promenade (Source: MME/Ahmed Fakhroo).**

## 4. About Al Wakrah

Many people consider Al Wakrah (or Al Wakra, الوكرة in Arabic, derived from the word wakar roughly translating as "bird's nest") as a distinctive settlement in the State of Qatar for its cultural heritage (Figure 6). Due to a wealth of archaeological evidence, Jaidah and Bourennane (2010) argue Al Wakrah was the first urban center of Qatar. Originally, a small fishing and pearling village, Al Wakrah is the capital of Al Wakrah Municipality encompassing 120/km2 (300 mi2) of southeast Qatar today. It is second largest city in the country with an estimated 2015 population of approximately 88,000 people (Source: Qatar Ministry of Development Planning and Statistics). The initial core of Al Wakrah formed near the coast for trade and commerce as many settlements in Qatar. The settlement characterized by its special formation of vernacular urban fabric (**Figure 7**). The components making up the identity and culture of Al Wakrah as a physical place were the small courtyard houses, mosques, and narrow streets facilitating the catching of sea breezes in different open spaces and houses of the settlement. This 'organic' layout enabled residents to enjoy a more comfortable conditions during summer days of Qatar's harsh climatic conditions (Kostof, 1992; Major, 2018). Later, most of the buildings composing the urban fabric of the original settlement were abandoned and demolished during rapid urbanization and economic transformation of the country in the late 20th century.

In this context, globalization and rapid urbanization characterized the development of Al Wakrah, leading to a remarkable transformation in the morphology of the settlement over the last half-century (Salama & Wiedmann, 2013). A major economic boom caused urban transformation and transformation of its physical identity. The MME established a development plan for the city of Al Wakrah city in 2008. The plan was a turning point for the implications of cultural identity in the city. The most significant component of the plan was to regenerate Al Wakrah Beach and the older city neighborhoods in the immediate vicinity. The goal was to revive the old core of Al Wakra into a traditional marketplace known as Souq Al Wakrah Al Qadeem (roughly translated as "ancient bird's nest'). Heritage identity became a priority in the preservation and reinforcement of historic traces of the traditional urban fabric. As a result, reconstruction of the residential courtyard house prototypes was pursued to revive the genus loci

(or 'spirit of place') characterizing the original village streets and buildings. The markets of the new souq became embedded within courtyard houses, transforming from domestic room to retail units, all clustered together based on retail type. The newly designed buildings reflected the local Qatari architectural style of the fishing village with low-rise buildings and traditional masonry construction techniques. Today, there is capacity for more than 800 shops in the new souq selling traditional crafts and wholesale goods as well as several restaurants.

**Figure 7. Historical aerial views of the village of Al Wakrah, Qatar in the (left) 1950s with the Al Wakrah Fort visible in the background and (right) 1960s with two mosques in close proximity to each other clearly visible based on the minarets. Source: MME.**

The result of these efforts is evidenced in the sequential transformation of the Al Wakrah settlement over time. It is most evident in the tendency for some streets to become wider. Many also became straighter in geometric terms. However, what remains clear is the relatively simple parallel and perpendicular relationship of principal streets to the coastline of Al Wakrah. Historically, this is an important consideration in the traditional urban fabric of Qatari settlements, such as Doha and Al Wakrah (Khan et al, Forthcoming). We can demonstrate this by highlighting the two principal routes running parallel to the coastline in yellow and the 5-6 principal routes running perpendicular to the coast in red (**Figure 8**). Such a diagram helps to demonstrating the morphological sequence of the settlement based on what routes have remained more or less consistent over time. The most significant feature remains the main spine of today's souq running parallel and immediately adjacent to the coast and the spine (today's Al Wakrah Road) running parallel farther inland, even as the block structure of the interstitial areas change. Beginning during the 1980s, both parallel spines became much straighter due to modern transportation planning and human modification of the coast. Morphologically, the connection between the sea and the land remains one of the most important historic attributes of Al Wakrah, accurately reflecting the story of the people who lived there in the past. The creation of the Al Wakrah coastal promenade became a prominent feature of the renovation and reconstruction plan in the early 21st century.


