

A Conceptual Framework for Sustainable Neighbourhoods in Al Wakra, State Of Qatar

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Abstract: In the past two decades, sustainability has been a significant concern when planning cities. As a consequence of development occurring in cities, its essence to people is discounted. An example of this is Doha, Qatar's capital, which has undergone massive urban developments because of the post-WWII discovery and production of oil and gas. Doha's urban fabric has been transformed from a rational, people-based, and environmentally adapted design into zoning and transportation dependent planning. However, in the past few years, Doha has started to adopt sustainability-driven urban planning policies. For example, development of the new city Lusail has legislation and design regulations directed towards sustainable planning. Therefore, this research study is focused on the urban planning of a neighbourhood in Al Wakra, Qatar. The focus is on its relationship to the old city layout and the possible implementation of sustainability principles in present-day development in the area. The study also develops strategies and design that utilize sustainability principles. The study process includes a literature review, data collection, detailed site analysis, and exploration of present and historic plans for Al Wakra. Additionally, various alternatives that follow specific strategies are generated to identify a desirable approach for the neighbourhood. Furthermore, the strategies highlight actions needed to implement the development concept. As a result, the study generates an ideal approach for the further development of Al Wakra. Furthermore, the findings can act as a reference for similar developments with a comparable climate, surroundings, environment, size, and population.

Keywords: Built Environment, Urban Fabric, Sustainability, Sustainable Neighbourhoods, Doha, Al Wakra.

INTRODUCTION

Sustainability has been the core of urban development and design for the past few decades. It emphasizes the economic, environmental, and social aspects of the built environment. However, it is not a completely innovative approach for developing and designing cities. Cities all over the world have historically been designed intuitively and, at times, strategically. Trading, climate, geographical location and features, and the movement and interaction of people were the driving forces for the development of old cities. Take Qatar before the discovery of oil as an example. Qatar's population was composed of Bedouins residing in areas by the peninsula during summer. The location of their buildings was strategic for addressing their needs and adapting to the weather. For example, trading buildings, fish and pearl markets, and houses were located by the water for direct access [1-3].

Similarly, their houses were located near the water for natural cooling and ventilation from the sea

breeze. Furthermore, buildings were built adjacent to each other for shading and ease of movement from one place to another. However, after the discovery of oil, nomads became settlers, which led to changes in the urban environment [4-7].

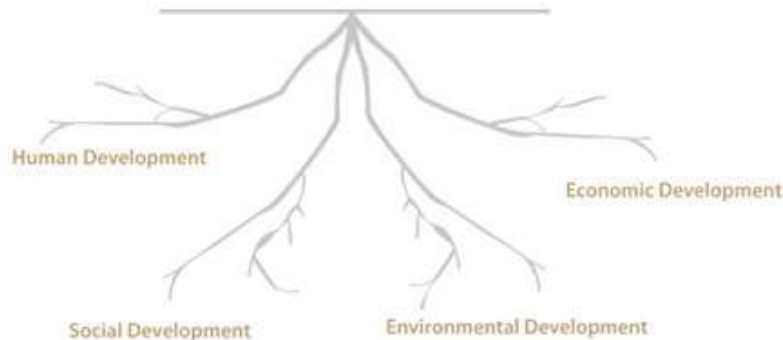
The discovery of oil in Qatar drastically changed its cities. Temporary buildings were re-built, and roads were introduced for movement between cities. All these changes occurred in a 40-year span, which is considerably abrupt for the implementation of development. As a result, little effort was made regarding sustainability-conscious urban planning. However, Qatar has realized their shortcomings and has begun to approach sustainability [4, 8-10].

Sustainability has been a prominent consideration for development and design in Qatar. It is evident in both the macro- and micro-level of the urban fabric through two frameworks: the Qatar National Vision 2030 (QNV 2030); and the Global Sustainability

Assessment System (GSAS – formerly known as QSAS) [11, 12].

QNV 2030 is the macro-level framework for Qatar’s efforts for creating a sustainable country. It is aimed at generating economic growth that considers and efficiently utilizes the country’s natural and human resources. It emphasizes four pillars: human; social; economic; and environmental development. Although

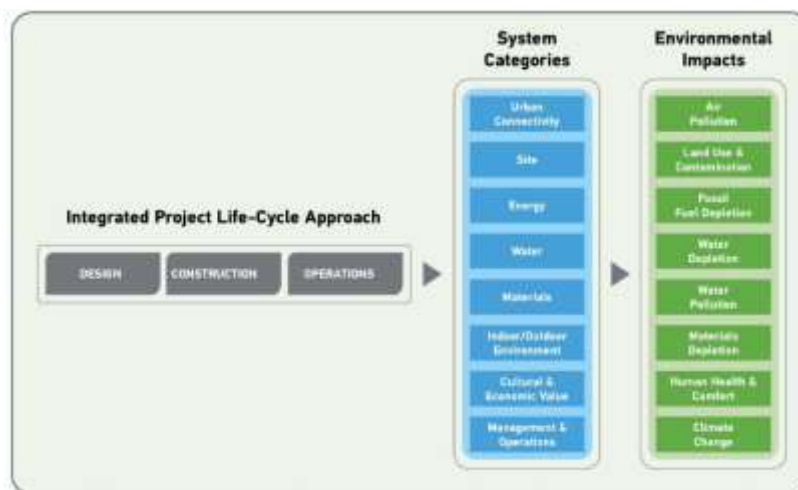
all these pillars link to sustainability, environmental development is the pillar that discusses policy-based sustainable urban planning. It specifies sustainability-based approaches for urban expansion and population distribution. Furthermore, it encourages interconnecting economic growth with the development of the social realm and protection of the environment. Similarly, Qatar has generated an assessment system focused on evaluating micro-level features [13-19].



