

Souq Waqif Neighborhood as a Transit-Oriented Development

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Abstract: In a rapidly developing nation such as Qatar, the prime aspect of growth is directed toward delivering social, economic, and environmental coherence in its neighborhood development. Qatar's current fast economic growth and the physical transformation of its built environment compromises social and environmental aspects. However, if applied suitably, these transformations can enhance these compromised aspects while increasing economic prosperity. Such transformations include major urban public transit systems currently under construction for the 2022 FIFA World Cup and 2030 Qatar National Vision (QNV-2030), which aims to connect the center of Doha to several megaprojects and transit villages around major metro stations. The main goal of projects such as the Doha Metro System is to reduce the number of vehicles on the road networks while providing a "stress-free" transition experience. Therefore, the pursuit of transit-oriented developments (TODs), as part of an integrated transportation and land use strategy, will aid in the revitalization of urban neighborhoods in terms of both social and environmental aspects, while allowing for economic prosperity. The main challenge for urban planners is to design the metro stations and accompanying facilities to be well integrated into the urban context of their surroundings, thus reducing traffic through the design of mixed-use, compact transit villages. This study aims to explore the extent to which the new metro station can be interconnected with the spatial form of the built environment of the Souq Waqif neighborhood. This research study argues that efficient integration of land use with balanced transportation will contribute to creating a more livable environment with reduced automobile dependence while aiding the economic context. The research design includes qualitative data based on theoretical studies to assess the principles of TODs and the extent of further implementations that can be employed for the Souq neighborhood to become a TOD. DOI: 10.1061/(ASCE)UP.1943-5444.0000615.

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Introduction

While the population of different urban areas is increasing, few regions are experiencing growth as fast as the Middle East. The urban share of the total population was reported to be 70% by the end of 2015, whereas the average for all developing countries was 54% (World Bank 2014). Gulf countries, in particular, have received vast attention due to their rapid development, which, in contrast to Western cities, is described as "instant." Qatar, one of the current developing Gulf countries, has experienced vast rapid urban growth over the past 20 years. Doha is the largest city and capital of Qatar and has one the fastest-growing populations in the Arab world. Its population has increased from below 500,000 to 1.2 million in only 20 years, and it is expected to continue to grow at unprecedented rates (World Bank 2014). Nevertheless, this growth has allowed Qatar to promote itself to the world through the upcoming FIFA World Cup 2022 and has initiated various megaprojects and

facilities, such as the metro line, airports, ports, parks, and stadiums to serve the 2030 Qatar National Vision (QNV-2030) (Furlan and Elgihani 2018; Furlan et al. 2019b).

With Doha growing at this rate, several problems will emerge due to the rapid population and physical growth, leading to serious environmental and social problems. Moreover, the drastic increase in population leads to complications in growth management, housing, infrastructure, and transportation. In the process of increased automobile significance, areas of Doha are becoming uninhabitable swaths for human beings due to traffic congestion. Planners are wasting vast amounts of space for automobiles, although automobiles spend ±95% of their lifetime parked (Barter 2013; Furlan and Sipe 2017; Furlan and Saeed 2019). As a response to this drastic increase in traffic congestion and automobiles, the state of Qatar is currently constructing a new metro system, which includes approximately 100 metro stations along the four main lines (Fig. 1).

These stations will aid in the creation of transit-oriented developments (TODs) along the metro rail corridors, thereby enhancing the region's vision for smart growth and economic developments by creating walkable and vibrant neighborhoods. This research study focuses on the heritage site of Souq Waqif in the center of Doha and studies the extent of the potential to which the adjacent transit stations and new metro station would aid in developing it as a TOD. The Souq is currently known for its traditional urban fabric of social, cultural, commercial, and recreational centers. It dates back a minimum of 100 years and was renovated in 2006 to conserve its traditional architecture style. It is in a strategic location, referred to as *the heart of Doha*, adjacent Msheireb to the west, Bidaa Park to the north, and the Corniche to the northwest. The Souq is currently served by bus stations and several underground

