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Doha Metro System in the State of Qatar: The Metamorphosis of Al Sadd District

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Abstract: The State of Qatar has been undergoing radical transformation, coordinated by the national development planning strategy, to realise the aims of Qatar National Vision 2030 (QNV-2030). Efforts towards sustainable urban growth and development have included the establishment of a new transportation system, as well as transit-oriented developments (TODs), which significantly enhanced pedestrians' access to amenities and facilities, particularly during major events. This research study aims to develop alternative design strategies for public transit systems and land use amidst the larger challenge of urban metamorphosis focused on boosting sustainability by enhancing liveability. The Al Sadd district was selected as a case study due to (1) its significance as one of the oldest mixed-use districts in Qatar, with a significant role in the economic development of Doha; (2) its many layers, which have overlapped; and (3) its lack of heritage significance. Data, gathered from both primary and secondary sources, consisted of questionnaires, site visits, walk-through observations, focus groups and structured interviews. The use of these research methods facilitated the exploration of the physical forms and sociocultural characteristics of the area, enhancing understanding of the urban quality, and providing inputs for a strategy to enhance the urban sustainability and liveability of the district.
Keywords: Sustainable Urbanism, Social Sustainability, TOD, Land Use, Transport System, Al Sadd, Doha (State of Qatar)

Introduction

In August 2008, the Qatar National Vision 2030 (QNV-2030) development-plan was established by the Qatari government in response to the country's rapid economic and urban growth. Despite the substantial ongoing growth and rapid advances in social development, a plan was required to prioritise investments in areas needing long-term vision. The plan laid out in the QNV-2030 was designed to support the nation's development while transforming Qatar into an advanced economy featuring consistently high living standards [1, 2].

One of the key challenges regarding emerging cities, such as Qatar's capital city, Doha, is the need for urban qualities to be essential aspects of sustainable expansion [3, 4]. Thus, this research study aims to shed light on the urban qualities of public transit systems and land use, amidst the larger challenge of metamorphosis to boost sustainability by enhance liveability.

The Al Sadd district in Doha, located along the Gold Line Metro on the eastern side of Qatar, between the Joaan and Bin Mahmoud stations, is significant for two reasons: (1) being one of the oldest commercial and residential areas in the country, and (2) playing a notable role in the economic development of the nation [5, 6]. Furthermore, because of its multi-layered nature, gradual development and lack of cultural heritage significance (being an artefact of the Western approach to development), this area was chosen as an excellent case-study neighbourhood for creating a strategy for development, which, in turn, can be applied to other districts with similar characteristics and problems.

This research study aims to propose a masterplan for the development of a compact neighbourhood. The plan features reduced traffic, improved pedestrian connectivity and enhanced liveability for the entire community, thereby boosting access to jobs, increasing safety and promoting healthy living. The study is based on the analysis of primary, secondary, visual and oral data collected from site analysis, focus groups and structured interviews. By investigating the district's urban qualities and spatial manifestation, the challenges and restrictions inherent in attempting to boost liveability in a sustainable fashion were revealed. Accordingly, the conceptual

planning strategy will be combined with a primary conceptual development approach.

Literature Review

Thousands of years ago, human beings began altering the environment. Dense built environments and/or cities have become focal to the need of sustainable urban developments, not only because a growing percentage of the world's population reside within, but because economic actions centre on the development of urban zones. Although urban areas are a natural focal point of social and economic movement, many issues stand in the way, including disparity, weakness and environmental disregard—the latter including increased carbon dioxide emissions in the wake of transportation systems growth [7-9]. These circumstances have prompted the adoption of a sustainability-centred approach for the urban development and/or growth of cities [10-12].

Urban Sustainability

Daly stated that the "first step toward clarifying the term sustainability would be to adopt the dictionary distinction between growth and development" [13]. The term "to grow" is defined as "to allow nature to enhance in size by the addition of material through assimilation or accretion". In many cases, this causes unbalanced urban expansion [14]. However, the term "to develop" is defined as "to comprehend the potentialities of [so as to] gradually bring the area to a fuller and better state" [13].

Although sustainability has been defined from a wide range of perspectives, within an urban context it has always meant promoting and securing the long-term well-being of people, as well as of the planet. A sustainability-oriented approach can only be developed by balancing the use of natural incomes with the manufacture of waste within a city. A sustainable approach must also improve that region's liveability by meeting the community's need for social amenities, economic opportunities and general health suited to the size, ability and density of local, regional and global ecosystems [15, 16, 9]. This can be accomplished by (1) the management of the urban space by a knowledgeable and qualified government that can achieve a balance between development and natural ecology; (2) providing an environment that facilitates social equality while enhancing urban identity; and (3) promoting economic growth consisting of diverse cultures and characters.

Liveability

A sustainable community is based on the enhancement of liveability and/or quality of urban life, which greatly impacts where people will reside within the community [17, 18]. Scholars have defined liveability as the sum of the features contributing to or increasing the community's perception of the quality of life within the built environment. These perceptions will evolve in relation to the built and natural environment, economic prosperity, social stability and equality, educational opportunities and cultural, entertainment and recreation options [19, 20].

Liveability is always associated with sustainability and issues related to infrastructure. In addition, it can provide an alternative model for the development of low-density rural areas where the populace, and thus services, are widely distributed and the arrangement of infrastructure takes on an ecological, economic and social prospect [21, 3, 22].

Several theories of sustainable development were established in the early twentieth century, chiefly focusing on the local level—neighbourhoods and small cities—in order to develop liveable and environmentally friendly communities [23, 24]. For example, Howard, the leading proponent of the "*garden city*" movement, formulated a strategy in response to the requirements for diverse communities that aimed to enhance urban options while furthering intergenerational parity in an environment of urban expansion [25, 26].

Furthermore, several approaches have suggested that the application of urban sustainability be defined. An example from the AEC industry is shown below in Figure 1. Five main elements are shown to be intimately involved in the sustainability of the built environment, chiefly relating people with the surroundings. It is centred on the actions of promoting, maintaining and enhancing the quality of life for diverse populations.

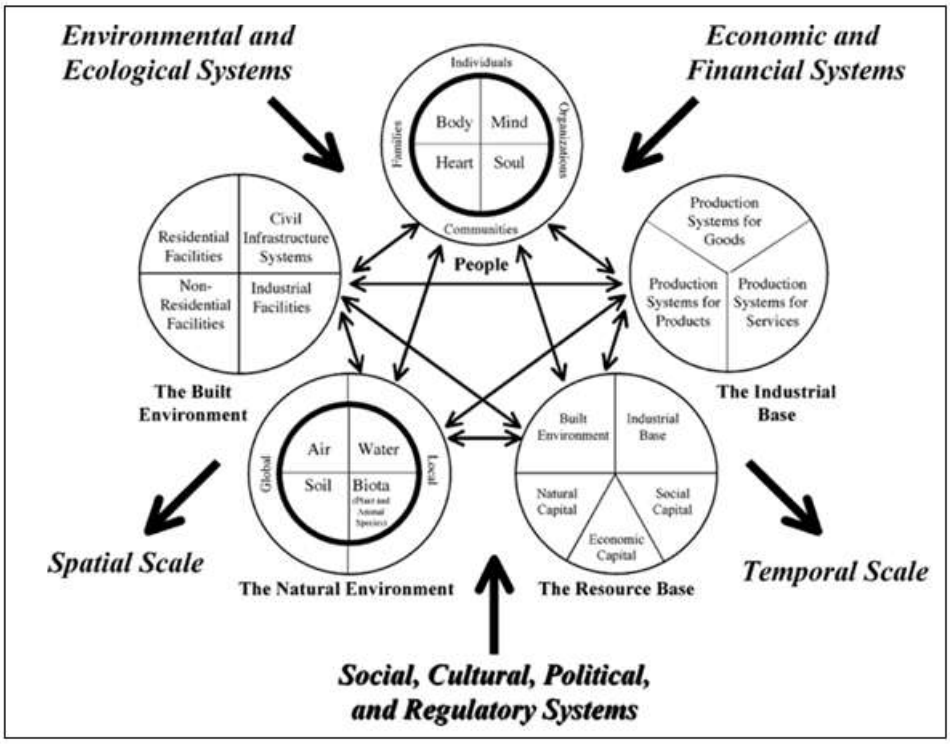

Fig-1: AEC industry: Sustainable urbanism approach

New Urbanism

The concept of liveability is central to "*new urbanism*", which is also defined as "*traditional neighbourhood design*" and "*neo-traditional neighbourhood design*". This model promotes more liveable and pedestrian-centric residential areas as a solution to suburban sprawl. It seeks to prevent overreliance on personal automobiles for every journey with the view to achieve eventual self-reliance [27, 28]. Bohl has described new urbanism as an architecture- and planning-based initiative that backs design-informed plans supported by traditional urban layouts. Such an approach helps to mitigate suburban sprawl and inner-city decay by constructing and reconstructing neighbourhoods, towns and cities [29].

The principles of the new urbanist approach to design can be applied to individual structures such as buildings, lots and blocks up to group-form structures such as neighbourhoods, districts and corridors—and even entire cities and regions [30]. These principles include connectivity, mixed use, diversity, mixed housing, quality of architecture and urban design, the traditional neighbourhood structure, increased density, smart transportation, sustainability and quality of life. Each principle has its own prerequisites [31].

In recent decades, Qatar has experienced a phase of rapid urban growth that has seen the principles of new urbanism used as the blueprint for future developments; more specifically, for the upcoming megaprojects now being planned. The pillars of this movement are sustainability, diverse transportation systems and compact mixed-use areas. In addition, cultural components must be respected during development through use of modern patterns of development that emulate traditional styles as inspiration [32, 33].

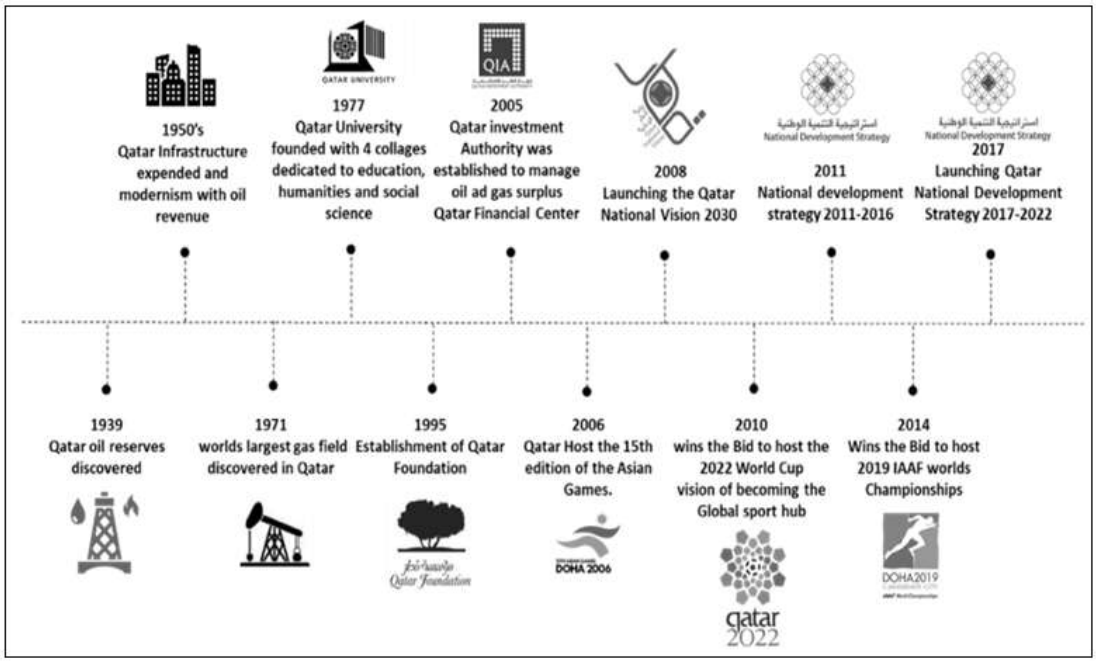

Fig-2: Qatar development timeline. Source: Uther

Qatar National Vision 2030 (QNV-2030)

Qatar is currently in an era of booming urban and infrastructural development, having experienced rapid economic growth and renovation of its built environment. At present, major urban public transit systems are under construction [34, 35]. Its capital city, Doha, has transformed from a humble midsized city into a hub of activity, featuring a signature skyline. This ongoing construction is a component of the development and promises made to welcome a global community in the years to come with infrastructure, transportation systems and urban areas continuing to see improvements and extensions as part of the 2030 vision [36]. The State of Qatar will continue its efforts to complete a series of "*megaprojects*" designed to attract global investment and tourism [37]. Qatar's constant activity, growing economy and expanding population have increased demand for new transportation systems [38] that provide safety, mobility and commercial accessibility without undue external impacts on the social, natural, and built environment. This ultimately enhances liveability and diversity.

Additionally, Qatar has established a roadmap to achieve its long-term goals and to implement its national strategies. This plan does not call for a new or independent sustainable development strategy, but rather emphasises harmony among the three pillars of sustainable development: economic, social and environmental growth [39]. As part of Qatar's urban development strategy, a framework for both long-term and short-term goals was introduced in the Qatar National Master Plan 2032. In addition, by 2026, Doha's "*megaprojects*" will be finalised, including new transportation systems and infrastructure (highways, railways, urban metro systems, public transportation services), as well as initiatives to foster active communities, such as residential and transit-oriented developments (TODs) [40, 41].

The 21st-Century New Transit System for Qatar

The Qatar Integrated Railways Program (QIRP) established the Doha Metro Project, a 300 km network intended to link all major districts to the city's international airport, port, Olympic stadium and urban villages. It will consist of four lines servicing 98 stations at ground level. This megaproject will be built in two phases. The first phase will focus on the Red, Gold and Green lines, which are due to open in 2019 with 37 stations and 75 km of revenue lines. The second phase will add 60 stations and more than 130 km of revenue lines. The establishment of these lines will revolutionise the movement of people around the city of Doha and its suburbs, while creating access to job opportunities through reliable and sustainable transport. This project will be foundational to achieving the aims of the Qatar National Vision 2030 [41, 42]. Qatar Rail's managing director, Abdulla Abdulaziz al-Subaie, stated that

> *Qatar has a low public transport share with only 0.50% travellers recorded in 2015. But by 2021, the Metro project aims to increase commuter traffic by 21% and to 24% by 2031* [43].

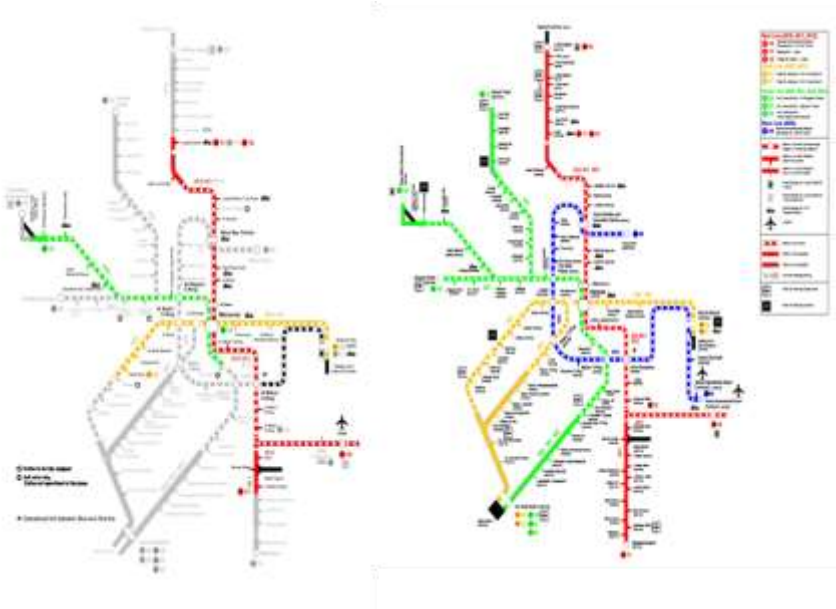

Fig-2: Qatar Metro line plan: phases 1 (left) and 2 (right)

Expectations of the 21st century public transportation systems provided by Mowasalat are high. According to Al-Subaie - CEO and the Director of Qatar Railway Company-, these systems will resolve many issues related to rapid growth, providing transportation for approximately 76% of the population in its catchment area. Furthermore, Qatar Rail expects that by 2021 travel times will have decreased by an average of 15 minutes. The Metro project will help to alleviate traffic congestion by reducing the number of cars used during rush hour by 170,000 and in so doing will also decrease carbon emissions by 110 tons per day. The Metro project is also poised to draw the interest of foreign investors, thereby boosting Qatar's global competitiveness, and creating endless real estate opportunities, particularly in communities of prime commercial significance, such as those around the West Bay, Doha Al Jadeeda, Umm Ghuwailina, Al Sadd, Bin Mahmoud and Hamad Hospital stations [44].

The Red Line, also known as the Coast Line, will run for 40 km and include 18 stations, from Lusail in the north to Al Wakra in the south. This line will connect Hamad International Airport's Terminal 1 to the city centre. The Green Line, also known as the Education Line, will run east-to-west from Al Mansoura to Al Riffa This line will comprise 11 stations, including Education City, Hamad Hospital, Al Shaqab, the upcoming Qatar National Library and Al Sadd. The underground Gold Line will run east-to-west through the core of Doha City, beginning at Airport City and continuing through Al Sharq, Doha Souq, Msheireb and Al Adhawaa before stopping at Sports City in the Aspire Zone. The execution of such a complex transit system will require thoughtful design and extensive build resources [45]. The heart of this system will be located in the city centre of Msheireb, where the main station will serve as the core for the Red, Gold and Green Lines during the first phase [41, 46].

Fig-3: Metro lines

The second phase of this project will see the construction of the Blue Line. The Falcate Line will additionally connect the newly constructed residential and commercial zones of West Bay and Airport City North along the main C-ring road [47, 48].

Transit-Oriented Developments (TODs)

Transit-oriented development is also a major solution to the serious and growing problems of climate change and global energy security by creating dense, walkable communities that greatly reduce the need for driving and energy consumption. This type of living arrangement can reduce driving by up to 85%.
–Transit-Oriented Development Institute [49].

Transit-oriented development is an approach to community expansion that includes a mixture of housing, office, commercial and other amenities connected to a walkable district and/or within approximately half a mile of a public transportation unit. Implementation of such an approach facilitates a liveable environment. These spaces are usually located within an 800m buffer area separating it from modes of public transport such as trains, metro lines, trams and buses. It is thus inherently designed to take advantage of access to public transport; assuming a walking speed of 3 mph (4.8 km/h), the spaces will be approximately 10 minutes away [50, 22].

Therefore, a successful TOD project provides the populace with transportation choices while helping to reduce congestion enhancing air quality, as well as promoting community-friendly zones prominently featuring pedestrian and cycle paths [51-53]. TOD seeks not only to achieve sustainable transport but also to give citizens the freedom to live, work, shop and relax easily. Accordingly, community development, in terms of affordable housing, can also be seen as a critical aspect of TOD [54, 55].

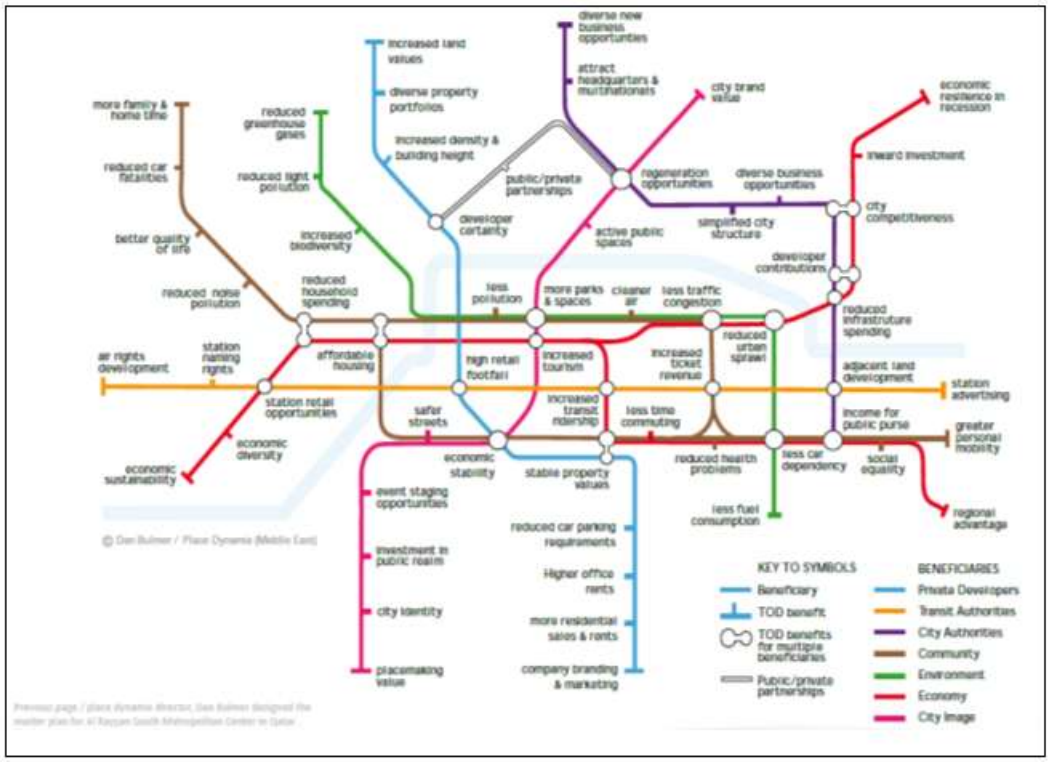

Fig-4: Advantages of TOD

When connected by streets, destinations become closer to each other, with direct routes and frequent services enhancing workers' mobility. What's more, increased uptake of public transport will boost profits, as businesses near a transit station are likely to see an increase in customer traffic [56].

TOD also makes the most of existing administrations. Public satisfaction can be increased by offering enhanced and more secure walkable paths, as well as adding trees, landscaping, lighting, parks and enticing architectural features. The aesthetics that result can reinforce a sense of community while improving quality of life. Increased transportation choices will translate into increased movement, especially for people who have a low level of income [57, 58].

Aside from developing and enhancing public transport, a walkable city is considered an important aspect that makes a city liveable. A walkable environment benefits tourists and residents alike, in terms of gaining a sense of place in the city [23, 59]. As J. B. Jackson observed, a sense of place is central to the process of development, focusing on how to enhance liveability through observations of an area's atmosphere and of the quality of its environment. This allows for the identification of a definite neighbourhood as a function of its features, providing an indefinable sense of well-being. In addition, such a sense offers a return point while promoting aspects of sustainability [60]. In short, a sense of place connects the place to the characteristic and social assets of a group and thus to the general population, with the resulting sentiment being a piece of the physical and social condition [61, 62].

According to Hummon, the sentiment that develops attachment is grounded in a group's social reaction to the highlights of an environment. The extent to which the group acknowledges the end goal of satisfying human needs will determine the importance ascribed to a particular area. A social dimension is added to spaces when people gather there.

Cultural and Sustainable Development

Culture is essential to human development, acting as the fabric individual and collective identities are made from. Dessein described multiple ways of viewing a culture's relationship with sustainability. Figure-6 relates the three rules of culture (orange) to the pillars of sustainable development (blue). From the left, culture is depicted as a fourth pillar, mediating among the three pillars, and finally creating an ever-changing culture of sustainable development [63].

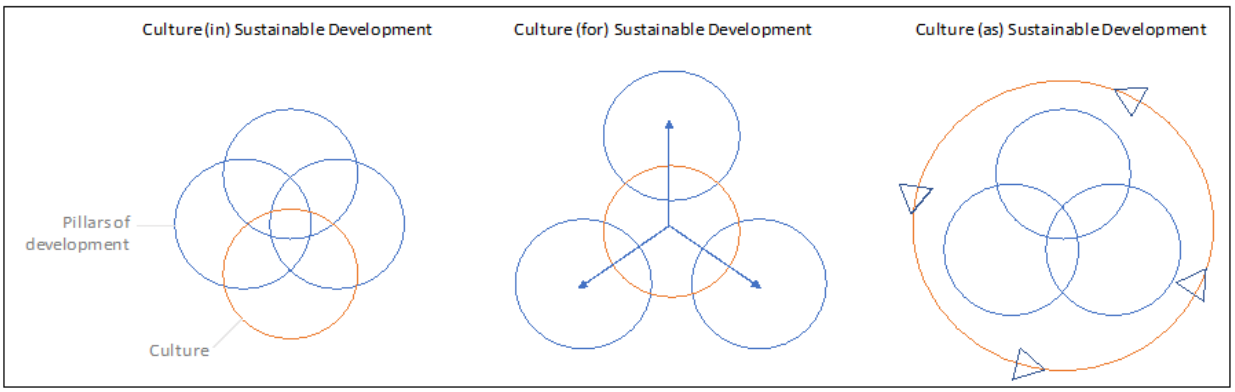

Fig-5: Culture and sustainable development: three models [63].

Identity is fundamental to the eventual fate of an area. Individuals should feel as if a piece of their surroundings reflects a part of themselves. At the urban level, the landscape should be such that it urges individuals to convey what is desired as a critical component. When considering more established urban areas as a whole, many scholars concur that the components of a city include its locale, resident's general space, the road and the square [26, 64].

Fulfilling the needs of the human group implies that fabricated conditions should be created in full awareness of the interrelationships between those conditions and cultural, social and economic assets, both locally and universally [65, 66].

A sense of place is related to attachment and reflection of cultural identity, which is lacking in many of the areas of Doha as a result of the Western approach to modernisation and globalisation. