

ORIGINAL ARTICLE

A social-ecological perspective for emerging cities: The case of Corniche promenade, “urban majlis” of Doha

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ABSTRACT

In the past decade, the capital city of Doha of the State of Qatar has experienced rapid urban expansion and other changes due to globalization, which has caused (i) the loss of a compact urban pattern, (ii) landscape fragmentation, and (iii) deficiency of green spaces. Therefore, as envisioned by Qatar National Vision 2030 (QNV-2030), the State of Qatar plans to invest substantial funds into the urban regeneration of the built environment, along with the development of large areas of public parks as a means of promoting more sustainable urban development and enhancing city residents' well-being. Accessibility contributes to the usability of public facilities on the part of the neighborhood community, thus enhancing city dwellers' well-being. Nonetheless, the authors argue, the urban network along Doha's Corniche promenade, the dominant open public space and the spine of the city, lacks connectivity at various scales of space. Therefore, this research study aimed to assess the existing conditions of Doha's Corniche and recommend strategies for implementing its integration into the newly emerging city's urban fabric. The findings, revealed through a network-analysis investigation based on graph theory, allowed us to generate a framework for shaping open public spaces, promoting higher living standards through a green network system planned at the city scale. The proposed framework addresses social-ecological challenges of distinctive open public spaces and helps define an approach for (i) tailoring the accessibility of open public spaces to their surroundings, and (ii) enhancing city dwellers' well-being.

Keywords: *sustainable development; open public space; social-ecological transdisciplinary perspective; green network system; well-being; graph theory; Corniche promenade (Doha)*

1. Introduction

Urban planning, evolving visions, and new management systems have greatly affected the rapid urban expansion of cities in the region of the Gulf Cooperation Council (GCC), which was founded in 1981. GCC countries (Kuwait, Bahrain, the State of Qatar, the United Arab Emirates, Oman, and Saudi Arabia) recognize the need for sustainable urban growth and adaptable infrastructure, along with the need to

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develop alternatives to their current economies, which rely heavily on oil and gas. Moving toward these goals, GCC countries have invested large funds into sustainable urban development (Saliba, 2015; Scharfenort, 2012).

Doha, the capital city of the State of Qatar, has experienced dramatic growth since the 1970s due to Qatar’s discovery of oil and gas. Since then, the city has been flourishing in numerous sectors, including real estate, construction, housing, alternative resources, and, more recently, sustainability. The State of Qatar has set its vision to develop holistically as a nation and to make tourism a source of economic growth. In line with this vision, Doha has hosted various national and international sports events, aiming at becoming a hub for sporting mega-events. In particular, due to its recent naming as host of FIFA World Cup 2022, the country has experienced a rapid urban expansion, including the development of a public transport network (e.g., the Doha Metro), several megaprojects, housing and hospitality facilities, and green urban areas (Furlan and Sinclair, 2021; Tannous, Furlan, and Major, 2020; Furlan, Petruccioli, et al., 2019). At the same time, the prevalent national urban planning strategy over the last 30 years has seen an increase in urban density and land consumption (i.e., sprawl) (Al Saeed and Furlan, 2019; Furlan and Al-Mohannadi, 2020; Furlan, Zaina, and Patel, 2021). This strategy has had some clear and adverse consequences for the distribution of public parks and other green spaces due to inefficiencies in the public planning process, even as the State of Qatar has recognized urban development as a major contributory factor in the environmental deterioration in the country (see **Figure 1**) (Al-Harami and Furlan, 2020; Fromherz, 2012, 2017; Salama and Wiedman, 2013; Tannous, Major, and Furlan, 2021).

In 2009, the Ministry of Municipality and Urban Planning (MMUP) developed the Qatar National Master Plan (QNMP), in accordance with the government’s objectives for the management of sustainable national urban growth, with a planning horizon to 2032, as illustrated in Figure 1. The QNMP is considered the physical tool for the realization of the Qatar National Vision 2030 (QNV 2030), prepared by the General Secretariat for Development Planning to guide national development strategies across all public and private sectors. The Vision lays the foundation for Qatar’s long-term development strategy based on four pillars of sustainable growth: human, social, economic, and environmental development. The QNMP includes the Qatar National Development Framework (QNDF), which defines place-making strategies; Municipal Spatial Development Plans (MSDPs); and Action Area Plans for key expansion areas (Chaikhouni, 2012; General Secretariat for Development, 2008; Rizzo, 2014).

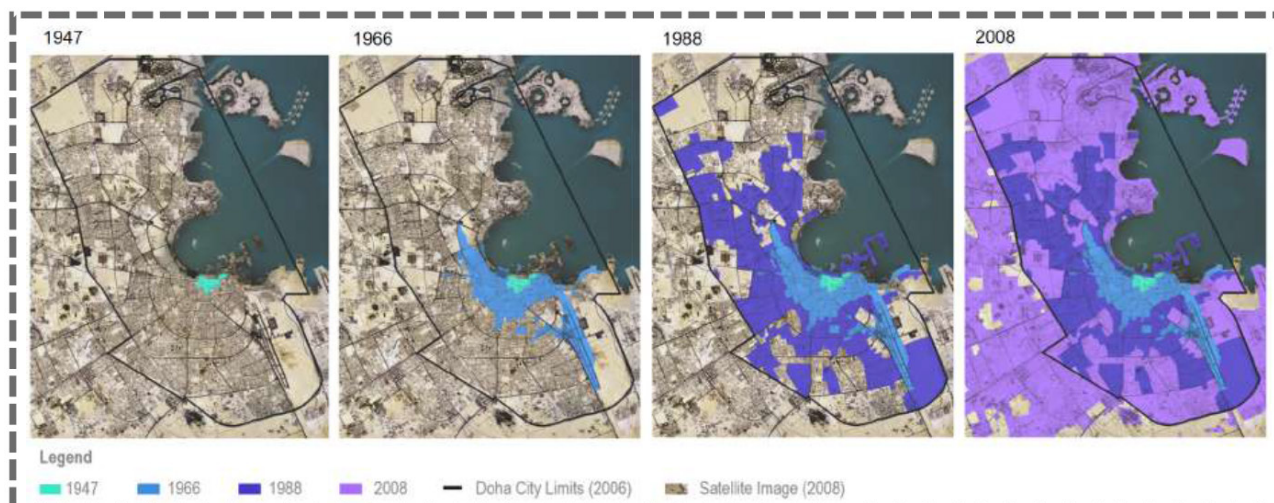
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Source: Ministry of Municipality and Environment edited by authors

Figure 1. Urban growth of Doha (1947–2008)

One of the key principles guiding development is the adoption of urban design and planning strategies to ensure more sustainable growth, conservation of the natural environment, and preservation of land for public green spaces. However, despite the establishment of national action plans, policies, and tools to manage sustainable growth, provide economic vitality, and develop livable and sustainable communities, Doha is facing challenges related to (i) sustainable urban regeneration of high-profile districts, (ii) loss of a compact urban pattern, (iii) landscape fragmentation, and (iv) deficiency in average open public spaces, which, in turn, impact on city dwellers' well-being (Al-Mohannadi and Furlan, 2022; Al-Mohannadi, Furlan, and Grosvald, 2022; Al-Mohannadi, Furlan, and Major, 2020; Artmann et al., 2017; Mell, 2017).

Urban green spaces can provide an extensive variety of benefits for supporting natural and urban environments, as well as creating and enriching social systems to be utilized by city residents. Scholars suggest there are still other health benefits, such as improving air quality and the general well-being of citizens, as well as physical benefits, such as enhancing the urban settings of cities. However, selecting inappropriate locations for public green spaces can make them less accessible to the residents they are intended to serve, underutilized or neglected by the community, and, in the worst-case scenario, abused and exploited for illicit and criminal behavior. In this regard, assessing the accessibility of public green spaces might play a cardinal role in better promoting the effective social and ecological functionality of a city (Šiljeg et al., 2018; Tan et al., 2013).