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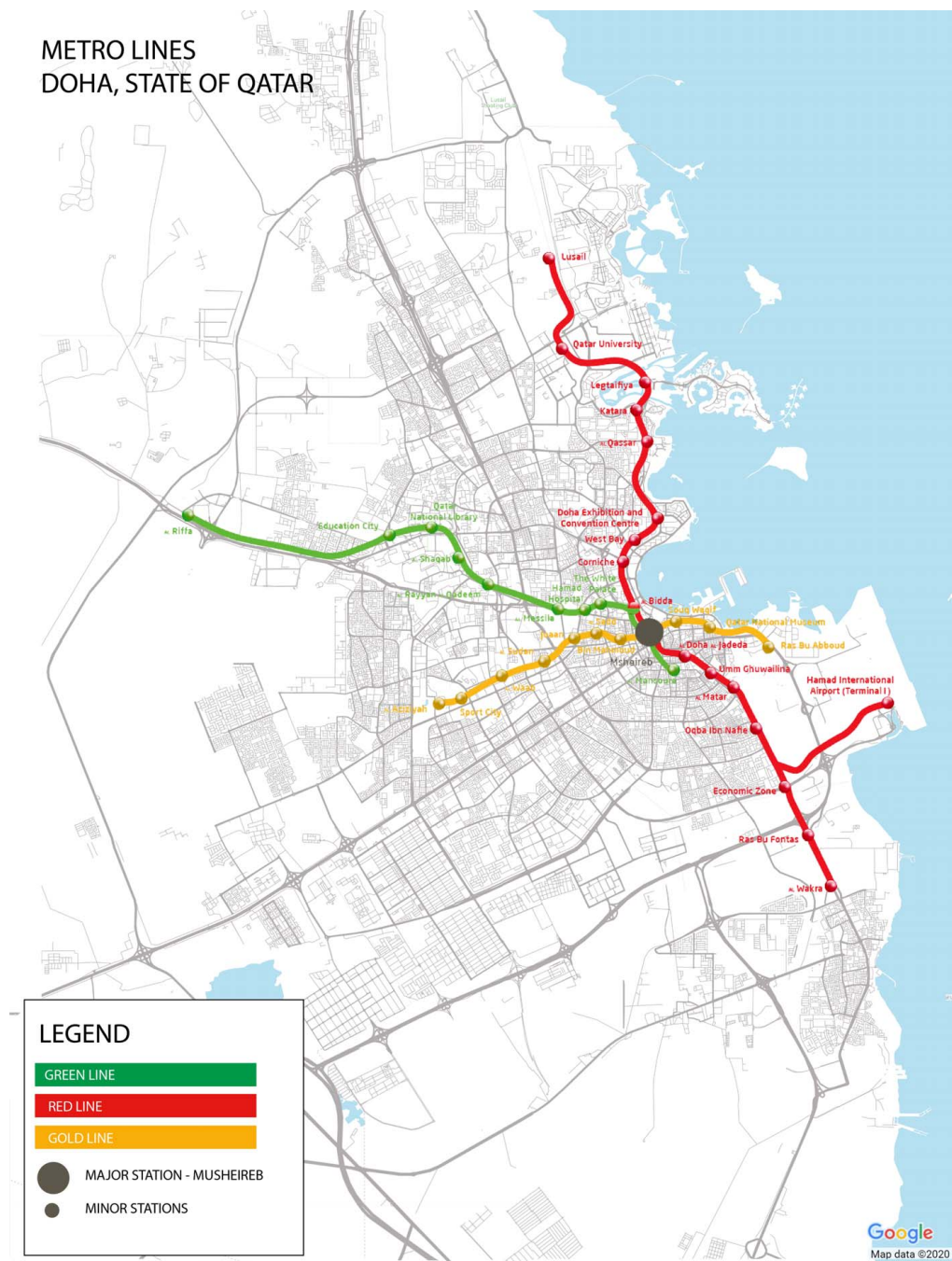


Fig. 1. Metro lines and stations in Doha, Qatar. (data from [Qatar Rail 2018](#); Map data ©2020 Google.)

car parking locations, as well as by two stations of the future Gold Metro Line (Furlan and Faggion 2015; Furlan et al. 2015; Furlan et al. 2016; Furlan and Tannous 2018) (Fig. 2).

Background/Literature Review

Qatar's Urbanism

Growth and Challenges: QNV-2030

Among Gulf countries, the State of Qatar is emerging in its regional and global aspects. With the first substantial urban settlements appearing in the 1940s, Qatar's urban development is a relatively young experience. Before the 20th century, Qatar was primarily

characterized by fishing and pearling villages. Prior to the discovery of oil, its population had not reached 30,000. Doha, the capital of Qatar, had a population of 12,000 inhabitants (Elshestawy 2008). However, the dramatic urban revolution began with the influx of the petrodollar in the 1950s and accelerated due to the increase in oil revenues after 1971. Today, the sprawling city of metropolitan Doha consists of 1.4 million inhabitants (Remali et al. 2016).

With more than 90% of Qatar's population living in Doha, the country has taken significant steps toward creating sustainable and improved urban infrastructure (Al-Asiri 2017; Furlan and Alattar 2017). This is now evident as the major neighborhoods and megaprojects, such as Education City, Katara, Musheireb Downtown, and Lusail City, have come to life, along with the satellite cities and the 2022 FIFA World Cup stadiums (Fig. 3).

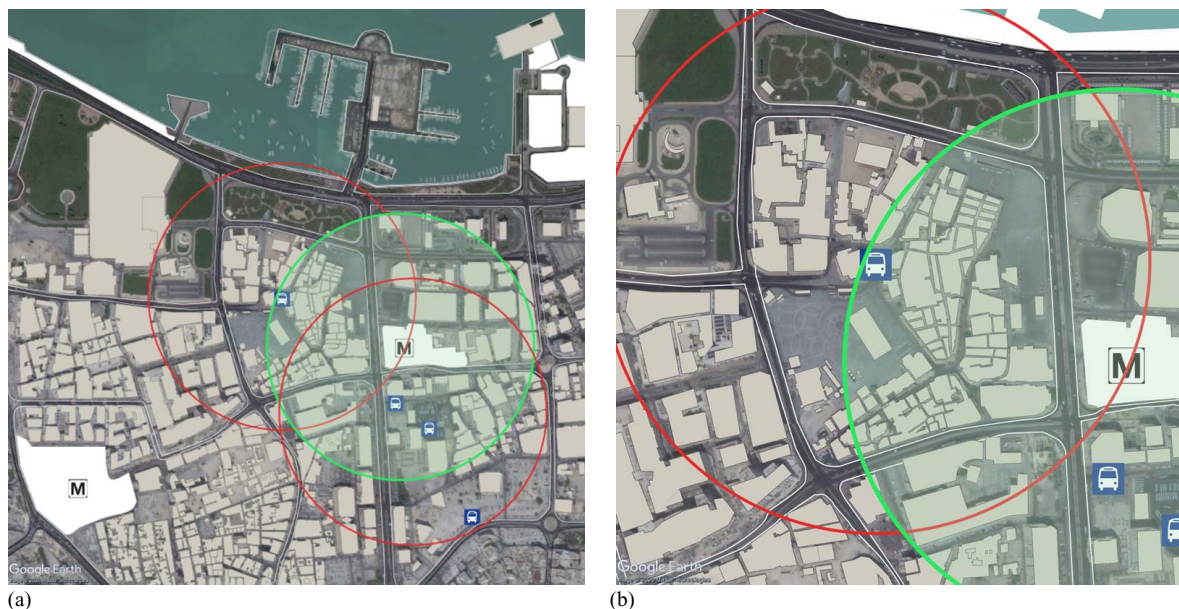


Fig. 2. (a) Transit stations in 2 km² area; and (b) transit stations in (1 km²) area. (Map data ©2020 Google, image ©2020 Maxar Technologies.)