Qatar National Vision 2030 Pillars
(Source: QNV 2030 Document)

The GSAS is the micro-level sustainability effort of Qatar that ensures consistency in the development processes. The focus of GSAS is on the architecture and infrastructure proposed for development in the country. Its assessment categories emphasize aspects that need to be met throughout the development process. The primary process consists of design, construction, and operations and is designed to address eight system categories that tackle various environmental impacts [20-24]. These eight categories

specify urban connectivity, site, energy, water, materials, indoor/outdoor environment, cultural and economic value, and management and operations to expand the three broader pillars of sustainability – economic, environmental, and social. With the macro and micro frameworks generated and the implementation stages, it is rational that future developments in Qatar will be aimed at sustainability [25-27].



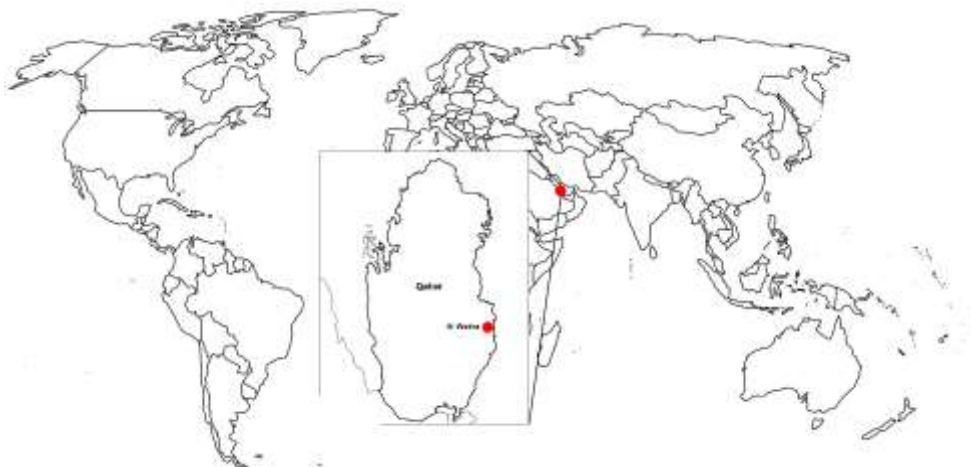
Global Sustainability Assessment System Framework
(Source: GSAS Overview 2017 Document)

Continuous development in Qatar because of its growth and the upcoming 2022 FIFA World Cup has led to an abundance of potential areas for sustainable developments. One of these areas is Al Wakra, an area being developed to host one of the main stadiums for

the 2022 FIFA World Cup. Al Wakra is an ideal area to highlight, not just because of its role in the World Cup but also because of its historical background. It was the pearling capital of Qatar and was home to around a thousand Qataris in the 17th century [28, 21]. It is

currently being developed to house about 60,000 or more residents. Its development and expansion for the upcoming mega-event began around 2008, which can

be identified as a pre-mature phase. Therefore, its urban fabric is at an accommodating phase for changes and improvements.

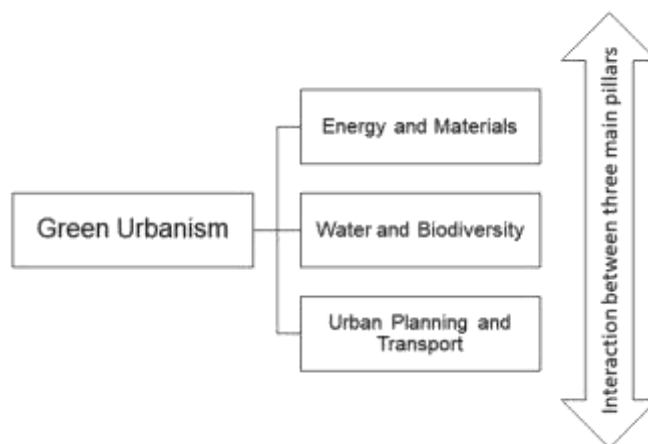


World Map with a Zoomed-in Map of Qatar highlighting Al Wakra
(Source: Authors)

**Background
Green Urbanism**

Green Urbanism, also referred to as sustainable urbanism, views sustainability as an organizing principle that consists of perspectives and recommendations for best practice. Additionally, urbanists that support Green Urbanism create consistent cases for smart growth and compact development, avoiding sprawl [29, 30]. Furthermore, these urbanists are starting to be known as leaders, advocating the

utilization of new development to produce “eco-districts” that put a stop to building-by-building resources and infrastructure management. Such practices include different levels of emphasis encouraging various sustainable principles and practices, promotion of high-density development, and the importance of site and building design concentrated on addressing the local climate and ecological systems [31-34].