The Doha Corniche (usually referred to locally as “the Corniche”) is the dominant open public space and spine of the city. It is commonly defined as a direct link with other radial connectors, linking the West Bay City Business District (Sheraton Park) to Souq Waqif (the “Gold Market”, a key Doha heritage site) and the Museum of Islamic Art (MIA). The Corniche consists of a wide thoroughfare with heavy vehicular traffic, Al Corniche Street, side-by-side with a pedestrian and cycling promenade. The promenade is immediately adjacent to the bay and access to it, along much of its length, requires that one cross Al Corniche Street. When not otherwise specified, the term “Corniche” will be used in this paper in reference to the promenade, or the promenade and street considered together; “Al Corniche Street” will be used to refer specifically to the vehicular roadway.

In the present study, the authors argue that the full potential of the Corniche has not been realized in terms of the extent and manner with which it is integrated with the surrounding urban fabric. Following this argument, this study investigated connectivity at various scales of space of the Corniche and recommends strategies for improving this public realm’s connectivity with the newly emerging city’s urban fabric. The revealed framework addresses the social-ecological challenges of the Corniche and defines an approach for (i) tailoring the accessibility of an open public space to its surroundings and (ii) enhancing the well-being of the city’s residents.

2. Literature review

2.1. Green urbanism: Green spaces as vital nodes within urban fabric

Green urbanism focuses on the design and planning of public green spaces as fundamental spatial systems integrated within the urban fabric of cities. The role of the green public realm goes beyond the decorative mode and encompasses a wide range of vital social-ecological functions, beneficial to both city residents and the natural environment (i.e., the ecosystem). Green areas provide a spatial arena for recreation, sporting, relaxing, and social activities (de Oliveira, 2017). The efficient planning of green spaces, in terms of location and use, can generate an enhanced level of social interaction and social capital among users. Therefore, researchers stress the importance of carefully allocating and designing green spaces within urban settings, emphasizing the quality and provision of amenities within such spaces over mere quantity (Gottdiener et al., 2019).

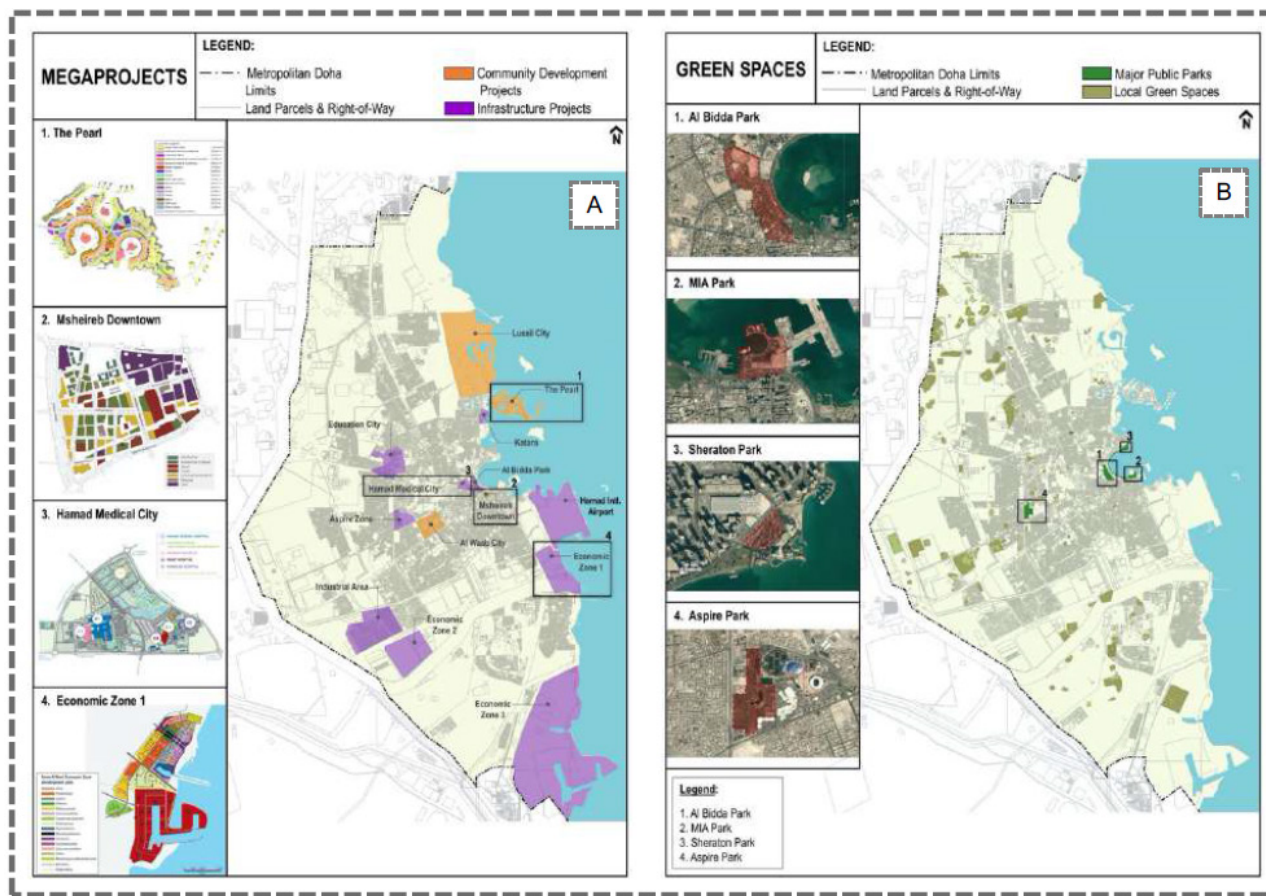
Urban green spaces can help to promote physical activities, improve the health of the general public, and enhance the psychological well-being of residents. Just as the vegetation in parks and green spaces can help to improve the environment and air quality of dense urban developments, the loss of natural landscape and green spaces due to rapid urbanization can be detrimental to public health and natural ecosystems (WHO Regional Office for Europe, 2016).

Despite the importance of green urban areas integrated within the built environment of cities, planners have sometimes treated green spaces as being outside the civic equation—as unregulated and abandoned pieces of land—simply because green spaces are often not perceived as vital areas or nodes and, hence, may not be used efficiently. This may be primarily because of the lack of safety measures incorporated into such spaces, thereby discouraging communities from efficiently utilizing green spaces (Gehl and Svarre, 2013).

This may also be the case in Doha. Over the past two decades, the efficient placement and use of public green spaces have been neglected due to the demands of rapid urbanization and globalization (Furlan, 2019; Furlan, Petruccioli, and Jamaledin, 2019) (see **Figure 2**). Accordingly, this research study aimed to define a method for assessing the efficient utilization and arrangement of public green spaces in the city of Doha, focusing specifically on the singular settings of the Corniche promenade.

2.2. Well-being: Social-ecological transdisciplinary perspective

The concept of well-being offers a holistic perspective to understanding social-ecological systems. As scholars have argued, the concept of well-being involves more than an individualistic notion of living and being well; the concept also emphasizes spatial and social dynamics. Therefore,



Source: Authors

Figure 2. Metropolitan Doha: (a) megaprojects and (b) green spaces

it contributes to diverse areas of social and eco-urban theories.

Urban planners and sociologists have proposed a number of insights—as the foundation of the master plan concept—to move towards interdisciplinary research and governance for complex social-ecological systems. An interdisciplinary social-ecological perspective is required in order to face the challenges of global environmental changes and to conceive and promote novel options for sustainability (van Kamp et al., 2003).