**Figure 8. Areal views of Al Wakrah in (top, left to right) 1947, 1959, 1966, and (bottom, left to riht) 1980, 2008, 2019. Source: MME–Edited by Authors.**

Figure ground representations of Al Wakrah today demonstrates many free-standing buildings including the historical forts, the reconstructed souq, several mosques, a school, and contemporary residential villas characterize the settlement today (Figure 9). Many of these contemporary residential villas reside in the center of large yard with fencing surrounding the compound on all sides (Al-Mohannadi et al., 2019). The block pattern (composed of older buildings pending demolition or regeneration) to the north of Souq Al Wakrah offsets in relation to the coast. The morphology of the souq itself following the courtyard house typology within internal courtyard spaces becoming part of the larger block pattern, hence the larger blocks in Souq Al Wakrah. However, it the block pattern of the surrounding areas were modelled based on the fences defining residential yards, it would reflect a significantly larger block size in the more contemporary residential development of the city.

Souq Al Wakrah expands along the coast in north- south fashion with an area of ~0.31 km.sq (76 acres or 'ac'). The paper tends to focus more on the main part of the souq in the middle area instead of is northern (still unopened) and southern extensions. Most of these extension areas of Souq Al Wakrah include large children playground and park in the north and vacant retail units in the south for large wholesale goods and services, especially associated with boating.

**Figure 9. The figure ground representation of Souq Al Wakrah and its surroundings context for an area of (left) 2 km$^2$ with the formal boundaries of the souq today highlighted in red and (right) 1 km$^2$ focusing on the main part of the souq. Source: Authors.**

There is a large number of pedestrian-only *sikka* routes interconnecting between secondary streets running along the western edges of the souq and the main spine along the coast. There are five relativity clear straight streets running perpendicular to coast, including the two streets that defines the norther and southern perimeter of the main part of the souq. Most of the routes in the souq are reconstructed to represent the historical precedent of the original fishing village. The block pattern of Souq Al Wakrah seems closely knitted together since the courtyard houses typology are connected via a series of courtyards to facilitate cross-circulation in movement from retail area to retail area. A satellite image provides a clearer picture the courtyard house typology in the souq (**Figure 10**).

**Figure 10. Satellite view of Souq Al Wakrah from 1 km in 2020 (Source: Google Earth/Maxar Technologies).**

## 5. Morphological, Land Use, and Spatial Analysis

Hillier (1999b) argues the layout of organic cities possess a strongly consistent geometric logic in their axial structure. Such settlement form tend to emerge naturally or organically based on the local actions of resident's following simple rules of aggregation (Hiller & Hanson, 1984; Major, 2018; Major et al, 2019). However, such settlements around the world tend to possess a geometric logic based on open-angle connections in their axial structure within 15° of a direct 180° continuation and near right-angle connections within about 15° of 90° providing access to individual dwellings in residential area (Hillier, 1999b). Main routes tend to cater to non-residential land uses such as retail and civic purposes. The main spine of Souq Al Wakrah follows this logic in relation to the coastline, being composed of longer lines of movement connecting via open-angles with shorter lines of varying length connecting to it at a right or near right angle. This maps a relatively clear form of street hierarchy in the urban pattern of the settlement, facilitating the historical connection to the coast. The result is a pseudo parallel-perpendicular geometric logic in the older areas of the Al Wakrah settlement, which only lack the regular grid adherence to perfect right angles found in other parts of the world (Major, 2018). The only place that does not maintain this grid logic is the southern area of the souq where there is a 45° connection formed due to modern planning transportation. Longer, more highly-connected routes associate with wider streets and stronger visual connectivity between the coast and surroundings in accessing inland land uses (**Figure 11**).

**Figure 11. Main spine of Souq Al Wakrah along the coast constructed of long lines of movement with open angle connections and perpendicular routes composed of routes of varying length connecting to the main spine at a right or near right angles. Source: Authors.**

The consequences of this morphological layout become more apparent in a pedestrian shed from the geometric center of Souq Al Wakrah (**Figure 12**). In the case of Souq Al Wakrah, the geometric center is the entry plaza adjacent to western parking area. A pedestrian shed map provides a simple measure of walkability 'as the crow flies' in specific radii as measured based on metric distance. The strong connection of the sea and the land is obvious again, as most of the souq lies within walkable 400 meter (m) distance from the geometric center. The souq is strongly linear in shape, extending in a north and south fashion. However, the main part of the souq itself in very walkable within a short distance (3-5 minute walk) except for the corners of the blocks to the extreme north and south. At the same time, the area of surface parking lot and high-speed vehicular flows of Al Wakrah Road to the west isolates the souq from the surrounding areas of the large Al Wakrah settlement day. However, the relativeness nearness of the historical fort and a mosque on the other side of Al Wakrah Road suggest some potential

for creating a strong physical connection between the heritage district of the souq and these western areas. The northern and southern extensions of the souq lay outside of this walkable distance due to its linear shape. To the north, this walkable distance only encompasses the facades of some residential buildings, which are mostly unoccupied due to a future urban renewal project. The pedestrian shed radius of 400 m does not even reach the southern extension. A walking distance of 300 m from this geometric centre encompasses almost the west side parking, about half of the coastal promenade, and most of the significant authentically historic structures remaining in Souq Al Wakrah itself.