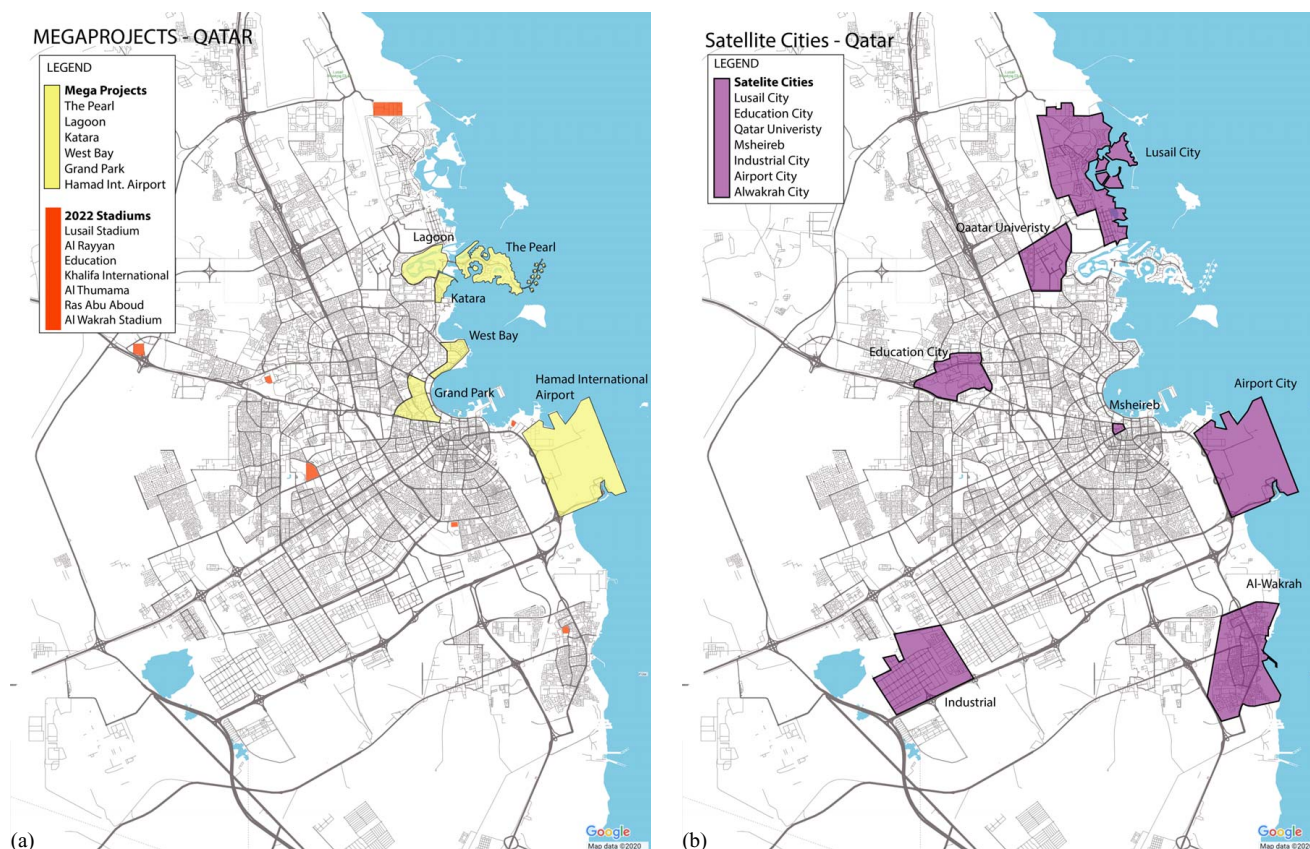


Fig. 3. On the map of Doha, Qatar, (a) shows the main megaprojects and World Cup 2022 main stadiums, and (b) shows the satellite cities. The megaprojects are concentrated along the coastline. The satellite cities are also constructed on a large scale that reshaped the urban fabric of Qatar. (Data from Qatar Ministry of Foreign Affairs 2020; Map data ©2020 Google.)

These major projects are reshaping the urban fabric of Qatar (Rizzo 2014; Furlan and Almohannadi 2016; Furlan and Al-Mohannadi 2018). Although the implementation of these projects has contributed to Doha's primacy, the absence of a national planning framework has caused more traffic congestion,

land value inflation, affordable housing shortages, and localized environmental impacts (Rizzo 2013). To confront these issues, and in the light of the QNV-2030, the Ministry of Municipality and Environment (MME) has adopted a national framework for urban development (Furlan et al. 2019a).

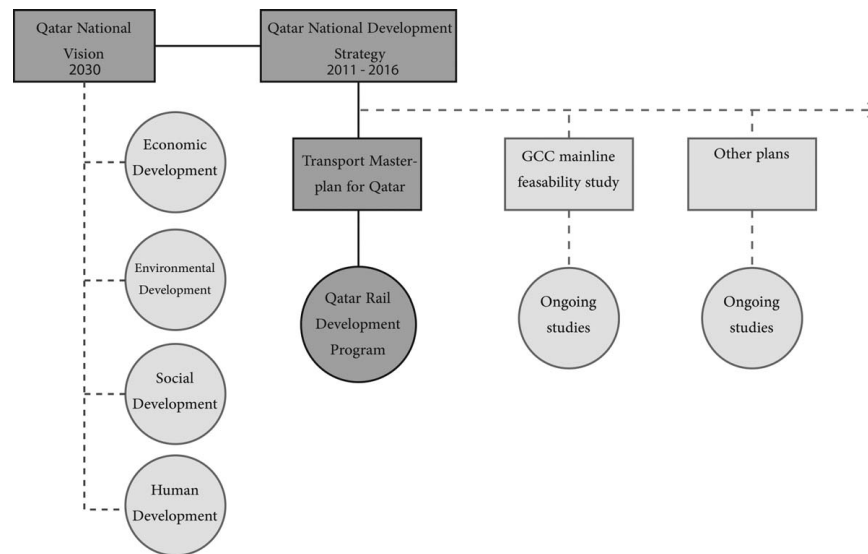


Fig. 4. Qatar national planning framework. (Data from MME 2008.)