In the framework of Well-being in Developing Countries (WeD), social well-being is defined as “a state of being with others and the natural environment that arises where human needs are met, where individuals and groups can act meaningfully to pursue their goals, and where they are satisfied with their way of life” (McGregor, 2008, p. 4). The concept of well-being comprises individualistic and basic-needs aspects of well-being within broader social, psychological, and cultural needs required to live well. This notion, reflecting spatially, socially, and culturally interlinked perspectives, is predicated on (1) material, (2) relational, and (3) subjective dimensions. While the material component of well-being concerns the physical necessities of life (e.g., income, wealth, financial assets, and physical eco-spatial system services), the relational component takes into account social interactions and collective actions (the sense of being part of a community) and the subjective dimension encompasses cultural values, norms, and belief systems (sense of satisfaction with a “way

of life”). Careful consideration of these three dimensions—material, relational and subjective—yields insights into (i) how the different facets of a “life well lived” inter-relate, and ii) how human behavior works both on short and long timescales. Therefore, the concept of well-being recognizes the dynamic multidimensional variability of way and quality of life, such that well-being is conceptualized as a state of social involvement and participation with others, as well as the conditions underlying ecological-urban systems (i.e., ecological-spatial capital) (Bay and Lehmann, 2017; Gottdiener et al., 2019).

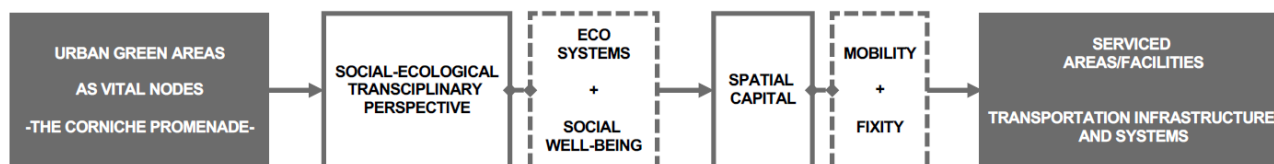
2.3. Spatial capital: A mobility and fixity perspective

Urban sociologists argue that (i) cities can be developed vertically or horizontally (“up or out”) and (ii) urban growth can cause mobility problems. They also argue that urban planners and developers tend to adopt regional planning strategies aiming at densifying city centers and at spreading low-density development towards the cities’ outskirts or municipal boundaries, which, in turn, causes problems of urban sprawling and environmental sustainability (Kabisch and van den Bosch, 2017; McLennan, 2004). As a result, the failure in adopting smart regional planning triggers the socio-spatial problems of “mobility” and “fixity”. “Fixity” refers to city dwellers being forced to live in undesirable places with poor social services and inadequate transportation infrastructure; “mobility” refers to city dwellers being allowed to move towards urban areas with first-rate social services and transportation infrastructure. Mobility and fixity relate to the socio-spatial advantages and disadvantages associated with (i) serviced areas and facilities and (ii) transportation infrastructure and systems (Gottdiener et al., 2019; Roberts et al., 2017). In turn, “spatial capital” refers to the value assigned to the area where city dwellers reside; it determines and evaluates a given location’s advantages and disadvantages with respect to mobility and fixity. In this context, the term “capital” refers to a sum or “accumulation”.

Economic capital is the accumulation of wealth. Social capital is the accumulation of social bonds and social networks that can be converted by individuals for personal gain or power over others. Cultural capital is the accumulation of knowledge and symbolic status that allows individuals to strategically navigate various influential networks or institutions, and, in the aggregate, it is how social groups distinguish themselves from other social groups on the basis of tastes and cultural preferences. Spatial capital is conceived in a similar way, as the accumulation of locational advantages by an individual or group relative to existing transportation alternatives (Gottdiener et al., 2019, p. 340).

Spatial capital is commonly assessed through (i) the access of a person or social group to a number of transportation options (private vehicles; public systems such as trains, buses, and subway systems; or bike lanes and pedestrian networks) allowing convenient travel to shops or to one’s workplace; (ii) access to a number of transportation services that are handicap accessible; and (iii) the sum of choices that individuals (or members of a social group) have across all transportation options, enabling them to easily and efficiently navigate within the city’s boundaries (see **Figure 3**) (Knowles and Ferbrache, 2019).

Smart and sustainable growth across a metropolitan region is feasible if the municipality provides multiple forms of transportation, allowing residents convenient access to desired areas and facilities, and/or if planners create the conditions for the accumulation of spatial capital. This can be augmented through the placement of thoroughfares and public transportation systems, reducing



Source: Authors

Figure 3. Conceptual framework

dependence on fossil fuels and the carbon footprint of regions (Brown and Dixon, 2014; Molotch and Ponzini, 2019). From this perspective, pedestrian networks and bicycle lanes can be considered the most energy-efficient means of mass transportation and, as a result, help greatly to diminish social problems related to urban sprawl and, ultimately, to enhance spatial capital. The present research study aimed to define a method for assessing the degree of spatial capital of open (green) public spaces, with specific reference to Doha's Corniche promenade. Furthermore, the researchers argue that such capital reflects the well-being of the city's inhabitants.

3. Research design

This study aimed to assess the existing conditions of Doha's Corniche and to recommend sound strategies for promoting its integration into the surrounding urban fabric. The assessment was conducted through a green network analysis based on the branch of mathematics called graph theory, which is recognized as an efficient way of exploring and assessing spatial/territorial limits and constraints. In graph theory, one investigates sets of objects called "nodes" (or "vertices"), connected by "links" (also called "lines" or "edges"). In the present context, nodes are significant places of activity in the city, for example, transport hubs or public areas such as parks, and the links that join them are walkways, bike paths, or roads. An important node without sufficient links connecting it to other nodes represents an inefficiency (e.g., an attractive green space surrounded by busy streets that cannot be safely accessed on foot or by bicycle). Graph theory permits such situations to be analyzed mathematically, though in this paper such findings are summarized qualitatively.

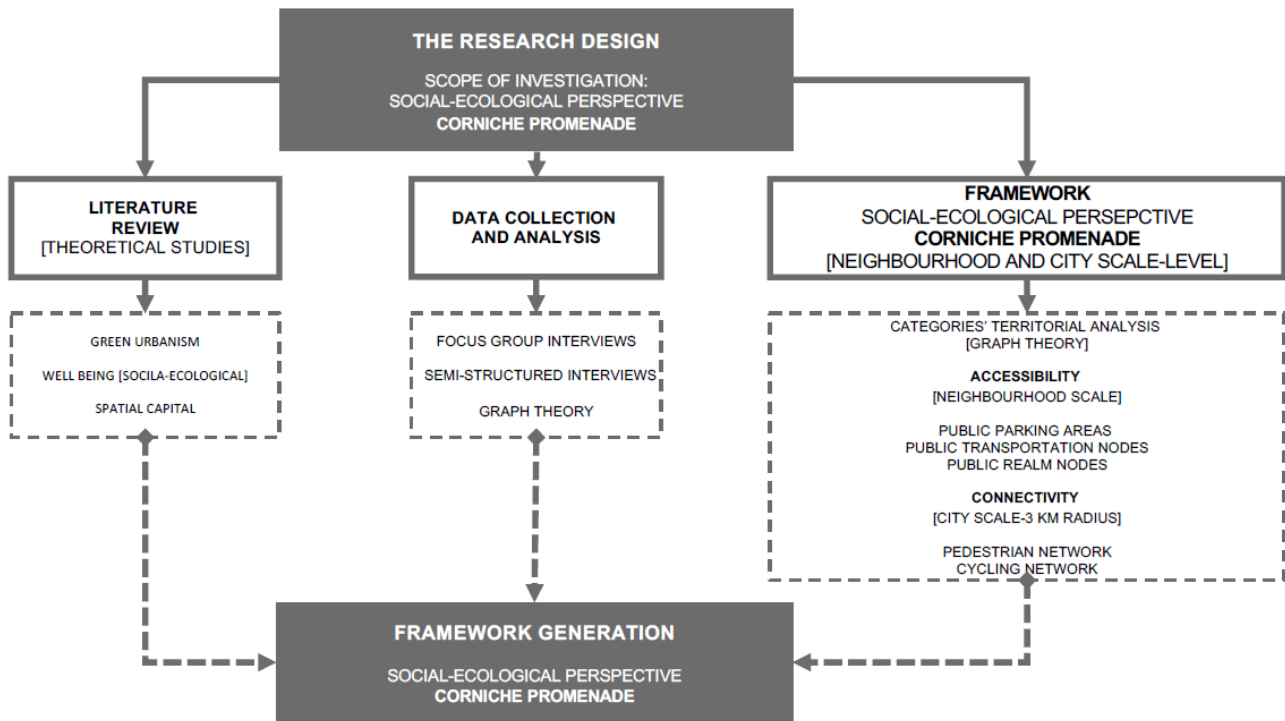
Finally, as a contribution to reducing metropolitan landscape fragmentation, the study sought to promote higher living standards through a green network system planned at the city-scale level. The research design consisted of three stages (see **Figure 4**) (Denzin and Lincoln, 2011; Marshall and Rossman, 2014).

3.1. Theoretical studies

The review of the literature provided information about the social-ecological transdisciplinary theory dealing with the complexity that emerges when ecological system studies are linked to social well-being approaches. Citation analysis was used to review the core literature (journals, authors, and other sources).

3.2. Data collection and site analysis

The research study made use of both qualitative and quantitative methodologies. Structured interviews and surveys of relevant participants (urban designers, urban planners, and city residents)



Source: Authors

Figure 4. Research design

provided useful perspectives and insightful views concerning the extent to which a comprehensive approach for planning a green network system for the Corniche can be implemented at different scales.

3.2.1. Data collection—Focus group interviews

Ten focus group interviews, with six members per group, were conducted with 60 participants. Those taking part included urban and transport planners, urban designers, practitioners, and academics working for private and public bodies, occupying critical roles in relevant organizations. Collectively, they have expertise in policy analysis concerning public transport and integration of land use at various scales (local, regional, and national). The goals of the focus group interviews were as follows:

- To specify the geographical context of Qatar and define strategies supporting the planning of a green network for the Corniche.
- To identify design challenges related to the adopted strategies for planning the green network system.
- To obtain in-depth insights about Doha’s master planning and future challenges to its planning practices.

3.2.2. Data collection—Semi-structured interviews

In November 2019, oral data were collected through initial questionnaires and semi-structured interviews conducted with 40 professionals and researchers from the Ministry of Municipality

and Environment (MME), Qatar Rail (QR), Ashghal Public Works Authority, ASTAD Project Management, and the Qatar Transportation and Traffic Safety Center (QTTSC-Qatar University); these professionals and researchers are from leading international consulting firms and research centers working on urban developments of different geographic scales in Qatar. Such data were also collected from 60 users who regularly visit each park. The aims of the interviews were:

- To define in detail the visual categories or layer maps to be explored in order to determine how green networks for the Corniche can best be planned and implemented. Relevant points include (i) accessibility to/from public parking areas, (ii) accessibility to/from public transportation nodes, (iii) accessibility to/from urban green spaces, (iv) pedestrian connectivity to/from neighboring urban green spaces, and (v) bike connectivity to/from neighboring urban green spaces.
- To explore the benefits of planning a green network system for the Corniche and promoting an increase in cycling and walking and the concomitant improvement in city residents' quality of life.
- To investigate barriers and gaps in governance knowledge hampering the development of green networks in practice, which can be mitigated in order to facilitate and improve the urbanization process in line with the master planning in Qatar.

3.2.3. Data collection—Visual material

The methods adopted for collecting visual data were site visits and observations, cartographic maps, aerial views, and photographs. A network analysis based on graph theory provided a way of framing and evaluating features of mobility to and around the selected green urban space and identifying gaps related to accessibility and connectivity at the required city scale. The graph comprised a network represented through graph drawings of nodes (N) and corridors (C), where each node (N) represents a habitat.

3.3. Data analysis and findings: Planning city-scale green network system for the Corniche

Research by design is a commonly applied methodology in urbanism and architecture. It involves two steps: (i) territorial analysis of the investigated area and (ii) generation of a vision, as a way to produce concrete ideas for the investigated area's metamorphosis, through the use of specific design tools. Particular emphasis is given to the interplay between territorial analysis (network analysis based on graph theory) and planning exploration (proposal for a master plan). The resulting approach for planning a green network system for the Corniche specified a framework for enhancing the dependency between mapping and design. Therefore, the proposed framework must specify and fill the gaps identified using the two main design tools of territorial analysis, which investigated (i) accessibility and (ii) connectivity. The systematic approach of research by design consists of analyzing and understanding possible interdependencies and unlocking potentials between flows at two different urban design and planning scales, namely at the (i) neighborhood level and (ii) city level. Moreover, the proposed framework must address social-ecological transdisciplinary challenges and provide insights for moving incrementally towards interdisciplinary research and governance for complex social-ecological systems in a given region, which, in this case, are Qatar and the globalizing GCC.

4. Case study setting: The Corniche

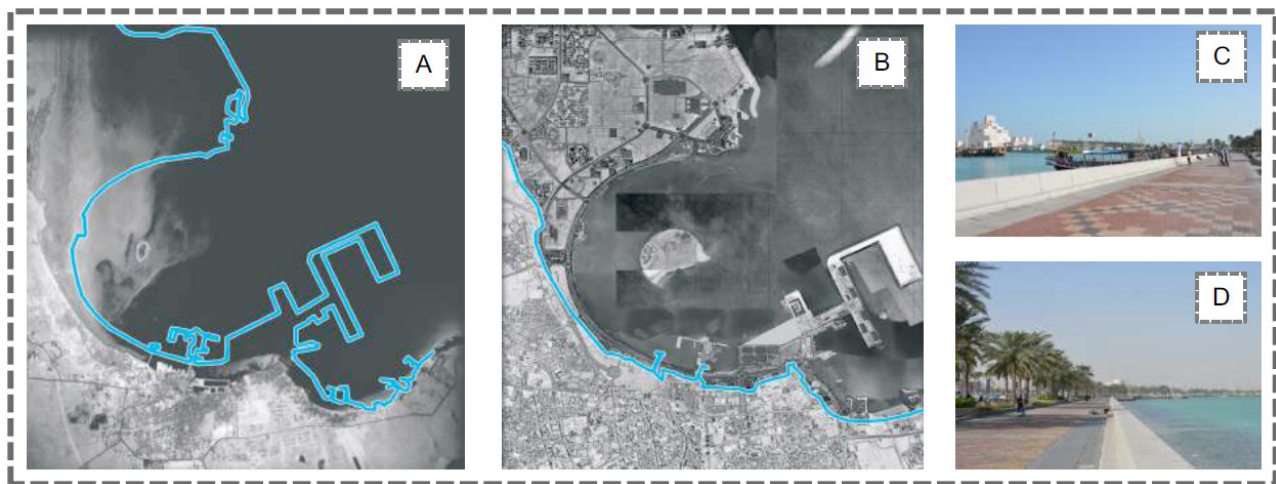
The Corniche is composed of a narrow pedestrian strip, extending about 7.5 kilometers along Doha Bay from the Sheraton Hotel at the north end to the Marriott Hotel at the south, past Dhow Harbour and Doha Port facilities. A belt of prestigious administrative, cultural and commercial facilities and parks lines the Al Corniche Road, a dual carriageway running parallel to the pedestrian strip (Gunay, 2003, p. 19).

Doha’s Corniche promenade, a waterfront path extending for several kilometers along Doha Bay, runs parallel to Al Corniche, with a narrow strip of green area and a walkway connecting the West Bay Business District with Souq Waqif, a cultural heritage site, and the Museum of Islamic Art. The Corniche was created through intensive dredging work between the late 1970s and early 1980s, which remodeled Doha’s coastline. The Corniche is a space for pedestrian circulation and is Doha’s longest continuous belt of open public space, popular for walking, cycling, jogging, and for the celebration of festivals, such as Qatari National Day and Sports Day (see **Figure 5**).