Green Urbanism Main Pillars
(Source: Authors)

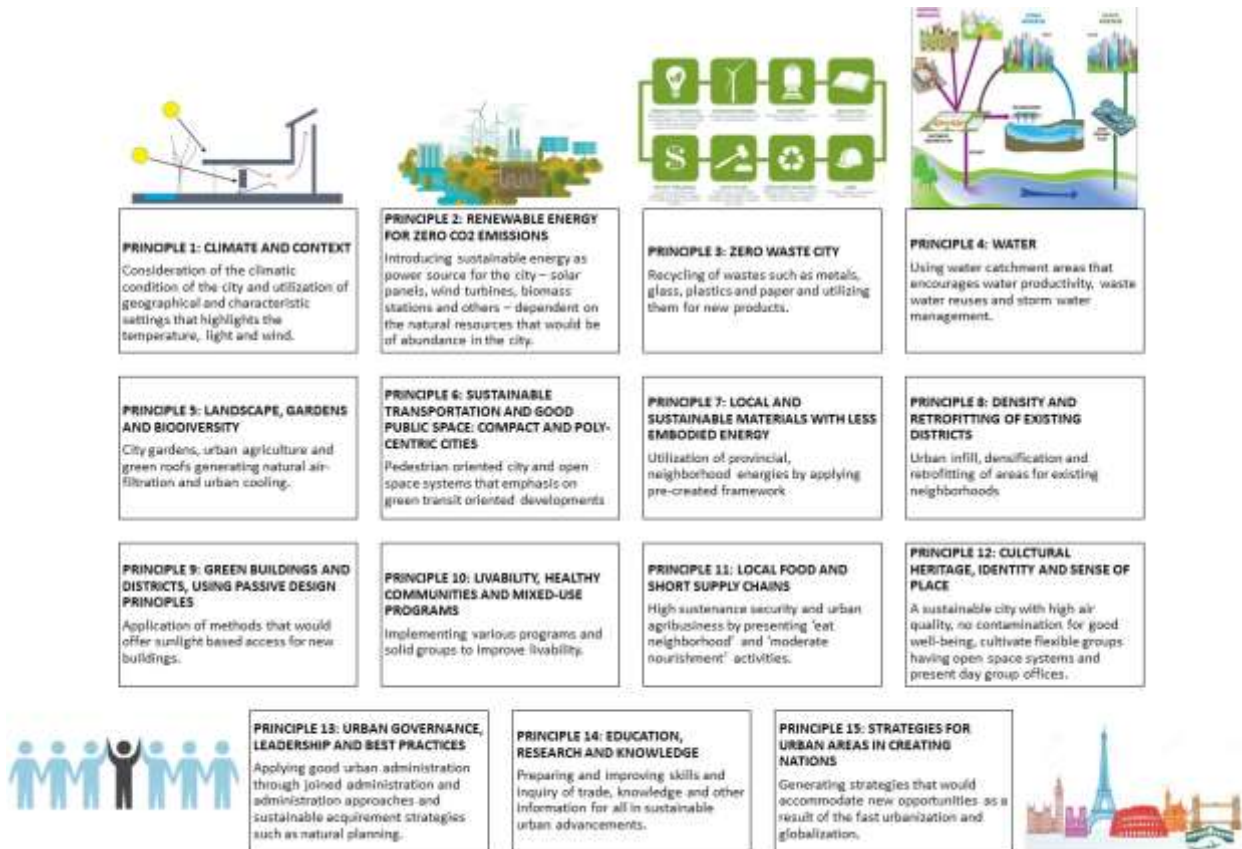
Green Urbanism includes practices that focus on different sustainability principles and practices. One example of this is the goal towards zero-greenhouse gas emissions from urban developments. Another is adapting current environments to function within the limits of their ecology instead of neglecting and avoiding this aspect. Other practices involve water self-sufficiency, emphasis on food production, and

utilization of local materials and energy resources. Through these practices, together with small developments, individuals living in a community can live healthier lives because of physically driven transportation – walking and biking. Furthermore, it results in vibrant urban neighbourhood that can attract skilled workers and investments. Therefore, Green

Urbanism is ideal for addressing urban development [35-38].

Green Urbanism, including its definition and examples, can be paraphrased in terms of the concerns cited in the QNV 2030 regarding urban development and its impact on the environmental development pillar of the National Vision. The QNV 2030 states that dense urban development should accommodate individuals in a suitable area. Similarly, Green Urbanism promotes compact development which, in layman’s terms, can be

described as high-density development such as neighbourhood clusters [39, 40]. Additionally, the vision emphasizes infrastructure and development that compensate for their environmental impact by regenerating the site after construction or offsetting its effects in another way such as carbon capture and storage. Likewise, Green Urbanism includes practices that address such scenarios [41-43]. Another aspect that makes Green Urbanism ideal for Qatar is that the country itself is concerned about sustainability, which is evident in their initiative to create the GSAS.



Principles of Green Urbanism

(Source: Authors)

New Urbanism

New Urbanism is an approach that encourages the development of communities in the way that they "have been built for centuries around the world." It emphasizes the incorporation of living,

working, shopping, and playing to generate a vibrant, traditional community. Its most prominent contribution to urban planning is the redirection from car-oriented cities into a pedestrian-oriented urban realm [44, 45].



Diagram showing the idea of a transect

(Source: Urban Design for an Urban Century: Shaping More Livable, Equitable, and Resilient Cities, 2nd Edition)

The approach consists of the idea of the transect, traditional main streets, pedestrian pockets, and traditional town centres. A transect provides a rough distinction of the urban core from suburban areas and agricultural preserves. Through this concept, the distribution of densities and land use is evident and guides urban growth. Similarly, it aids in creating a well-planned density from the urban core to the 'edge' that has the potential to accommodate the possibility of morphing the different sections to adapt to changing needs and population [46, 47].

A traditional main street effortlessly becomes a public space for interaction while acting as the economic centre of the community. It is usually composed of commercial facilities along the street. It allows the car-dominated element of the community to be part of a pedestrian-friendly area by re-directing vehicles and incorporating lanes that ease pedestrian and cycling movement. For example, parking spaces

can be located behind buildings instead of in front to give priority to the movement of pedestrians [48-50].

Pedestrian pockets address the human aspect of communities through mixed-use developments. The availability of essential facilities such as schools and stores results in walkable spaces, which decreases the need for vehicular transportations. Further, pedestrian-oriented areas increase social interactions and act as a common informal gathering space for people. Additionally, it encourages a healthy lifestyle, as walking and cycling are forms of exercise.

On the other hand, traditional town centres focus more on walkability than pedestrian access. They are a central space for interaction, but this does not always mean it is just an open area. It sometimes consists of markets and mosques or other communal spaces that become a gathering element for the town [51, 52].



Diagram showing the design features of New Urbanism

(Source: CNU Journal)

The design principles of New Urbanism are regular grid streets, traditional town centres, scale, and character. It encompasses design features such as densification, traditional main streets, walkability, and traditional town centres. These design principles and features exist in Qatar but have diminished as a result of rapid development. Therefore, their implementation is suitable for Qatar because it allows for the regeneration of the old urban fabric. Similarly, it can accommodate

the current organization of the city as it follows a specific street grid. Further, the design features of New Urbanism can increase the vibrancy of the city. Furthermore, the introduction of other building types can aid in solving the sprawl happening in some regions of Qatar.

Sustainable Neighbourhoods



A visualization of a sustainable neighbourhood
(Source: Google)

Sustainable neighbourhoods are also identified as 'real traditional neighbourhoods' or 'genuine neighbourhoods' because of their compactness, pedestrian-orientedness, and various land uses. The main driving force for design is the needs of people and the ease of movement from one place to another without the need for mechanized transportation. An example of such is an urban neighbourhood that acts as the backbone of a transit corridor. It contains features such as high-intensity transit modes, high-performance

infrastructure, car-free and mixed density housing, and distinctive greenway edges. These features fall into five fundamental design principles [53, 51, 54].

The five primary design principles of sustainable urban neighbourhoods are: 1) identifiable centres and edges, 2) walkable size, 3) mixed land use and housing types, 4) integrated network of walkable streets, and 5) specific sites designated for civic purposes.



Basic design conventions of a sustainable neighbourhood
(Source: Sustainable Neighbourhood, Chapter 7)

Identification of centres and edges is essential for a neighbourhood, as its role is to gather the community. The purpose of the centre is a location for organized and spontaneous assemblies, events, and day-to-day casual interactions. A centre can be identified by

being encompassed by various land uses and reasonable high-density buildings. Similarly, an edge is recognizable through greenways and transit-oriented facilities and features.

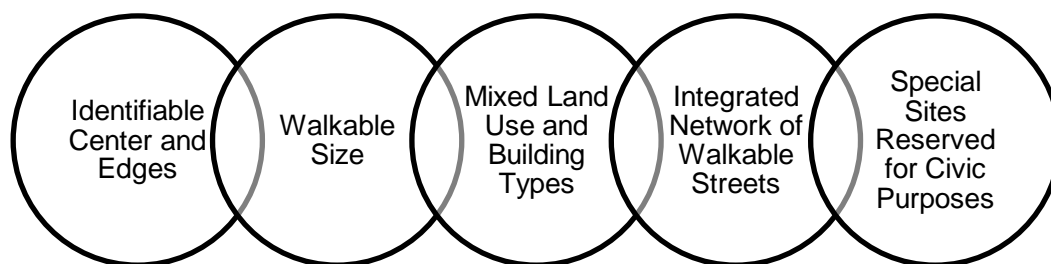
The size of a neighbourhood also plays a role in collecting people into spaces. Therefore, specifying an appropriate walkable size encourages movement and interaction. According to Dover and King, a radius ranging from forty to two-hundred acres (0.16 to 0.80 square kilometres) is suitable as this is the distance that an individual can tolerate for travel. However, not all neighbourhoods reside on flat land; therefore, the distribution of land use within this suitable distance is also crucial [55, 51].

Land use distribution is dependent on the topography and the needs of people in a neighbourhood. An advantage of such a neighbourhood is the location of a mixture of land uses and housing types within walking distance of recreational and work-related facilities. This is because the recreational and work-related facilities act as the point of origin and point of destination for the people. Similarly, this type of distribution allows the existence of two types of environments: an environment where residents walk to their houses, workplaces, recreational areas, and everyday needs and services; and an environment that accommodates various lifestyles and incomes near each other. If done correctly, such a neighbourhood can successfully intertwine these environments without

decreasing the overall attractiveness of the area for other people. Further, this aids in providing security and vibrancy, as diversified households have varying interests and schedules, making spaces active at various times of the day [56-58].

An integrated walkable street network can also play a role in vibrancy, as it directs the flow of people around the neighbourhood. This entails creating a network of streets that encourage walkability by having a maximum distance of one-hundred eighty meters in width. This encourages the movement of an individual from one side of the street to the other side. However, longitudinal distance from one point to another can be difficult to achieve, and such areas can be allocated for more essential purposes.

Vistas down streets and areas on the tops of hills are identified as prominent sites in a neighbourhood. They stand out and are focal points, as people spot such areas easily, especially they are framed by buildings. Additionally, they may not fall within the walkable radius, which makes these ideal sites for civic uses such as landmarks, parks, plazas and other public spaces [20, 59].

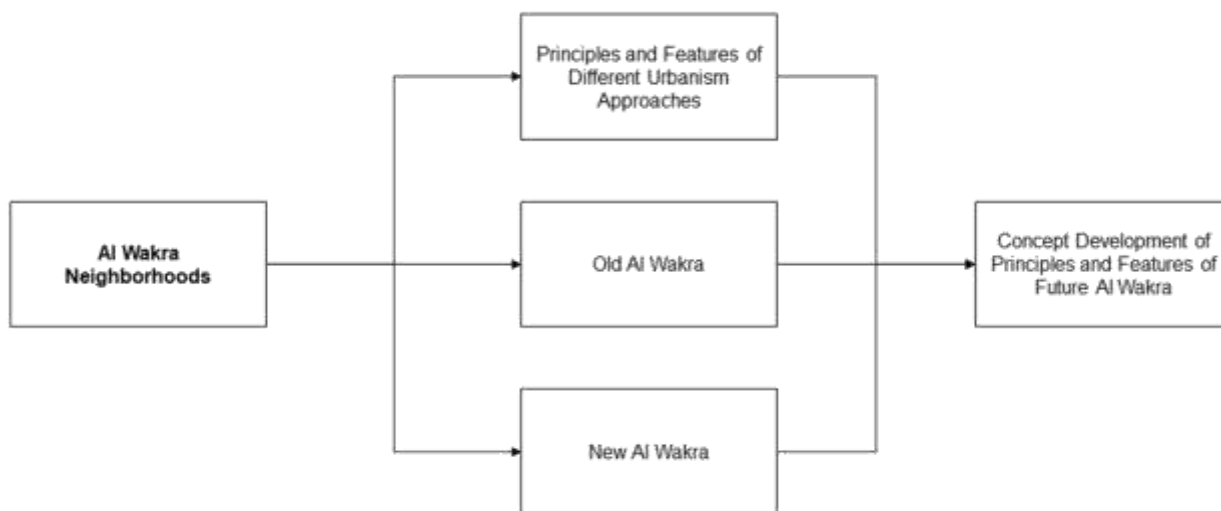


Design Principles of Sustainable Neighbourhoods

(Source: Authors)

Sustainable neighbourhoods are similar to traditional neighbourhoods. Qatar historically had neighbourhoods that were sustainable for its location and population. Therefore, incorporating sustainable neighbourhoods in Qatar's urban fabric is not an innovation but a re-introduction of the traditional neighbourhoods that existed forty years ago. Furthermore, this would bring back the vibrancy and diversity of neighbourhoods lost through the rapid

development, such as the one in Al Wakra. Similarly, it would encourage more site-specific, climate, and necessity-based approaches to design that are more organic and economically feasible. However, because of the culture in Qatar, addressing the demand for privacy, personal space, and other space is crucial for the acceptance of such an approach by the citizens of Qatar.



Aim of the Research

(Source: Authors)

The Research Design

The research will follow a historical and case study method. These methods will be used to generate a broad understanding of the area of study – Al Wakra. The historical method will include an analysis of the historic district around the eighteenth century. Through this, there will be a better understanding of what existed in the area and the elements suitable for sustainably developing Al Wakra.

The study will explore Al Wakra and its possible contribution to the Qatar National Vision 2030 through four main steps: 1) identification of QNV 2030 related pillar/s, 2) literature review, 3) analysis and 4) concept development. Due to the complexity and the timeline allotted for the steps, the schedule and structure will have a duration of a three months as the final assignment/project for the Research and Statistical Analysis in Planning, Master’s in Urban Planning and Design course [60, 61].

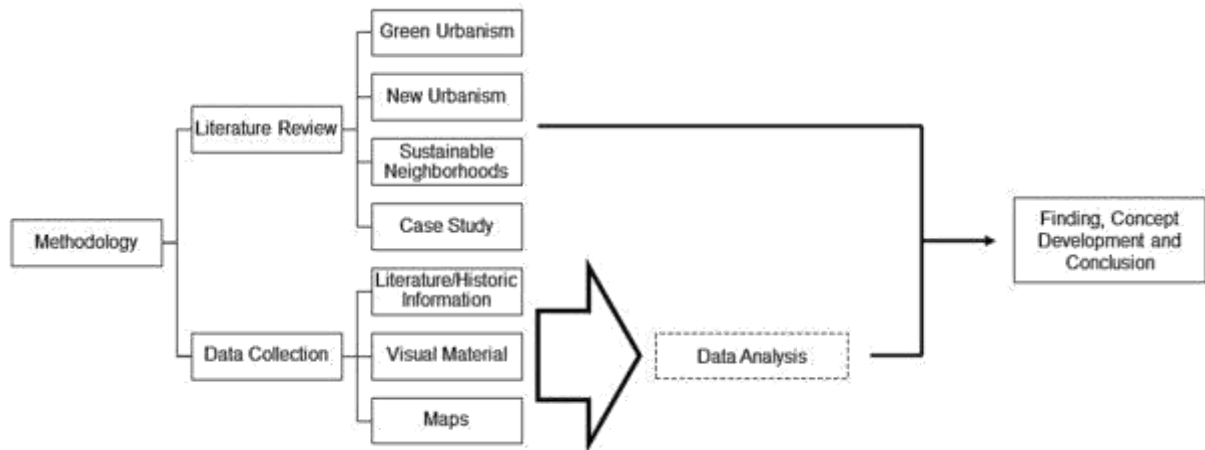
Steps of the Research Design:

1. **Identification of QNV 2030 related pillar/s:** A brief description of the QNV 2030 and its pillars that emphasizes the importance of sustainable urban planning
2. **Literature Review:** Summary and review of the literature on various urbanism approaches applicable to the case of Al Wakra that highlights the principles and features that can be adapted