QNV-2030 rests on four pillars: human, social, environmental, and economic development (Fig. 4). The human development strategy focuses on citizens' basic needs, such as healthcare and education. Social development, on the other hand, oversees the establishment of cohesiveness within the entire society. The Ministry of Environment oversees the environment development strategy, and four ministries in cooperation with the Qatar Central Bank have prepared strategies concerning economic development. One of the main aims is to enhance the urban fabric and junctions of culture and infrastructure by bringing forth diverse urban mobility (Furlan and Petruccioli 2016). Qatar Metro is one of the main contributions to the 2030-QNV as a response to the increasing demand of the growing population. However, the metro started operating in May 2019, long before the 2022 FIFA World Cup event (Furlan and Sipe 2017; Furlan et al. 2019b).

Qatar's Neighborhoods: Souq Waqif as a Case Study

The prosperity after the oil revenue of the late 1970s contributed to changes in Qatar's national housing forms and built environments (see Fig. 5). Neighborhoods prior to the oil discovery consisted of complex systems of winding alleys that served as access to individual homes. These neighborhoods, also known as *Ferej*, were wall-to-wall family houses in close proximity. The high density of the built area was also influenced by the hot climate and the necessity to shade walkways and expose walls (Rizzo 2014). Conversely, neighborhoods built after the 1960s suffered from sprawl as settlement patterns were determined by the development of modern infrastructure. Subsequently, old courtyard houses were replaced by low-density modern buildings, and roads were winding in central areas (Wiendmann et al. 2012). Although the oil boom led to sprawl of the suburban settlements around a mixed-use center, the most recent growth strategy has led to a phenomenon of "cities within a city," developments with a predominant emphasis on waterfronts, such as The Pearl, Lusail, and Katara.

For its cultural and social importance and location integration with the QNV-2030, the Souq Waqif neighborhood is used as a case study to assess a given area. The Souq is characterized by the integration of the contemporary and traditional urban fabric within the city center of Doha. Even though several of Doha's historic settlements were replaced during the modernization period,

the country's rulers aimed to establish Doha as a cultural center. Subsequently, the heritage site of the traditional Souq Waqif was rebuilt in its original location using traditional materials and techniques from 2004 to 2008.

Sustainable Development

Sustainable Urbanism and Smart Growth

"Cities are complex, interconnected and dynamic systems that are both a threat to the natural environment and an important resource in their own right" (Roosa 2007, p. 174). Thus, urban sustainability rests in the challenge of solving both problems experienced within the cities and those caused by the cities. It underlines the role of cities and positive urbanism in shaping more-sustainable communities by emphasizing a new approach in more ecologically responsible forms of living. Beatley (2000) identified four basic principles of sustainable development: the principle of policy integration, the principle of urban management, the principle of cooperation and partnership, and the principle of ecosystem thinking (Farr 2008; Wiedmann et al. 2014).

It is generally advocated that smart growth is one of the essential equivalents of sustainable development. Smart growth is a design and planning movement that focuses on directing growth into compact, walkable urban centers to avoid sprawl. The movement proposes the reduction of the use of automobiles by developing multimodal transport systems and high-density, mixed-use compacted developments with an emphasis on pedestrian networks. The main 10 principles, shown in Fig. 6, are considered the foundation of the smart growth approach to pedestrian-friendly developments. An additional key factor for achieving smart growth is urban public transit systems. Urban connectivity has a crucial effect on the creation of livable communities that promote pedestrian-driven and healthier neighborhoods. Planning policies and regulations also encourage the principles of smart growth through mixed-use compact developments, which allow people to access different facilities within walking distance.

Social Sustainability

Urban sustainability can be approached in various ways. Although the subject of sustainability includes a clear social mandate, the focus has been directed toward environmental issues and economic growth. The neglect of human dimensions has renewed interest in