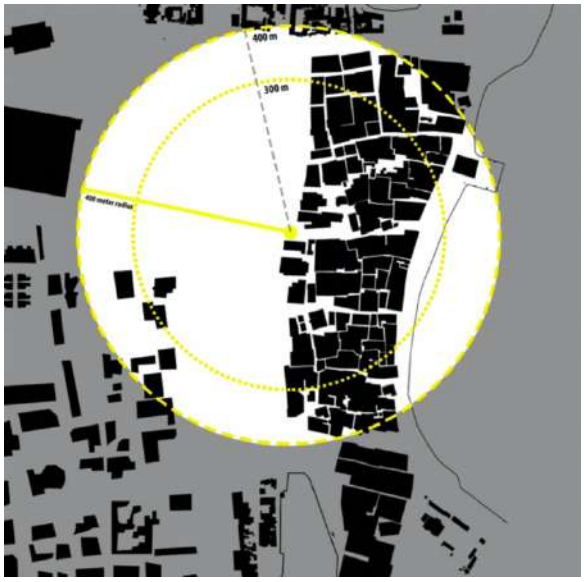


**Figure 12. Pedestrian shed of a 3-to-5-minute walk (300-400 meters) from the geometric center of Souq Al Wakrah. Source: Authors.**

A rank ordering of the urban blocks of Souq Al Wakrah laying within 300 m of the geometric center provides further evidence about the walkable nature of the souq (**Figure 13**). We arranged all of the urban blocks laying within 300 m in descending order based on metric area to demonstrate the overall block profile of the souq. There are 61 urban blocks and free-standing buildings within 300 m of the geometric centre of Souq Al Wakrah with the block possessing the most extended length in one dimension being 130 m in length. These figures roughly translate into an average block size 2,623 m2 or 51 m x 51 m if based on a square shape in the central portion of Souq Al Wakrah. This does not account for the space allocated to courtyards, alleyways, and principal routes. If we back out an approximately 25% for these types of spaces, then average block size is around 2,000 m2 or a typical square block of about 45 m x 45 m.


**Figure 13. Blocks within the radius of 300 m (or an area of 0.28 km$^2$) in descending order in terms of metric area for Souq Al Wakrah. Source: Authors.**

Land use patterns typically emerge to capitalize on the natural movement of pedestrians as shaped by the potential of the morphological layout and visual permeability, which can affect the number of users in an area (Hillier et al., 1993; Hillier, 1996). The phenomena of clustering for similar types of land use functions such as commercial retail units can then produce a multiplier effect above and beyond the natural movement levels as determined by the configuration of routes in the urban grid (Hillier, 2002). However, in the case of Souq Al Wakrah, the land use pattern it completely pre-determined by the urban planning and development agencies of Qatar. Because of this, the modern land use planning of the souq

clusters together of similar types of retail and function in well-defined zones (**Figure 14**). The land use map highlights the hotel land use with very large footprints at the northern and southern perimeters of the main souq. There are more or less six areas categorized by specific retail functions such the general retail, perfumes, fabrics, gold, and bird market areas. There is a widespread clustering of restaurants along the coastal promenade but also inland adjacent to the western parking area due to their strategic locations adjacent to the sea (for the view) and parking (for convenience).

**Figure 14. Land use plan of Souq Al Wakrah indicating broadly the division of retail zones. Source: Authors.**

The land use map is useful for identifying the retail zones in the market, but a mapping of active frontages and blank walls is more informative in the case if Souq Al Wakrah due to its reconstruction based on the courtyard house typology (**Figure 15,** left). The opening of retail units directly onto a route defines an active frontage, which indicates an opportunity for casual interaction with retail items for-sale (e.g., browsing) as well as other shoppers. If there are not, then it is bank wall with more limited opportunities for interaction. There are a large number of active frontages focused along the coastal promenade and along the western edge of the souq adjacent to the surface parking lot. There are also some active frontages and kiosk in front of shops in the Al Baraha area.[2]

However, the overwhelming majority of facades in Souq Al Wakrah consist of blank walls due to the inward focus of the courtyard typology within urban blocks, where there are more retail units. This generates some degree of 'hidden activeness' for people in movement through the souq who can hear retail activities taking place but are not able to observe them until they enter one the courtyards where there are retail units. In contrast, the coastal spine and western spine adopt a more traditional street-oriented retail units and active frontages so there is a much more vibrant atmosphere on the outer edges of the souq than within its heart. Mosques and hotels also possess blank frontages due to privacy reasons associated with religious activities and sleeping accommodations.