3. Analysis:

4. **Site Analysis of Modern (Current) Al Wakra:** Qualitative analysis of the current Al Wakra neighbourhood to understand how the area works and identify any development/s that are considered for sustainability
5. **Site Analysis of Historic (Old) Al Wakra:** Qualitative analysis of the historical Al Wakra neighbourhood by identifying vernacular planning that relates to climatic, surrounding, and individual considerations adaptable to the development of sustainable approaches
6. **Comparative Site Analysis:** Qualitative analysis of the area through comparison of the opportunities and challenges from the old and current urban fabric of Al Wakra that identifies similarities and differences useful to generate sustainable approaches

7. **Concept Development:** Through the QNV 2030 related pillars, design principles, and features from the literature review, the analysis and generation of design principles and features for the future development of Al Wakra that highlight neighbourhoods, the environment, transportation, land use, circulation, the street network, transit, pedestrians, bikes, the public realm, core areas, building typologies, and parking strategies



Research framework and process of investigation
(Source: Authors)

The focus of the collected data is on climate, topography, and environmental considerations; land use, core areas, and building typology; and connectivity and transportation. The opportunities and challenges for each type of data collected are outlined for a better understanding of the possible weight of each critical factor on the balance of the plan [62]. These factors will be used to generate a concept that is refined and graphically illustrated.

Findings

The findings will be structured in three sections: analysis of the urban fabric of the 1) old Al

Wakra; 2) new Al Wakra; and 3) comparative analysis of the two urban fabrics. These findings will highlight four vital thematic factors, namely climate, topography, and environmental considerations; land use, core areas, and building typology; and connectivity and transportation. Additionally, they will help generate an overview of what has worked in the past and what is working in the current urban fabric of Al Wakra. Therefore, a holistic development concept will be generated that can integrate the past and the present for the future.



Al Wakra aerial views (left) in the 1950s (Source: Catnaps) and (right) in the 2010s
(Source: Google Map)

Context (The Key Factors)

Climate, Topography, and Environmental Considerations

The climate in Qatar is arid: mild and pleasant in the winter, and scorching and humid during the summer. Therefore, the climate in present-day Al Wakra is similar, but it sometimes feels hotter than

usual because of the minimum amount of shade that exists in the area. However, it does get colder during the winter, primarily by the water.

The topography in the current Al Wakra is very flat with a minimum difference in elevation between the land and the sea. However, there are some

high points further south that are a product of sand moved from one area to another.

Climatic consideration is very minimal and addressed through utilization of air conditioning and

shades on building windows. However, some areas do have environmental considerations as a result of their preservation from the older urban fabric.

Site Analysis: New Al Wakra



Map of Al Wakra from 2010s
(Source: Google Maps)

Land Use, Core Areas, and Building Typography

The current land use of Al Wakra is diverse and includes traditional areas and commercial, residential, medical, and recreational spaces. The main road the land uses, distributing and locating them as the following: traditional and port district on the right side of the main street with the remaining land uses on the left side. This division was a result of the implementation of the road network, which might have been driven by the location of the port.

The core areas of the current Al Wakra are the main street, traditional district, and the port.

However, the main street stands out as it is composed of commercial areas that generate movement in the area. Similarly, it connects Doha to the traditional district and the port.

There are various building types in the current Al Wakra, namely residential, commercial, traditional, medical, and recreational buildings. However, these building types are separated – residential buildings are either the stand-alone type or apartments, and commercial buildings are only for commercial use.



Map of Al Wakra from 1950 indicating land use
(Source: Authors)

Connectivity and Transportation

The present-day Al Wakra is connected to the capital city, Doha, towards the north via Al Matar Street and soon through the Qatar railway. The roads follow a hierarchical arrangement, with Al Matar Street to Al Wakra Main Street as one of the primary roads, which branches out to secondary roads that direct people into neighbourhoods and finally tertiary roads that move into more restricted areas. All these roads have both direct and partially direct connections between each other, which makes it possible for people to move from one point to the next through various routes. However, this can be a disadvantage as some

routes lead individuals into private places for movement rather than for accessibility purposes.

The Qatar railway will connect areas from the north and the south of Doha to the capital. Additionally, more public transportation-oriented neighbourhoods and cities, which Qatar currently does not have, are envisioned. There is one central rail station in Al Wakra located by the transition between the Al Matar Street to Al Wakra Road as well as three sub-stations between the Al Wakra central station and the one in Messaieed. However, these sub-stations are located only by the rail route, which means a different type of transportation is needed to move people within neighbourhoods and to the stations.



Map of Al Wakra from 2018 highlighting road and rail connections
(Source: Authors)

Opportunities and Challenges (from the site analysis)

The current land use and road network of Al Wakra can serve as a backbone for many possibilities for the implementation of sustainable principles. However, there is some work to be done to apply them: first, re-analyzing the way in which the roads and the

land uses interact.; and second, changing the area from a vehicle-dependent neighbourhood to a pedestrian-friendly area that allows access to primary facilities within distance.

Site Analysis: Old Al Wakra



Map of Al Wakra from 1950 (Source: Catnaps)

Context (The Key Factors)
Climate, Topography, and Environmental Considerations

The climate in Qatar is arid: mild and pleasant in the winter, and scorching and humid during the summer. The climate in old Al Wakra was similar to this but generally more comfortable during the summer because of its proximity to the sea. However, it becomes frigid during the winter, which caused movement inland.

The topography in old Al Wakra was very flat with a minimum difference in elevation between the land and the sea. This was beneficial for the general land distribution of the area. However, there was a sandbar that blocked a part of the old Al Wakra corniche and inhibited the movement of boats in specific areas.

In the urban fabric of old Al Wakra, the environmental considerations are evident in the orientation of the buildings and the distance between them. The buildings are oriented towards the sea to take advantage of the sea breeze, which can cool and ventilate the buildings. Similarly, the buildings are next to each other to decrease the walls exposed to the sun and maximize the effect of the breeze.

Land Use, Core Areas, and Building Typography

The land use of the area, based on the 1950 map, was mostly residential and abandoned houses. However, this might not be accurate as there would have been some mixed-use areas near the water that were accessible to boats. Further, markets and mosques existed by the water and within the neighbourhoods but information regarding such is insufficient.



Map of Al Wakra from 1950 indicating land use
(Source: Authors)

The urban core of old Al Wakra, although not apparent in the maps, could have been the market (souq) or the mosque or both. Based on historical information regarding cities in Qatar, souqs and mosques have been the centre of cities because of their roles in the trading, social, and religious aspects of society.

The types of buildings in the area would have been courtyard houses, mixed-use buildings with commercial on the ground floor and residential on the upper floors, markets (souqs), and mosques. The courtyard houses have a privacy component where

windows towards the streets are higher and inaccessible. Similarly, mixed-use buildings provide privacy, but they usually house the merchants that sell the products on the ground floor.

Connectivity, and Transportation

Al Wakra is fifteen kilometers south of Doha and was connected by a makeshift road. The road network in old Al Wakra in the 1950s was evidently in the preliminary stages, a part of it developed into a permanent road in the existing areas. However, the area was composed mostly of narrow (Sikka) streets that pass through almost all the spaces of old Al Wakra.



Qatar map highlight Doha and Al Wakra (Source: Authors) and (right) Map of old Al Wakra highlighting the main street (Source: Authors)

The narrow streets, also known as Sikka, were designed as a response to 1) pedestrian movement, 2) privacy, and 3) climatic factors. In the old Al Wakra neighbourhood, Sikka meant high pedestrian movement because of their dimensions. The width of a Sikka ranges from one to one and a half meters, which is wide

enough to accommodate people and some carriages. Additionally, the design was for the navigation of individuals from private to public areas and vice versa. Most importantly, Sikka played a role in cooling the area and the houses as they act as paths for wind movement.



An example of the fereej (neighbourhood) elements in old Doha (Source: Authors)

Opportunities and Challenges (from the site analysis)

The historic urban fabric of Al Wakra emphasizes the vernacular urban design in the country in the 1950s and earlier. Taking advantage of the climate and the natural environment allowed the area to become sustainable in the sense that the need for mechanized non-renewable and renewable energy was minimal. Additionally, the types of land use and housing were diverse and accommodated various

individuals of society, which made the neighbourhood vibrant. Further, the core areas connected by Sikka were great social interaction generators. However, some of the elements need to be altered to adapt to the modern needs of the area. Similarly, the land use is not as sustainable now as it limits the area to a residential population when the area has immense potential to contribute to other aspects of the overall development of the country, such as economics and social areas.

Comparison



Land use map of Al Wakra (left) 1950 and (right) 2018
(Source: Authors)

Opportunities and Challenges

Both urban fabrics have their advantages and disadvantages in achieving sustainability. However, the old urban fabric is closer to being sustainable because of some features and factors. One of these factors is the existence of climatic and contextual-driven urban design that is similar to the vernacular approach. Additionally, the area’s density aids in the walkability of the neighbourhood, found in the principles of green and New Urbanism. However, residential land use type is found predominantly in the old fabric, which in its time may have been ideal and sustainable but in the present day does not help sustainability in the urban realm.

On the other hand, the present urban fabric is strong in terms of its diverse land uses for the social and economic aspects of the city and neighbourhood. An example of this is the location of a commercial district by the main streets, allowing accessibility for vehicle users. Additionally, it acts as a buffer between residential areas and main roads. Similarly, the port provides opportunities to make a livelihood in the area together with the cultural heritage of the souq. However, there are still some possible improvements to the current urban fabric of Al Wakra, especially the lack of pedestrian movement. Therefore, adapting some of the old fabric’s features and qualities together with existing land uses and other proposals would aid in creating a sustainable neighbourhood.

Development Concept: Concept Principles and Features

The development concept is aimed at becoming a catalyst for generating sustainability-based policies for the future development of Al Wakra. It will address urban connectivity and growth, as well as cultural and economic value. It will also follow

principles and incorporate features from both the literature review and the site analysis that can be applied and adapted to the circumstances of present-day Al Wakra.

The driving principles for the development concept are the five principles of urban design: enhance liveability; create community; expand opportunity; promote equality; and foster sustainability. The critical thematic factors will detail approaches and features that encompasses these principles.

Neighbourhoods

The neighbourhoods encompass a centre, mixed land use, non-mechanized oriented movement (pedestrian and bicycles), and varying levels of streets. The neighbourhood should have a centre that is accessible by the most private and the most public paths through a well-planned articulation of the street network.

Environment

There are some untouched natural environments in Al Wakra, and their protection is a priority. Therefore, the development concept proposes to avoid development in these areas. An example of such is the selection of core areas far from these natural environments.

Transportation

The transportation system follows a specified hierarchy. Walking is the prioritized mode of transportation followed by cycling. Transportation such as public buses and taxis, the railway, and private vehicles help with movement further than walkable distances. For example, a person may move from one neighbourhood to another using public transportation.