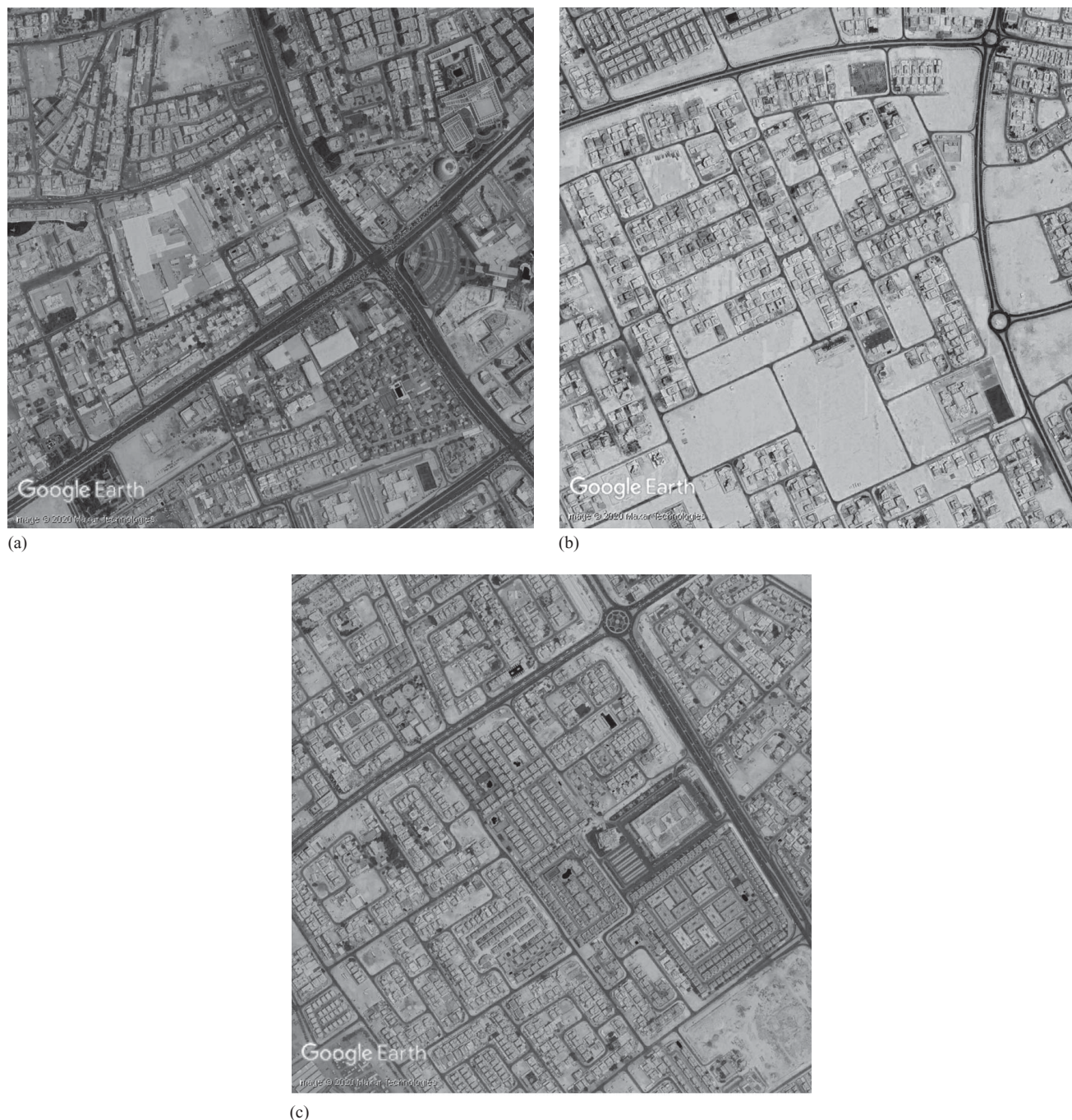


Fig. 5. (a) Traditional urban neighborhood with an interconnected alley street system (2 km²); (b) and (c) neighborhoods with broken street systems and superblocks. (Map data © Google, image © 2020 Maxar Technologies.)

the concept of “social sustainability” and aspects thereof. Social sustainability rests in a society that realizes the relationship between citizens and the society they coexist in to meet their basic needs (Manzo et al. 2019). The means of practical implementation of social sustainability are undefined; however, one basic need that is largely acknowledged is users’ happiness. Several key themes are included in Fig. 7, which lists basic needs frequently held as essential supports of social sustainability (Colantonio 2009). These concepts are considered necessary for the social and psychological survival of human beings and communities. This is because, at the basic level, it is certain that food, water, shelter, and employment are crucial components for the sustainability of communities and individuals. Similarly, a strong

sense of place, social network, and identity are considered essential requirements. This shift from traditional “hard” concepts toward “softer” themes within the sustainability discourse has caused many debates on the role policymakers play in delivering these objectives. Therefore, the central concept of social sustainability is understanding the circumstances conducive to human happiness.

Transit-Oriented Developments

The high level of automobile dependency is one of the main complications confronting urban planners in contemporary cities. The TOD model became one of the key planning paradigms aimed at reversing auto-oriented expansions. As defined by Ogra and Ndebele (2014,

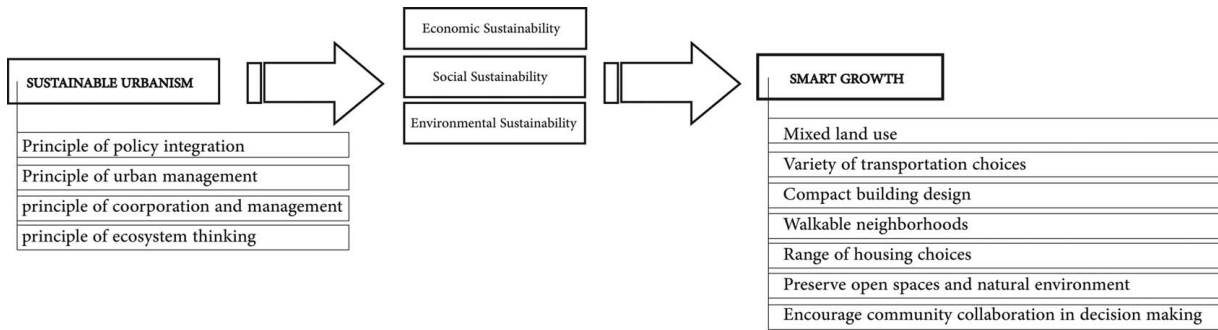


Fig. 6. Chart of principles of urban sustainability and smart growth. (Data from [Beatley 2000.](#))

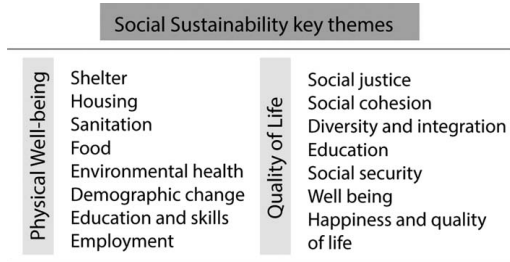


Fig. 7. Social sustainability key themes. (Adapted from [Colantonio 2009.](#))