[The] Doha Corniche is defined as the coastal strip from the Sheraton Hotel to Doha Port and its interface with the area of Doha Bay containing Palm Tree Island. The Corniche is built on land reclaimed from the sea and is the result of the recent planning strategies that have transformed the dense urban fabric and intricate circulation system of old Doha on the south of the bay (Gunay, 2003, p. 17).

Due to landfill policies over recent decades, the Corniche now forms an almost complete circle, influencing the macro-form of Doha city. While old Doha, located on the south bank of the Corniche, originally had an intricate circulation system, the semicircular shape of the new coastline has given rise to a new planning approach that has created a transport network of parallel ring roads and radial arteries.

5. Findings



Source: Authors

Figure 5. (a) Doha in 1956 (waterline in 2003) (Gunay, 2003). (b) Doha in 2003 (waterline in 1956) (Gunay, 2003). (c) View toward north side. (d) View toward south side.

The findings are divided into two sections: (1) site analysis (i.e., territorial analysis based on graph theory) and (2) the Corniche proposal and guidelines. Site analysis, developed and conducted using two assessment tools (accessibility and connectivity), provides the insights needed to develop the ensuing master plan and guidelines based on a comprehensive approach for implementing a spatial urban green network model, the ultimate aim being the enhancement of the well-being of the residents of Doha (Secchi, 2007).

5.1. Site analysis

The site analysis was conducted by using a two-part assessment:

(i) Accessibility to/from neighboring districts (analysis at the neighborhood scale):

- Public parking areas (private vehicle use).
- Public transportation nodes (pedestrian and cyclist networks).
- Public realm nodes (pedestrian and cyclist networks).

(ii) Connectivity to/from neighboring urban green spaces (analysis at the city scale):

- Pedestrian networks within a three-kilometer radius of the Corniche.
- Cycling networks within a three-kilometer radius of the Corniche.

5.1.1. Accessibility to/from public parking areas

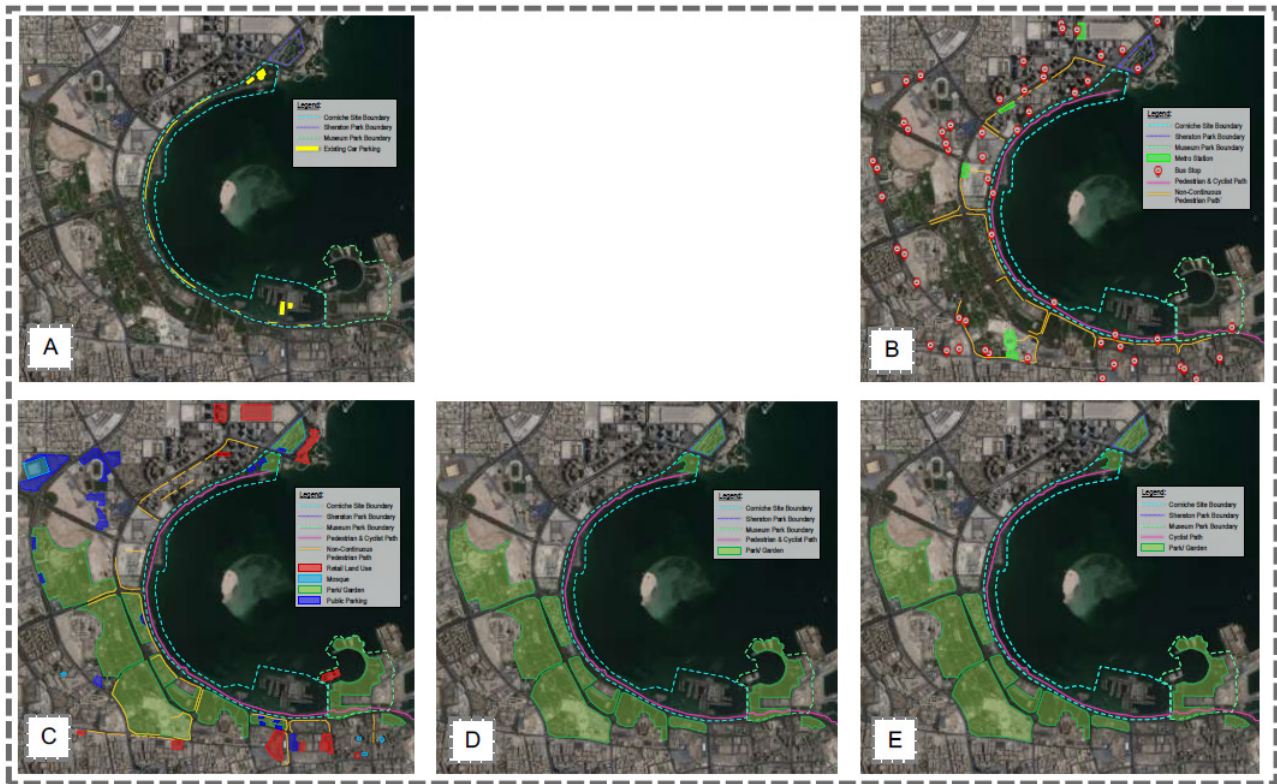
There are several public car parking areas located along the Corniche, including those located (i) at the eastern side of the entrance gate of MIA Park, dedicated to MIA visitors, and (ii) at the western side of the entrance of Sheraton Park. Site observations revealed that the parking areas along the promenade (i) can be fully occupied and/or congested during weekends and public holidays, (ii) can be used by MIA Park and Sheraton Park visitors, but do not adequately serve these two main parks, and (iii) are occupied most of the time by Corniche visitors.

In the present context, one of the prime factors needed to fulfill sustainable urbanism principles is to reduce the need of using private cars to reach the Corniche. This can be achieved by designing efficient pedestrian pathways and cyclist networks along the promenade. An appropriate design and policy framework was developed, one which promotes a well-integrated pedestrian and cycling network; for example, it is desirable to connect the promenade to nearby residential areas and parking areas, such as those in West Bay and at Souq Waqif (see **Figure 6(a)**).

5.1.2. Accessibility to/from public transportation nodes

City buses and the Doha Metro are two active modes of public metropolitan transportation. The nearest metro stations for the Corniche are located on the opposite ends of the main road, at Souq Waqif, Al Bidda Park, and in West Bay. In addition, within a one-kilometer distance of the Corniche, there are about six bus stops, out of which three are located along Al Corniche Street leading directly to MIA Park. Access to all of these stops requires pedestrians and cyclists to cross the main road.

Until December 2019, the only mode of public transportation in Doha was city buses, which



Source: Authors

Figure 6. Site analysis. (a) Accessibility—Existing car parking along Corniche promenade. (b) Accessibility—Non-continuous pedestrian path to/from metro stations and various bus stops in vicinity of Corniche promenade. (c) Accessibility—Non-continuous pedestrian path between public destinations and Corniche promenade. (d) Connectivity—Existing pedestrian network along Corniche promenade, showing non-continuous connection among urban green spaces in Doha metropolitan area. (e) Connectivity—Existing cyclist network around Corniche promenade in Doha metropolitan area.

was not sufficient to meet demand, so the use of cars proved dominant. The subsequent opening of the Doha Metro has increased the number of visitors to the Corniche, especially during weekends. Therefore, it is important to consider and prioritize pedestrian accessibility from metro and bus stations to the promenade, as this will guarantee safe and easy access for visitors. Moreover, the positioning of bus stops along the promenade between Souq Waqif, Al Bidda Park, and West Bay metro stations can further promote pedestrian and cyclist accessibility. Therefore, the present non-continuous pedestrian and cycling lanes, along with a relative paucity of crossovers and bridges, should be re-planned in order to develop a network that is accessible, efficient, and well integrated.

The on-site analysis reveals that there is no convenient pedestrian/cycling accessibility from public transportation nodes directly to the Corniche promenade. Specifically, the lack of efficient and continuous pedestrian networks from metro stations and bus stops results in an overall lack of accessibility to the Corniche. The pedestrian path is non-continuous, mainly due to the wide main road and lack of crossovers, bridges, and sidewalks, all of which are either damaged or simply absent along much of the promenade. As a result, the walking experience to the seaside promenade is unpleasant and unsafe; crossing the main road is hazardous because of the near-constant heavy vehicular movement. Additionally, Doha’s harsh climate—especially during the summer—adds to the unpleasantness of the pedestrian experience, given the general lack of shading devices along

the walkways in the city. This overall lack of urban design elements, such as sidewalks, vegetation buffers, water features, shading, and seating at reasonable and regular intervals, makes the existing pedestrian network much less appealing for prospective users than it could be otherwise (see **Figure 6(b)**).

5.1.3. Accessibility to/from public realm nodes

There exists a wide variety of public destinations along the Corniche promenade. Plazas, open spaces, and parks are all examples of public realm nodes. Souq Waqif, MIA Park, Al Bidda Park, and Sheraton Park in West Bay, all connected to the Corniche, are four significant destinations with similar land use and constitute the main public nodes relevant to this study. All of these prominent civic amenities lack convenient and safe accessibility (green corridors) for pedestrians and cyclists alike.

There are no well-planned pedestrian and cyclist networks connecting these four destinations with nearby public destinations. The existing pedestrian path has not been implemented in a manner consistent with that of creating an accessible and well-connected network. As it is, pedestrian paths are provided for public places independently, without a holistic consideration of realizing a contiguous, safe, and comfortable pedestrian network. According to international urban design standards, pedestrian networks should be continuous, safe, comfortable, permeable, and accessible, and should possess urban design elements that enhance user satisfaction and friendliness. Currently, none of these standards are being met. The Corniche promenade consists of a continuous pedestrian path, but one which is isolated from key public realm nodes located within significant nearby destinations.

Thus, well-planned pedestrian and cyclist networks should be implemented in order to provide safe and convenient access to the Corniche promenade from nearby public realm nodes. The networks should link the public realm nodes to the promenade in a way that ensures holistic and seamless accessibility. One suggestion would be to provide pedestrian bridges at all crossings and intersections along Al Corniche Street, thus ensuring both continuous traffic flow and safe pedestrian movement between pedestrian networks and nearby public realm nodes (see **Figure 6(c)**).

5.1.4. Connectivity to/from neighboring urban green spaces—Pedestrian network

Connectivity here refers to the pedestrian and cyclist networks among the parks in the Doha metropolitan region. The first step in strengthening and improving the city-wide system involves mapping all regional and local parks, including all smaller public parks, that can be used by all citizens. From the map (see **Figure 6(d)**), it can be observed that the existing spatial distribution of green space is fragmented, with absolutely no connection between the Corniche promenade and nearby parks. This makes them inconvenient to use, thereby creating inefficiency throughout the system.

Cities around the world are prioritizing “smart connectivity” as a primary urban planning element. Smart connectivity involves not only sustainable transportation options but also incorporates non-motorized connectivity by providing safe and comfortable pedestrian and bicycle networks. The map in Figure 6(d) illustrates the current situation for pedestrians in Doha, highlighting connectivity (or lack thereof) between the Corniche promenade and nearby urban green spaces.

In his book “A Theory of Good City Form”, Lynch (1981) examined the benefits of open space networks, which must be accessible from the urban fabric of the city if motorized vehicular movement is to be reduced. Similarly, in the case of the Corniche, the road network is the only network connecting places and blocks. Hence, it can be argued that a green pedestrian and bicycle network (i) should be planned by taking into account existing road connectivity, and (ii) should form a new network, using existing travel corridors and overlaying the city’s fabric in a way that avoids disturbing the existing road network (see Figure 6(d)).

5.1.5. Connectivity to/from neighboring urban green spaces—Cyclist network

While there are three large regional parks along and adjacent to the main road, Al Corniche, all smaller parks are located far from the Corniche promenade. The connection from MIA Park to Al Bidda Park and Sheraton Park is defined by the Corniche, such that the three larger parks are well connected through a bicycle network. However, this network does not connect to the smaller parks. As most of the parks in the city were created in order to make use of unused vacant plots of land, their locations were not strategically planned. That said, the researchers contend that redesigning and retrofitting the city’s urban space could link many of these underutilized landscape spaces, incorporating them into a more successful, ecological, and attractive green space network radiating from the Corniche promenade.

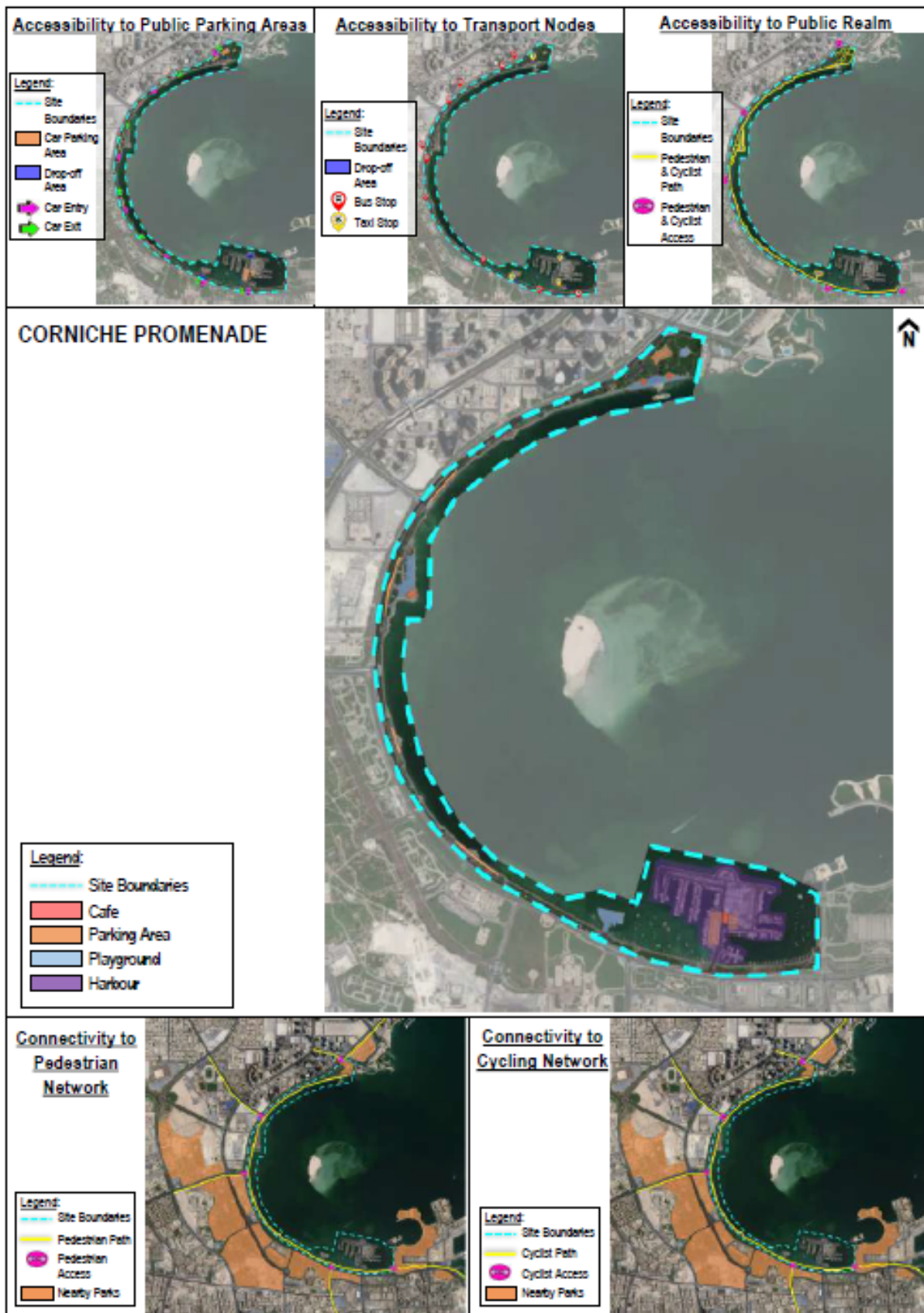
The territorial analysis highlights the lack of a coherent bicycle network within the Doha metropolitan area. The only bicycle pathway, which follows Al Corniche Street, connects the three regional parks (MIA Park, Al Bidda Park, and Sheraton Park). The rest of the urban green spaces located in the nearby neighborhoods lack any bicycle network. Multi-modal transit options are critical to moving forward in efforts to heighten livability and sustainability in Doha (see **Figure 6(e)**).