[2] Al Baraha is the name of main public space at the center of the settlement, which citizens use for social cultural activities.

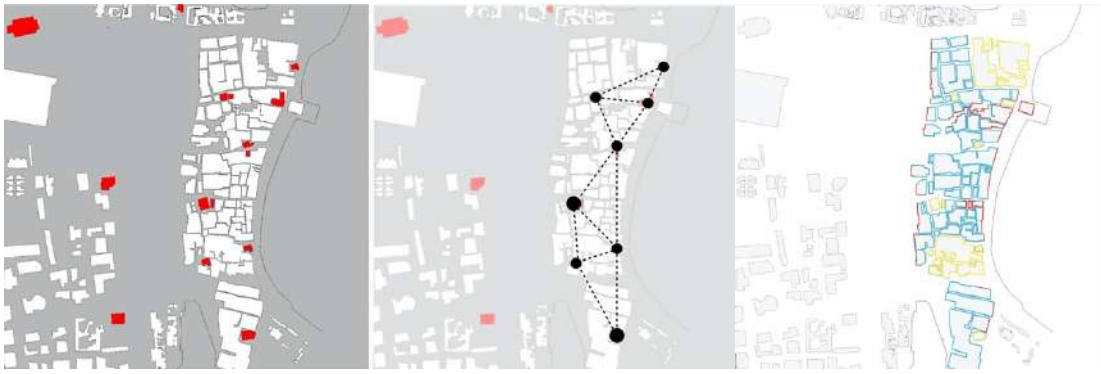

**Figure 15. Illustration of (left) active and blank wall frontages where red indicates active, blue means blank and yellow indicates hotels and mosques, (center) location of mosques and prayer rooms, and (right) 'as the crow flies' distance relationship between the nearest mosque to the next in Souq Al Wakrah Source: Authors.**

Another noticeable attribute of the land use strategy is the location of mosques and prayer areas (Figure 15, center). Mosques often represents the civic and religious heart of Islamic settlements, often categorized into Friday mosque as well as smaller mosques distributed around the settlement to ease accessibility for users (Tannous, 2020). The mosque also represents an important representable element of the cultural building heritage of souqs and important component of the public realm (Tannous, 2020; Major & Tannous, 2020). In Souq Al Wakrah, there are nine mosques and prayer areas in the main part of the souq. However, there are only two mosques (both to the west) within a 400 m distance from the geometric centre of the souq in the surrounding areas. The number of mosques highlights the cultural importance of the souq for the religious and civic identity of citizens. In this context, a worship location is available for approximately every 17,778 m2 of area in the souq. Additionally, the extended nature of the souq in north-south direction results in scattered network connecting together all the mosques and prayer areas so that the average distance between the mosques is only 150 m or less than a 2-minute walk based on the average walking speed of 1.4 meters per second (**Figure 15**, right). Generally, despite this high degree of accessibility, the mosques also tend to reflect the inward-looking nature of the urban morphology of Souq Al Wakrah. Seven of the mosques/prayer areas locate within the interstitial areas of the urban blocks with only four located at the edge.

Streets are a link between spaces forming a relationship between layout and human activity patterns in an urban area. Axial lines are the representation network of the space syntax model. In the space syntax model of Al Wakrah city, the axial size is slightly less than 3000 of axial lines. The global choice measurement in the model of Al Wakrah highlights all of the major roads of the urban spatial network, including the main commercial street of Al Wakrah Road, Al Wukair Street, and the new orbital highway of Al Majad Street. It also highlights the importance of the main and secondary spine of the souq as well as some of the route perpendicular to the coast (**Figure 16**, left). The global integration (radius=n) measure in space syntax model of Al Wakrah highlights the main integration core of the commercial street that runs along the souq area, another main street connecting from the souq area operating as an east-west connector in the larger settlement. The network highlights another major road, which recently introduced a significant change in the street pattern.

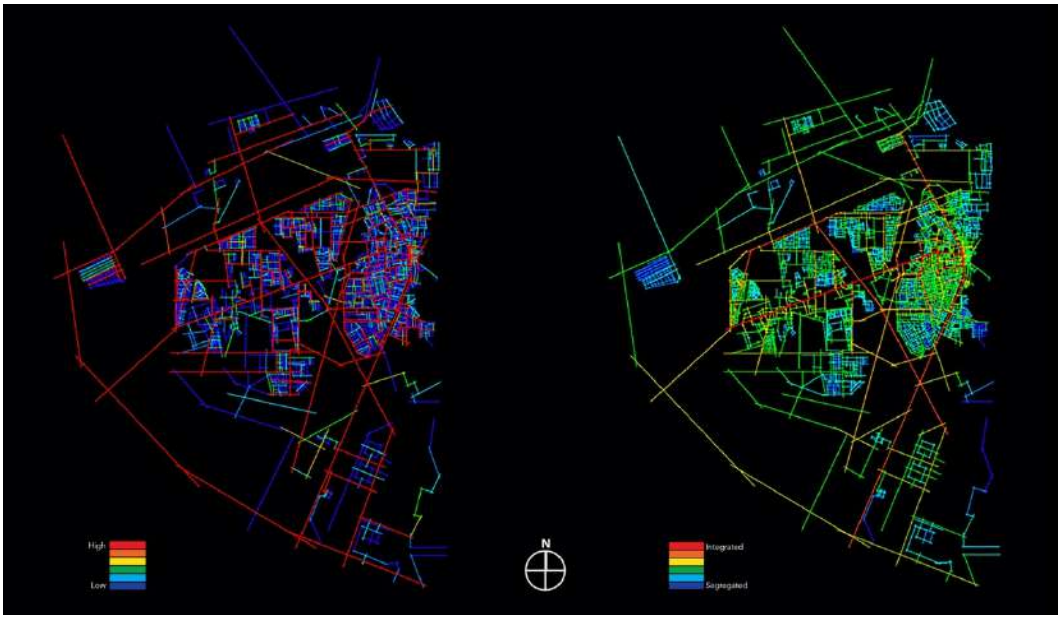


**Figure 16. Space Syntax model of (left) global choice and (right) global integration (radius=n). Source: Authors.**

This major highway connects immediately to Doha Expressway from north and runs along the Al Janoub Stadium site along the south and reaches Musiaeed area (**Figure 16**, right). The linkage of two highways makes the Al Wakrah settlement very accessible and even closer than before to Doha in the topological terms of space syntax. The space syntax model of the mean depth from the most integrated line, i.e., radius=5 based on the longest length of Al Wukair Street, demonstrate consistency for the significance of major roads connecting important nodes in Al Wakrah settlement to larger Metropolitan Doha region further to the north.

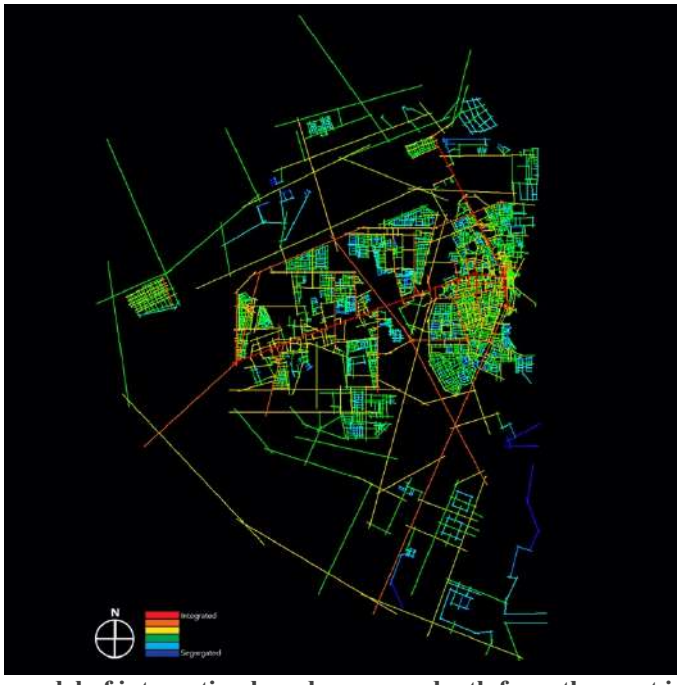


**Figure 17.Space Syntax model of integration based on mean depth from the most integrated line (radius=5). Source: Authors.**

Two major streets directly connect to Doha via Al Corniche and Doha Expressway. Both streets intersect with the main route of Al Wukair Street, allowing for accessibility in both a north-south and east-west direction. Also, the integration map highlight the importance of the land use pattern, since these routes crossing important areas such as the souq in the east) and the central core of Al Wakrah Hospital and Al Janoub Stadium to the west. This indicates a shifting of the central core in Al Wakrah over time from the old area adjacent to the coast to further inland in relation to the enlarged size of the settlement. (**Figure 17**).

## 6. Discussion

Souqs are important urban public areas that mirror the cultural identity of citizens who lived and the way they lived. The consideration of cultural heritage and identity was important during the reconstruction of the Al Wakrah settlement into a traditional marketplace. The souq provides a model traditional heritage public realm designed to attract many different types of users. Souq Al Wakrah, like any other traditional marketplaces, consists of a main and secondary spine interconnected by a series of narrow streets, open plazas, and, most importantly, a clear architectural style and heritage identity. The mapping of the souq appears to demonstrate the potential for a dynamic urban place, though it has not achieved such status yet in its entirety. The closer study of the souq shows a sophisticated urban morphology, allowing for readability and ease of use of the space by people. The unique and special components of the souq create a mental image of the souq, such as the promenade and the only observation spot injected to the sea on the left side of the main spine.

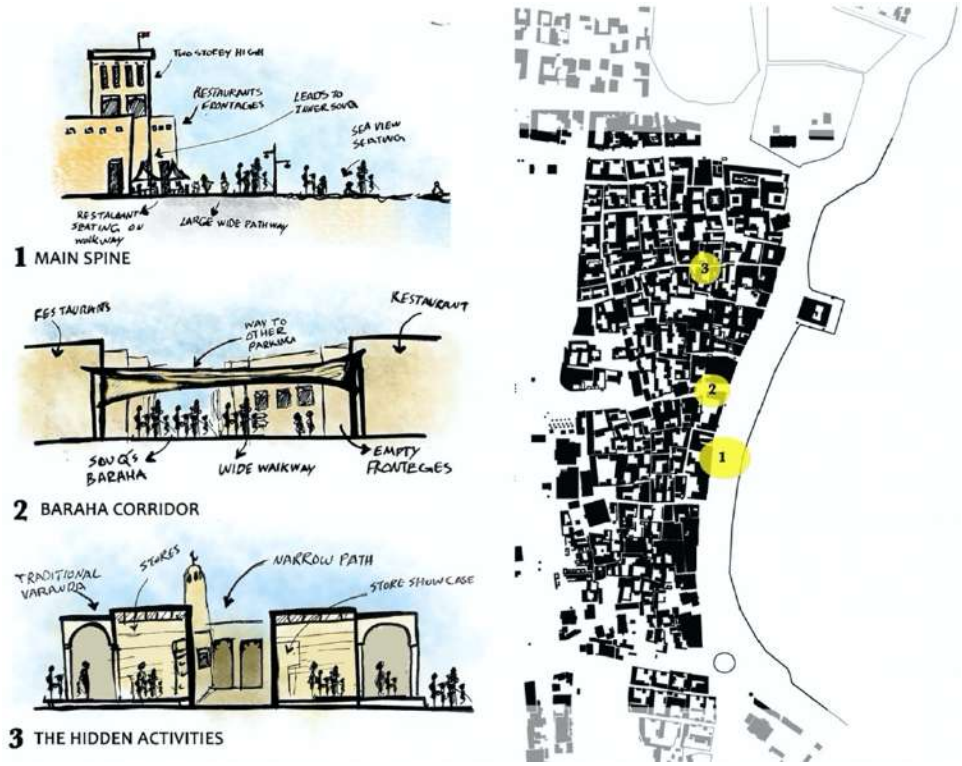


**Figure 18. Sketches of representative cross-section at three routes in Souq Al Wakrah. Source: Authors.**

The main spine is broad, but while passing through feels smaller because of the outdoor restaurants seating, which minimizes from the pedestrian area especially reaching the middle spot with restaurants on both sides, it makes it populated and busier. Nevertheless, their location along the promenade enhances the efficiency of a pleasant environment for users, with an interesting image in the mindset of users with the combination of nature on one side and architecture on the other side (**Figure 18**).

Generally, after the morphological analysis of souq Al Wakrah, these cases are very few since most of the paths are blank wall frontages. The urban blocks of the souq are oriented to inward. This inward-looking block results in a degree of 'hidden activeness' due to the renovated courtyard houses typology. It feels quiet and emptiness in the passageways. Still, walking down the narrow passages, you can hear activeness and people talking behind walls, coming from a series of courtyard houses. These courtyards provide a collective sharing space for the small shops that share a sense of openness and offers a shaded area with sea breeze for shoppers. Yet, the of these blocks' courtyards seem empty and seeks for more of public activities.

Additionally, the block size of Souq Al Wakrah promotes walkability. The interconnected houses and narrow passageways ease the connection between the parking area and the promenade on the opposite edge. In contrast, the rectangular form of souq Al Wakrah from the north-south emphasizes the strong relationship to the coast, resulting in longer walking distance. It highlights the successful connection to the sea and the week connection to the urban surroundings of Al Wakrah settlement from north-south and west. The disconnection arose from the urban growth of Al Wakrah after the widespread production and exportation of oil beginning in the 1960s. The urban growth of Al Wakrah city continued in scattered form until it filled itself, reaching the old Al Wakrah from different sides, which resulted in the dis-attachment of the souq to the surroundings.

On the other hand, leftover structures of the settlement near the coast are indications of their historical importance in the cultural identity of the settlement as a small fishing and pearling village. The Private Engineering Office (PEO) maintained this connection to the coast in their reconstructed morphology plan for Souq Al Wakrah. However, there is great potential for further links to the urban surroundings to overcome the separations caused by modern planning transportation measures in the west.

## 7. Conclusion

The paper studied the morphological transformation of Al Wakrah over time and specifically Souq Al Wakrah today. It included several different aspects of urban morphology for the settlement, souq, and the potential impact on urban functions. The study covered many elements such as history, culture, block size and pattern, architectural style, and space syntax analysis. The study concluded that the re-construction of the traditional urban fabric strongly preserves the historical relationship between the sea and inland uses. However, there is a disrupted relationship to the larger city of Al Wakrah due to provisions allocated to moving and stationary vehicles. The results of the analysis suggest the importance of morphological relationships in promoting walkability, even in the hot and harsh climate of the region.

Nonetheless, the historical significance of the oldest part of Al Wakrah endures through the intelligent weaving together of cultural identity through traditional building types and urban forms into a remarkable public space. It transformed into a destination area of visitors, residents, and tourists. The revival of traditional urban fabrics rooted in historical evolution is a worldwide phenomenon in pursuit of generating genus loci or a 'collective spirit of place' for traditional marketplaces as destinations for people to visit and linger. Morphological analysis can play a vital role in understanding this spirit of place, its nature, and the means for generating it through the design of new urban buildings and forms. It is the foundation of the best cities for people in marketplaces such as the souqs. It can play a fundamental role in creating the distinctive ambiance we often only discover in such urban spaces.

## 7. Acknowledgements

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## 8. References

Ahmadi, V., Chi-Ani, A. I., Farkisch, H., & Surat, M. (2012). "Morphological study of urban hierarchy in Boshrooyeh city of Iran," *Archnet-IJAR International Journal of Architectural Research,* **6**(3), 56-71.

Al-Mohannadi, A., Furlan R., Major, M.D. (2019). "Socio-Cultural Factors Shaping the Spatial Form of Traditional and Contemporary Housing in Qatar: A comparative analysis based on space syntax," *12th International Space Syntax Symposium Proceedings*. Beijing, China: Beijing Jiao Tong University, 8-13 July 2019, 285: 1-19.

Alraouf, A. (2012). "A Tale of Two Souks: The Paradox of Gulf Urban Diversity," *Open House International*, **37**(2), 72-81.

Boussaa, D. (2016). 'Cities in the Gulf; Rapid Urban Development and the Search for Identity in a Global World'. The Search for Identity with Reference to Dubai, Jeddah and Doha. Population Growth and Rapid Urbanization in the Developing World. IGI Global: IGI Global.

Chen, F. (2014). "Urban Morphology and Citizens' Life," In A. C. Michalos (Ed.), *Encyclopedia of Quality of Life and Well-Being Research*. Dordrecht: Springer Netherlands, 6850-6855.

Furlan, R., Petruccioli, A., Major, M.D., Zaina, S., Zaina, S., Al Saeed, M., Saleh, D. (2018) "The urban regeneration of west-bay, business district of Doha (State of Qatar): A transit-oriented development enhancing livability," *Journal of Urban Management*, Open Access, 16 November 2018, ISSN: 2226-5856.

Hanson, J. (1989). "Order and Structure in Urban Design: the plans for the rebuilding of London after the Great Fire of 1666," *Ekistics*, 334/335.

Hillier, B; Vaughan, L; (2007) "The City as One Thing," *Progress in Planning*, **67**(3): 205–230.

Hillier, B. (2002). "A Theory of the City as Object: or, How Spatial Laws Mediate the Social Construction of Urban Space," *Urban Design International*, **7**: 153–179.

Hillier, B. (1999b). "The hidden geometry of deformed grids: or, why space syntax works, when it looks as though it shouldn't," *Environment and Planning B: Planning and Design*, 169-191.

Hillier, B. (1999a). "Centrality as a Process: Accounting for Attraction Inequalities in Deformed Grids," *Urban Design International,* 4: 107-127.

Hillier, B. (1996). *Space is the Machine: A Configurational Theory of Architecture*. Cambridge: Cambridge University Press.

Hillier, B. Penn, A., Hanson, J., Grajewski, T., Xu, J. (1993). "Natural Movement: or, Configuration and Attraction in Urban Pedestrian Movement," *Environment and Planning B: Planning and Design*, **20**: 29–66.

Hillier, B. 1989. "The Architecture of the Urban Object," *Ekistics*, 334/335: 5–20. Jaidah, I., Bourennane, M. (2010). *The History of Qatari Architecture 1800-1950*. Italy: Skira.

Kankol, J.R. (2015). *Urban Grain: Fostering social and economic diversity through parcelization of large urban development sites. A test case in Seattle's Central District.* Master of Architecture Thesis, University of Washington, USA.

Khan, A. (2021) *Evaluating Morphological Transformations and Their Use Consequences Over Time in the Historic Settlement of Al-Wakrah, Qatar.* MUPD 760 Thesis Focus on Urban Design, forthcoming. Copies will be available from the author and Qatar University Library.

Khan, A., Major, M.D., Tannous, H.O. (Forthcoming) "Tradition and Transformation in Two Marketplaces: Souk Al Wakrah and Souk Waqif, Qatar," *Urban Design International*.

Kiet, A. (2011). "Arab Culture and Urban Form." *Focus*, April 2011, **8**(1), 36-45. Kostof, S. (1992). *The City Assembled: The Elements of Urban Form through History.* London: Thames & Hudson.

Major, M.D., Tannous, H.O. (2020). "Form and Function in Two Traditional Markets of the Middle East: Souq Mutrah and Souq Waqif," Special Issue on Space SyntaxTheory, Methods and Applications, *Sustainability*, **12**, forthcoming.

Major, M.D., Tannous, H.O., Mirincheva, V. (2019). "Urban Transformations: From restricted random aggregation to designed cultural intent in Middle Eastern cities," *12th International Space Syntax Symposium Proceedings*. Beijing, China: Beijing Jiao

Tong University, 8-13 July 2019, 282: 1-15.
Major, M.D. (2018). *The Syntax of City Space: American Urban Grid*. New York/ London: Routledge.

Radoine, H. (2010). *Souk Waqif On-site Review Report*. Report for the Aga Khan Award for Architecture, 13 May 2010. Retrieved: 26 June 2020 from ArchNet at

https://archnet.org/sites/6449/publications/1924.
Salama, A.M., Wiedmann, F. (2013). *Demystifying Doha: On Architecture and Urbanism in an Emerging City*. New York: Ashgate Publishing/Routledge.

Suneson, G. (2019) "These are the 25 richest countries in the world," *USA Today*, 8 July 2019. Retrieved: 18 July 2020 at https://www.usatoday.com/story/money/2019/07/07/richest-countries-in-the-world/39630693/.

Tannous, H.O., Major, M.D. (2020). "The Spatial Logic of the Arabian Coastal City: The Case of Doha, State of Qatar and Muscat, Sultanate of Oman," *5th ISUF-Italia 2020 Conference*, Sapienza Università di Roma, 19-22 February 2020, Rome, Italy. Tannous, H.O. (2020). *Traditional Markets in Context: A Morphological Comparison of Souk Waqif in Doha, Qatar and Mutrah Souk in Muscat, Oman*. MUPD 760 Thesis Focus on Urban Design, copies available from the authors and Qatar University Library.