BENEFITS OF TOD

PUBLIC SECTOR

- Primary
 - Increase ridership revenues
 - Provide joint development opportunities
 - Revitalize neighborhoods
 - Economic Development
 - Less traffic congestion
- Secondary
 - Less pollution and fuel consumption
 - Increase sales revenues
 - Reduce sprawl
 - Reduce road expenditures

PRIVATE SECTOR

- Primary
 - Increase rent and land value
 - Increase affordable housing opportunities
 - Increase retail sales
- Secondary
 - Increase access to labor pools
 - Reduce parking costs
 - Increased physical activities

Fig. 9. Benefits of TODs. (Adapted from [Cervero et al. 2004.](#))

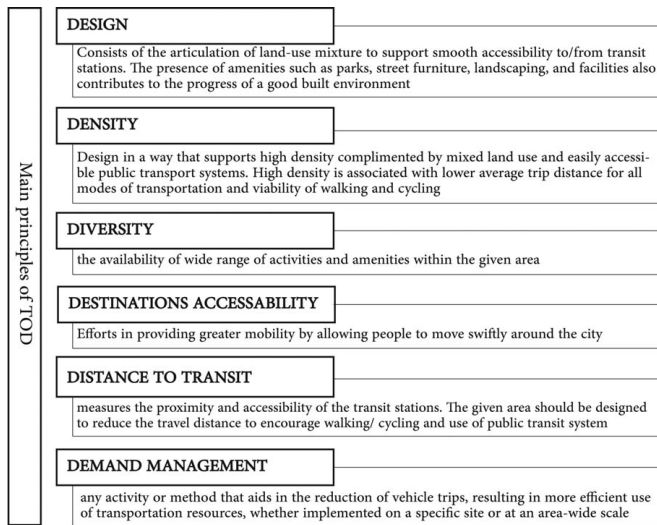


Fig. 8. The 6Ds of TOD. (Adapted from [Beatley 2000.](#))

p. 540), TODs are “higher density mixed use residential and commercial developments set within walking distance of key transit nodes such as rail or bus stations or around activity centers such as major shopping centers/offices.” These developments will be centered around high-quality transit systems to become pedestrian-oriented communities ([Bernick and Cervero 1997](#); [Cervero and Kockelman 1997](#)). The main aim of these developments is to reduce automobile traffic by prioritizing environmentally friendly traffic: bikes, public transportation, and walking. The primary components that constitute sustainable TODs are recognized by the concept of the 6Ds: design, density, diversity, destination, distance, and demand management, as detailed in [Fig. 8](#).

The definitions, along with the main concepts above, summarize TOD as a method aimed at reducing auto dependency through mixed-use developments complemented by a built environment that supports other modes of transportation ([Curtis et al. 2009](#); [Walker 2011](#); [Gerrity 2015](#)).

A community with a reliable transit system can discourage vehicle dependence and congestion, helping in the reduction of greenhouse gas emissions and the general improvement of community health. TODs can also strengthen the local economy, as people will be able to spend their time and money in local areas, rather than on vehicle transportation costs. Moreover, promoting compact development using existing infrastructure requires less cost than the expansion of public transportation and utilities cost caused by sprawl. A Center of Transit-Oriented Developments (CTOD) study reported that more than 40% of future demand of housing and nearly a quarter of all jobs are located near transit ([Zimbabwe and Ohland 2011](#)). Overall, a centralized TOD will create a more sustainable community in terms of both the public and private sectors ([Fig. 9](#)). With the introduction of the new public transit system within Doha and the given area of the Souq Waqif district, automobile dependency as the main means of transportation will decrease. This allows for new opportunities to introduce TODs in promoting sustainable neighborhoods as rooted within the national vision of Qatar, a comprehensive urban development plan that adopts sustainable policy with regard to urban expansion ([Ministry of Qatar 2008](#)). Through correct land use decisions, TOD achieves many of the main targets set out in the QNV that visualize a vibrant country.

Research Design

Methods of Data Collection

The Souq Waqif district is the selected area of this research study due to its cultural location and use, as well as the future possibilities that rest with the development of the future transit systems in Doha. The Souq Waqif plays a fundamental role in the development of TODs in the State of Qatar as the opportunity lies in its location between two main routes of the city: A-Ring Road and Al-Corniche Street. The Souq Waqif also stands to become one of the main economic hubs in Qatar due to its rich historical and touristic attractions. Hence, it is considered crucial to promote sustainable districts in the State of Qatar (Furlan and Faggion 2015).

Theoretical Study

The goal of this research study is to develop a method for measuring the current state of Souq Waqif against selected performance criteria in relation to becoming a future TOD. The most important part of the research was to test which data were available for collection. Therefore, the theoretical framework was deduced on a basis established throughout the literature review. Different principles, such as urban sustainability and smart growth, were assessed using various literature reviews. The research study proceeds with identifying the elements by which a successful transit village can be designed and planned by reviewing the definition of TODs in relevance to the QNV-2030 (Brown and Dixon 2014).

Qualitative Data

The scope of the research began by identifying the two main future stations around the selected area for analysis. Later, appropriate data categories and indicators are identified. The primary data were collected to identify and evaluate the status within the approximate 800-m precinct from the metro station using drawings, photographs, and maps. The secondary data collection consisted of site visits and interview surveys of citizens that aimed to assess the households and users in the selected area (Johansson 2003; Denzin

and Lincoln 2005; Marshall and Rossman 2010). Fig. 10 summarizes the research design.

The limitations of this study's methodology are identified. Significant indicators are drawn from secondary data and thus may be biased based in the methodologies used within the original data collections.

Data Analysis and Finding

Means of Transportation (Connectivity)

Qatar is an automobile-dependent city, where most of its urban areas sit within large blocks surrounded by multilane highways with grade separations that restrain accessibility. The given area of the Souq Waqif neighborhood is surrounded with main streets that are poorly designed for pedestrian use, with large sidewalks dedicated to car parking. Considering these settings, three systems are induced to enhance connectivity: street networks, reduced automobiles by encouraging walking and cycling, and the integration of multiple transit systems.

Street Networks

The road network of Doha is based on multilane highways and superblocks that have few intersections per square meter. However, the given area of the Souq Waqif and neighborhoods hold the advantage of having moderate urban blocks. The length of these blocks allows for the promotion of compact developments that enhance permeability. The streets surrounding the Souq are relatively short in relation to Doha, with the longest being approximately 4.7 km. This allows for the use of traffic-calming measures to reduce auto traffic as it moves around the given area. Some of these techniques are currently employed in these streets, such as alternate-side parking, pedestrian islands, raised brickworks and traffic lights. Other methods that could be adopted include curb and sidewalk extensions, speed humps, and creative uses of trees and street narrowing for the area to become much safer, more livable, and better connected to its surroundings.

Less Car-Dominant Lifestyle through Walking and Cycling

In promoting a less car-dominant lifestyle, the focus lies in walkability and cycling. These simple modes of transportation could reduce reliance on private cars for short-distance trips. However, 12 of 30 people interviewed considered cycling to be an inappropriate approach, due to climatic and cultural barriers. They argued humidity and heat would prevent people from using bicycles as common means of transportation. In addition, the style of dress for local males and females is considered not suitable for cycling (Alawadi 2016). The overall conservative culture of Qataris creates a barrier to cycling. However, planning decisions should not be based on the strict norms of 15% of the local population. Another limitation to cycling is Qatar's current urban structure that is based on highway systems. An 800-m trip from Souq Waqif to the neighboring park of Al-Bidaa is 15 min by car, with two time changes in direction, and requires passing through three traffic signals in the case of no traffic; however, the same trip can be taken throughout one line-of-sight pathway using a bicycle in under 7 min.

Therefore, a bicycle infrastructure could be effective under various arguments. First, climate is restrictive, but cycling is still suitable during the half of the year when Qatar's weather is pleasant. Second, while cultural values are respected, they generally change over time. Finally, Qatar's demography is almost entirely dominated by working-class immigrants from Asia, who are accustomed to bicycles in their own humid and hot countries (de Bel-Air 2017).

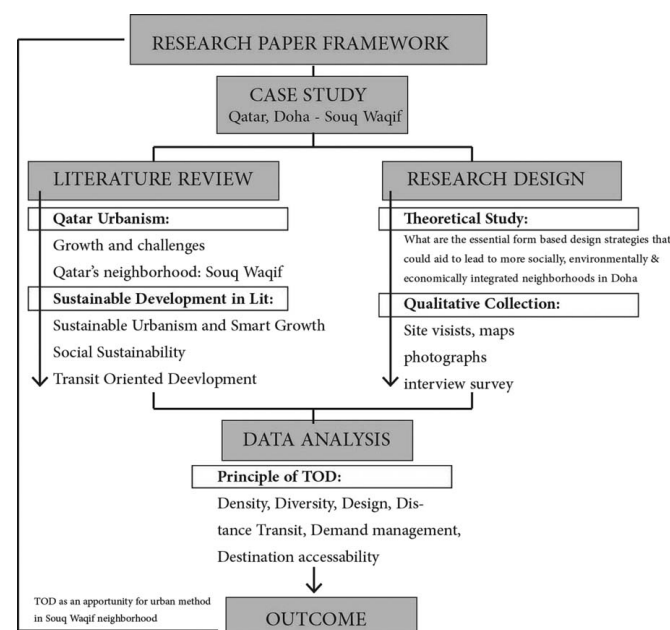


Fig. 10. Summary of the research design.

Although the Souq Waqif neighborhood is highly walkable with diverse and active movement, the level of walkability in relation to its edges and surroundings is disadvantaged. Most, if not all, of the surrounding streets have no decent sidewalks. In case of the presence of sufficient pedestrian infrastructure, the transition between sidewalks is difficult.

Integration of Multiple Transit Systems

Although car transport is offered priority in the district of Souq Waqif, cycling has been newly introduced by the labor community as a means of transportation. However, this practice is not supported by appropriate infrastructure, such as special pathways alongside streets or bicycle racks and different amenities. Other public transport facilities include bus stations that are accessible within 400 m of the metro station location. However, these bus stops are not accompanied by shaded pedestrian infrastructure. To remedy this problem, the pedestrian infrastructure and bicycle lanes should be integrated with existing transit systems, which, in turn, connect to major metro lines.

Prioritized Strategies

Analysis of Key Principles of TOD

Design and Destination Accessibility. The design aspect consists of an efficient, well-designed built environment. It emphasizes safe and smooth accessibility to transit stations, with the presence of amenities, such as benches, street furniture, trees, and landscaping along the way. This leads to greater mobility by allowing people to move around the city more swiftly and is thus considered an effort in achieving destination accessibility (Tannous 2020). Many of these amenities are found within the Souq, such as benches, fountains, and street furniture (Fig. 11). However, the users and participants of the interview survey highlighted the absence of shading elements, signage systems, and free gathering green spaces.

Considering how enjoyable the walk within the inner pathways of the Souq Waqif is, its edges cannot be described in the same manner. Of the Souq, 25% consists of open, empty areas at the edges, with no shelter or use besides that functioning as transition spaces. The Souq also suffers a clear lack of bicycle infrastructure within its boundaries

and surroundings. Although connections within the Souq itself have proven efficient, it lacks easy and safe pedestrian and bicycle connection with the surroundings as the main priority to transportation modes are automobiles.

Hence, the two main aspects of enhancements needed are street improvements and engaging civic spaces, as explained here:

1. Street improvements:
 - a. Incorporation of efficient signage systems
 - b. Incorporation of bicycle lanes
 - c. Multimodal connectivity
 - d. Safe, convenient, and comfortable environments for pedestrians and cyclists
 - e. Curb bump-out and bright cross walks
2. Engaging civic spaces and station improvements:
 - a. Plaza and open spaces (placemaking, enhance multimodal circulation network)
 - b. Station improvement (improved user experience, safe, convenient, and comfortable)
 - c. Integrated bike stations, local art installations, plazas, and open space improvements.

Density and Distance to Transit. A critical challenge facing urban planners in Doha is the high level of automobile dependency, mostly due to low-density developments. Aided by the presence of vast underground parking, the automobile is the main means of transportation to the Souq. To increase the presence of the new metro stations to reverse this problem, the Souq and its surroundings must be designed in a manner that supports high-density developments complemented by mixed land use that are easily accessible with public transport systems. Fig. 7 depicts the density level of the built form developments around the metro station to the east of the Souq, which is between medium and low density. However, it holds great potential to infill the empty plots or large parking lots with concentrated high-density, mixed-use developments to carry out an efficient transit-oriented density distribution for future public transportation of the Souq and its surroundings.

With the infill of unused areas, the given area will be designed to reduce travel distance, which will not only encourage the use of the metro station, but walking and cycling as well. An equally critical



(a)



(b)

Fig. 11. Images (a) and (b) show different amenities such as seating and shading devices found within Souq Waqif. (Images by Mark David Major.)



Fig. 12. (a) Souq Waqif location relative to context (map data ©2020 Google, image ©2020 Maxar Technologies); and (b) land use map of Souq Waqif.

variable in the TOD equation, distance has significant implications for the viability of any public transport system. However, the choice of these different modes of transportation is influenced by various factors that include but are not limited to land use and cultural, habitual, and practically reasoned factors. These factors capture the complexity of transport choices and indicate that accessibility alone is not the determinant of the use of these transit systems. Therefore, interviews with households and users within and around the site captured the intention of people to use walking and cycling as one of their main transportation modes, if available.

Diversity (Mixed-Use). Integrating a mix of land use is essential in providing a variety of services for a vibrant community. TODs usually have a variety of land uses, including residential, civic, and commercial (employment and retail). The existing land use of Souq Waqif area includes different types of markets, commercial, residential, religious, hotels, and public institutions. The Souq

and its underground parking are directly connected to an open green space at the northern boundary of the Souq. Conversely, the land use map [Figs. 12(a and b)] clearly suggests a lack of green spaces within the Souq itself. These green spaces can exist in small parcels, which provide ample spaces to accommodate healthy pedestrian movement with natural shade.

On the other hand, the Souq has lively pedestrian spaces and active ground floors. The efficient distribution of land use, especially along the south and west, provides a clear connection to Msheireb, which allows for greater economic prosperity. In addition, its strategic location between two metro station gives it an advantage to introduce new developments in established communities while still preserving the community's character and urban fabric. The increase in accessibility of the Souq and number of users will aid in the repurposing of underused spaces. It will give vacant and underutilized properties new life, allowing for

the adaptive reuse of ineffective buildings and the realignment of land uses to meet current demand.

Conclusion and Discussion

The presence of energy resources has transformed the country of Qatar from fishing villages to a center of economic and urban development. However, this form of fast growth has contributed to a decrease in the standards of urban living, which is particularly evident in Qatar's capital. Doha has become car-dominant, multilane superblocks with a lack of pedestrian movement. The roads are strictly designed for automobile use, with little to no consideration for other sustainable modes of transportation, such as walking and cycling. In response, Qatar is developing new metro lines and stations under QNV-2030.

This research study aimed to investigate the effect of the planned metro stations on their surrounding regions in becoming TODs. However, this study was constrained to the region of Souq Waqif, as it lies in the center of Doha. The study assessed the existing conditions of the selected site and identified the opportunities and weaknesses of the area.

The methodology employed in this research paper consisted of a combination of a literature review of urban sustainability, smart growth, TODs, and collected qualitative data of the given area. The analysis of the findings revealed the high potential of the Souq Waqif district to become a TOD after the operation of the new metro station. The Souq lies within approximately 800 m of the station, with clear connections. Moreover, the streets within the Souq are found to be permeable, walkable, and well connected, with various land uses and active ground floors. However, the Souq's edges are not well connected to the surroundings in terms of pedestrians or cyclists, as streets are designed to be automobile dominant. Therefore, investing in the empty areas, particularly to the west of the Souq, as recreation spaces of parks, children's playgrounds, public seating, and plazas can enhance the livability of the neighborhood. The location of the Souq as close to the water promenade (Al-Corniche) also provides a crucial component. With the opening of the new metro stations, the size of the surrounding streets should be decreased to promote the connection of this heritage site with the water and to enhance the social, cultural, and architectural sense of the given area.

Implications for Practice and Advancement of Research

After studying the physical and social aspects of the Souq Waqif neighborhood and assessing it according to the aspects of TODs, this research study proposes the following recommendations that were found to be missing in the Souq Waqif, but could contribute to the main principles of TOD: pedestrian and bicycle infrastructure, traffic-calming techniques, more public seating, shading elements, clear signage, and free green spaces for gathering. Moreover, the city should consider changing the citizens' preferences for low-density housing in the districts around the Souq Waqif: enforcing dense neighborhoods with increased residential densities will also aid in decreasing the distance traveled from the metro station to the surroundings. However, enforcing high-density developments on citizens that prefer low-density neighborhoods due to cultural norms challenges the dimension of sustainability: people should be satisfied and feel attached to their living environment. To mitigate such oppositions, experts and politicians should educate the public about TODs through open venues.

To completely understand the opportunities of such transparent planning approaches to planning Qatar's neighborhoods as TODs, future research should explore means of engaging the public in urban planning.

Data Availability Statement

All data, models, and code generated or used during the study appear in the published article.

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