Land Use

There should be diversified land use with an increase of mixed-use development in the neighbourhood cores. Further, the introduction of neighbourhood stores can provide necessities in a walking distance from more private areas. Additionally, some single-use development such as well-integrated commercial districts by the main street are encouraged.

Street Network

The current street network should be enhanced through re-evaluating the land use and transportation modes that can access specific areas. The street network can follow the hierarchy of main streets and roads into sub-streets and more private areas. Through this, privacy can be preserved, and implementation of various type of development can continue.

Transit

An implementation of transit-oriented development is a possibility in Al Wakra as it will house one of the central rail stations in the country. Therefore, encouraging such development would increase the density in the area and diversify the types of individuals within the space. As a result, a more vibrant and interactive public realm would emerge.

Pedestrians, Bikes, and the Public Realm

A high priority should be given to pedestrian and bicycle movement as it allows interaction, surveillance, and vibrancy in neighbourhoods. Additionally, it is beneficial to the health and economy of neighbourhoods as it encourages a healthy lifestyle for its residents and allows local businesses to flourish.

Core Areas

The core areas proposed for Al Wakra are in four significant areas: near the rail station; by the Al Matar Street - Al Wakra Road; Al Wakra Souq; and the 2022 FIFA World Cup Stadium. These areas were selected to become the cores of the neighbourhoods because they also act as landmarks. Additionally, they play a vital role in the economic, cultural, and social aspects of Al Wakra.

The area near the rail station is proposed to be a core area as it is the drop-off and transit connection of Al Wakra to and from Doha. Businesses tend to develop by transit zones, which is beneficial to the economy of Al Wakra as the activities and pedestrian traffic that the rail would generate both income and social interaction for its residents. Similarly, these developments will attract residents to the area, which will generate vibrancy and compact growth.

The other core area proposed is the Al Matar Street - Al Wakra Road. It is already an essential element of Al Wakra, and it is logical that it will remain and further develop into a vital element of the

neighbourhood. Additionally, it will have a different composition compared to the area near the rail station as the tendency is to have commercial areas by the main street, followed by residential and mixed uses. Another possibility for this core area is that the main street is re-imagined by implementing bicycle and pedestrian lanes, which would decrease the area that the road covers. As a result, this would create a more pedestrian-oriented street, which would encourage interaction between neighbouring spaces and areas.

The third core area proposed is the Al Wakra Souq, which will mainly act as a tourism and cultural element. It would have a more natural tendency towards gathering as it has the traditional features of old Al Wakra.

The stadium for the 2022 FIFA World Cup can be the new core area for the neighbourhood as it will attract individuals interested in the mega-event. Densification of the area can occur through concentration of commercial and recreational uses, which are supported by a mixture of residential building types to accommodate the activities and population that the area may house.

Building Typologies

Introduction of diversified building typologies into Al Wakra will aid in densifying the areas close to its core areas. The types of buildings proposed are single-use buildings, mixed-use buildings, and historically preserved buildings. The purpose of single-use buildings is to allow essential facilities such as hospitals, cultural centres, and recreational areas to have a space of their own. Additionally, it provides an option for residents who prioritize their privacy and personal space. Historically preserved buildings act similarly, providing a protected and conserved space for historic buildings. On the other hand, mixed-use buildings can create active areas, as residences and working spaces are within walking distance of each other. Similarly, it gives individuals with varying incomes options, as diversified and mixed areas can lead to affordability.

DISCUSSION AND CONCLUSION

Urban design provides the principles that drive various urbanisms to develop interpretations for addressing sustainability. It provides general definitions of enhancing liveability, creating communities, expanding opportunities, promoting equality, and fostering sustainability. As a result, Green Urbanism and New Urbanism share a common ground in terms of design features, which emphasize walkability, densification, and the public realm. Similarly, essential sustainable neighbourhood principles and features touch similar areas, creating a cohesive understanding of how one can develop a framework for addressing sustainability. Therefore, a foundation can be laid for

generating a conceptual framework for sustainable neighbourhoods in Al Wakra.

Through the consideration of urban design principles and the implementation of various urban features, a development concept for Al Wakra emerged. It covers nine elements: neighbourhoods; the environment; transportation; land use; the street network; transit; pedestrians, bikes, and the public realm; core areas; and building typologies. Each element's features qualities are taken from green and New Urbanism and the concept of sustainable neighbourhoods, which collectively generate a cohesive and holistic approach to planning future development in Al Wakra. Further, the comparative analysis between old and present-day Al Wakra helped to identify the potential opportunities and problems that exist in Al Wakra that feed into the urban fabric's ability to become sustainable. Furthermore, the development concept addressed the pillars of the Qatar National Vision 2030, which tackles sustainability.

Contribution to knowledge

The contribution of the research to knowledge is about the collection of urbanism approaches that are useful for creating a sustainable neighbourhood. Furthermore, it provides a case in a Middle Eastern country where sustainability is part of the country's vision and assessment system. Additionally, it provides insight into the possibilities and implementation of applicable principles and features adapted to the needs and environment of Qatar.

Implications for Practice and Advancement of Research

An expansion of the study can be achieved through further historical, climatic, and environmental research and quantitative method. A more in-depth understanding of the history, human-made elements, and the natural environment of Al Wakra will generate a better analysis of the site. Additionally, a quantitative method that involves individuals who live in Al Wakra could be employed to develop feasible and rational principles and features that residents themselves desire. Furthermore, the study can be expanded to produce a proposal of a detailed master plan for both the urban and street levels that visualizes the possibilities of a sustainable environment in Al Wakra.

Acknowledgements

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