5.2. Master plan and guidelines

The MIA Park master plan and guidelines contain a framework for enhancing the cohesion between mapping and design. As a result, the proposed master plan (pertaining to urban design) and associated guidelines (pertaining to urban planning) are intended to address and remedy the gaps revealed through site analysis design tools (see **Figure 7**).

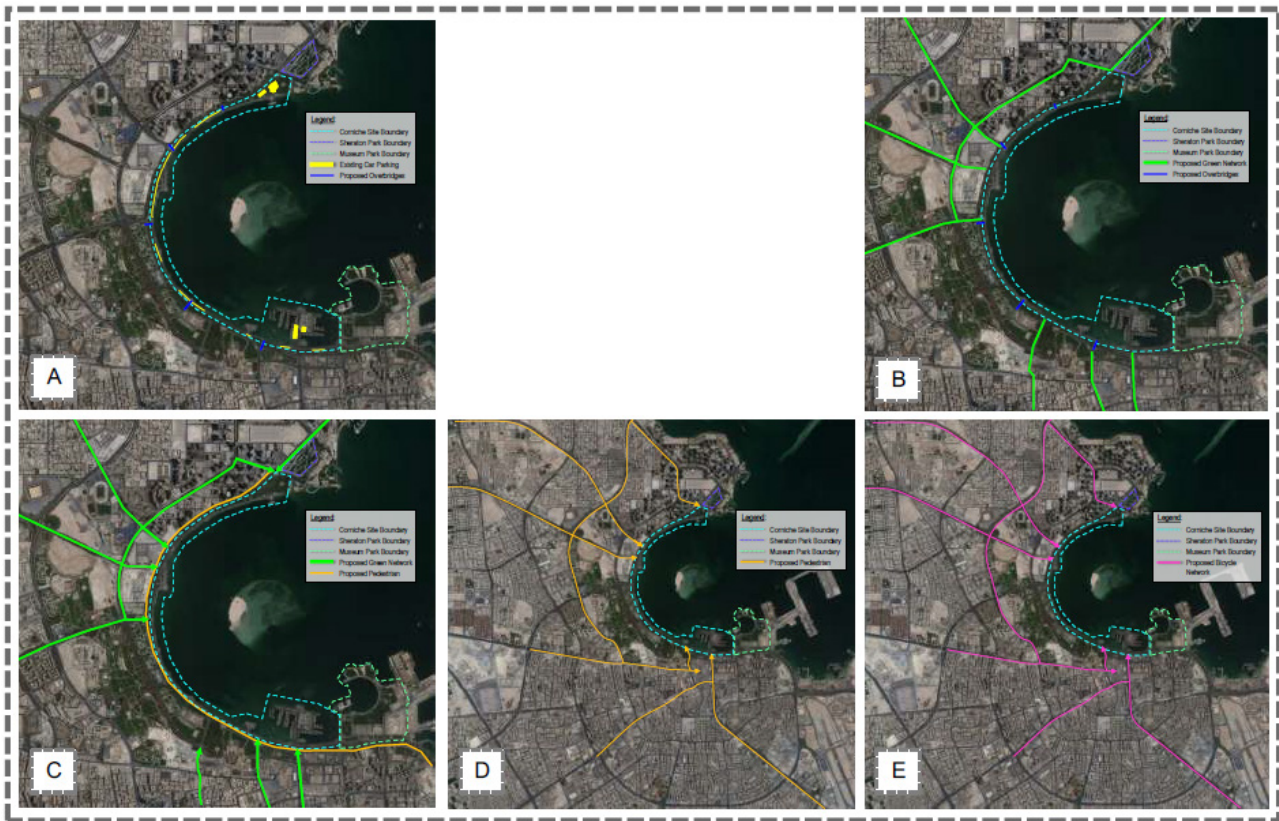
5.2.1. Accessibility from public parking areas

The proposal places livability front and center and, to this end, promotes walkability and the concept of “putting cars in their place”. Establishing the appropriate space for cars is essential for shaping Doha into a more pedestrian-friendly city. While the current arrangement of car parks is sufficient to meet the needs of car users, there remains a need to improve walkability between these parking areas and the surrounding communities, amenities, and destinations. To ensure that walking to and from parking areas is comfortable and safe, some design actions are required, (i) to improve safety in existing parking facilities and enhance them with appropriate urban design elements, such as with 24/7 surveillance and proper shading provisions, (ii) to provide pedestrian overpasses at about every 100 meters along Al Corniche Street, connecting the pedestrian network of the Corniche waterfront with the nearby parking facilities and other areas, and (iii) to establish parking fees for parking facilities, in order to encourage city residents to use public transportation and discourage reliance on private cars (see **Figure 8(a)**).



Source: Authors

Figure 7. Corniche promenade: Territorial (network) analysis based on graph theory



Source: Authors

Figure 8. Proposed master plan. (a) Bridges at every 100 meters connecting pedestrian network along Corniche promenade. (b) Green network connecting public transportation nodes to Corniche promenade, and proposed bridges at every 100 meters connecting Al Bidda parking area to pedestrian network. (c) Interconnected green network, including pedestrian and cycling paths, and proposed enhancement of Corniche promenade for pedestrians and cyclists by installing elements promoting safety and comfort. (d) Interconnected green network, including pedestrian paths, and proposed enhancement of Corniche promenade for pedestrians by installing elements promoting safety and comfort. (e) Proposed cyclist network at city scale.

5.2.2. Accessibility from public transportation nodes—Metro stations

There is a complete lack of a cohesive pedestrian and bicycle network between the Corniche promenade and the nearest public transportation nodes, i.e., metro stations and bus stops. The researchers contend that corridors and connections are vital ingredients of a more livable city and lead to a more successful urban space network. The network proposed here connects the neighboring urban fabric to the Corniche promenade through a well-designed pedestrian and bicycle network. While the Corniche promenade has a well-used and well-developed pedestrian network along its full length, the main challenge will be to connect users from the other side of the adjacent arterial road, Al Corniche Street, ideally with sun-shaded bridges at approximately every 100 meters. This will allow people to cross this heavily trafficked road in a safe and comfortable manner. Urban design and open space intervention should aim to seamlessly weave together pedestrian and bike paths, parks, transport nodes, and other amenities into an attractive and accessible public realm (see **Figure 8(b)**).

5.2.3. Accessibility from public realm nodes—Pedestrian and cycling network

The proposed network would ensure accessibility from all the roads connecting public realm nodes in the neighborhoods near the Corniche promenade. The bicycle network that currently runs only along the Corniche will need to connect to the proposed bicycle network throughout the proposed pedestrian network to ensure safety and comfort. Such intervention should incorporate (i) safe and frequent pedestrian crossings and bridge overpasses for pedestrians and bikers alike, thereby providing for easy access across the road, and (ii) the installation of shaded seating, small planters, landscaping, and waste bins along the pedestrian and bicycle pathway, which collectively would ensure a safe and comfortable experience for visitors and city residents (see **Figure 8(c)**).

5.2.4. Connectivity to/from neighboring urban green spaces—Pedestrian network

A continuous pedestrian network encompassing all the major ring roads should be planned at the neighborhood scale (see **Figure 8(d)**). Prioritizing walking over traveling by car can be facilitated (i) by enhancing community activities and facilitating the availability of informal vendors and food trucks along the network, and (ii) by incorporating signboards, lighting, and other attractive urban design elements, which would also encourage walking and/or multi-modal integrative participatory approaches (see **Figure 8(d)**).

5.2.5. Connectivity to/from neighboring urban green spaces—Cycling network

A continuous cycling network encompassing all the major ring roads should be planned at the neighborhood scale. Such a strategy must consider that (i) cycling could be encouraged through the provision of bike lanes, designed with anti-skid pavement and sufficient lighting (especially during the dark hours) to ensure safe travel and access for bikers, (ii) cyclists should be given priority over motorized vehicles at locations where it is necessary to provide road crossings and intersections, (iii) street furniture and resting areas should be provided to provide comfort to bikers at regular intervals, and (iv) the potential for bike-share and other programs that encourage easy use of bicycles should be considered as part of a viable alternative to automobiles (see **Figure 8(e)**).

6. Conclusion and discussion: Social-ecological transdisciplinary perspective

The improvement in urban design and planning strategies in recent years has benefited from the feedback and critiques of architects and planners, who have argued that social groups' well-being can be improved through a social-ecological transdisciplinary perspective of planning. Urban sociologists and social scientists argue that well-being is determined by a complex relationship of various social processes interacting within spatial forms, rather than through the influence of the physical environment alone. Despite this view, landscape architects and urban planners often fail to consider (i) the impact of ecological systems and (ii) the social basis of well-being, and mistakenly act as if urban design alone can enhance the frequency of neighborly interactions.

On the contrary, both criteria can be addressed through the development and regeneration of pedestrian-oriented neighborhoods integrated within the urban fabric of cities. The movement supporting this approach to master planning has been called "New Urbanism". The movement stresses that the past emphasis of urban planners on physical determinism and the over-dependence of city dwellers on the use of private vehicles (most typically, cars) have resulted in reduced

pedestrian access via sidewalks and fewer vibrant pedestrian-oriented neighborhoods, in turn denying the essence of cities’ culture. The movement advocates for a mixed-use and diversified urban fabric, as it pertains to both buildings and urban public spaces. This encourages social interactions among different social groups and, as a result, supports the formation of interesting, vibrant, and livable neighborhoods.

Personal interactions within an urban public space can be facilitated when the public space is connected to the nearby urban fabric through energy-efficient and sustainable means of mass mobility, integrating public transport and motorized vehicles with bicycle lanes and pedestrian networks. This view has given birth to “Smart Planning” and “Sustainable Growth” movements, comprising urban sociologists and planners who tackle issues and challenges related to (i) sprawling, (ii) environmental degradation due to unplanned expansion of urban settlements and of the environmental footprint, and (iii) transportation and accessibility—namely, easing access to sustainable alternative means of transport.

The insights revealed through a network analysis based on graph theory have allowed the researchers to specify a novel approach, which can enhance both the accessibility and the connectivity of the Corniche promenade. Accessibility to and from neighboring districts was assessed for (a) public parking areas needed for those using private vehicles, (b) public transportation nodes, such as metro stations, (c) pedestrian and cyclist networks, and (d) public realm areas. Connectivity for the last of these was assessed by determining access to and from neighboring urban green spaces and public realm areas located within a three-kilometer radius, assumed to be a reasonable maximum walking distance for a healthy adult. While the foregoing parameters have been discussed individually, the research team emphasizes how crucial it is to approach design using the framework in a holistic and systemic manner.

The Corniche of Doha is the longest uninterrupted public realm of the city: it is the “urban *majlis*” of Doha, the most significant gathering place that holds the city together. The key challenges for urban development of the city are (1) reversing the process of decline of its public realm and adopting a strategy that goes beyond the beautification of green areas, (2) enhancing the Corniche promenade’s physical setting in order to enhance livability, and finally (3) planning an effective system of open green spaces that are clearly compatible with the region’s environment and climate and well-connected and integrated with the Corniche promenade. In particular, a planned system of open spaces within the urban fabric of the neighborhoods of Doha should be planned and critically analyzed. Planning strategies and integration projects should be proposed in order to realize the development of a city in which public green spaces are part of the built environment and contribute to making the city more livable.

The present research study has confirmed that graph theory is an effective method for providing recommendations for implementing a green network system of parks based on two levels, namely the neighborhood scale and the city scale. One of the major challenges in creating an effective network relates to the selection, assessment, and strategic linking of nodes and corridors along the territory. Green outdoor neighborhood hubs where people and nature meet for recreation, leisure, and community events must be meaningfully and seamlessly connected to one another by corridors. Such corridors are typically green linear lanes that provide shade and cooling, as well as accommodate safe, comfortable movement within neighborhoods and through the urban fabric.

6.1. Implication of practice and advancement of research

The framework proposed here for the neighborhood- and city-scale green network system planning for the Corniche highlights the extent to which an urban planning approach needs to be implemented to enhance accessibility and connectivity of the promenade to and from neighboring districts and urban green areas through the two-scale-level method. The present research, while considering the specific case of the Corniche promenade, illustrates how the principles of green networks and social-ecological planning can extend to other cities in the region and well beyond.

Furthermore, the insights gleaned from this study make clear that the amount of green spaces and their spatial distribution within the metropolitan limits of a city are, by themselves, insufficient to enhance spatial capital. In order to bridge this gap, the urban planning of green areas requires a far more comprehensive and holistic approach, aimed at enhancing (i) ecological systems, (ii) social well-being, and (iii) connectivity of systems, thus necessitating an attentive social-ecological transdisciplinary perspective. Ecological diversity, landscape connectivity, and recreational values (often related to social-cultural aspects of city life) should be emphasized and must be considered vital tools to envision, evaluate, and foster such approaches to the development of green areas and the wider urban fabric.

The functionality of landscape connectivity is achieved through the spatial configuration of urban elements, such as patches (open spaces and public realm areas) and corridors (pedestrian and cycling networks). Such spatial configuration, including the network of green areas, must be carefully thought through by urban planners, while social-ecological diversity must be explored and planned by sociologists, landscape urban designers, and architects. The researchers argue that a social-ecological transdisciplinary strategy must be developed when translating our framework from theory to practice—the planning, designing, and building of sustainable cities that enhance city residents' well-being is a daunting yet urgent task.

Further studies concerning a contextualized social-ecological transdisciplinary approach to the development and integration of green urban areas in the State of Qatar should be explored and investigated at the regional (macro-scale), metropolitan (city-scale), and neighborhood (micro-scale) levels. A multi-level approach will allow city planners and developers to better customize the proposed framework in order to integrate the built and natural environments through a comprehensive, well-conceived green network system.

Further investigation into the functional-spatial roles of different types of green nodes and corridors in Doha would provide necessary and valuable insights for generating a detailed and implementable framework. This would go beyond suggesting optional features to improve natural and urban environments locally but instead can serve as a valuable model for sustainable master planning for Doha, for other cities in Qatar, and across the GCC.

6.2. Contribution to knowledge

This study of the Corniche promenade highlights the fact that Doha does not yet possess a “pedestrian and bicycle” culture, with people walking or riding to work or to leisure areas regardless of the often-sunny weather. The city currently lacks facilities favoring walking or the use of bicycles and shows poor connectivity of existing walkways and bike paths with car parking areas, bus stops, metro stations, and public areas located within the urban fabric of the city. The result is

that, at present, the city possesses low spatial capital, and a planning process is needed as the city continues to develop and improve its facilities. The goals here should be (1) to enhance the spatial capital of green public spaces, (2) to increase public involvement in impeding an urban growth pattern motivated by mostly speculative and lucrative goals, and (3) to promote the development of a livable, human-scale community. Researchers and public agencies can utilize the methodology and findings of this research study for the future advancement of knowledge in the evaluation of the viability of public parks and other green spaces.

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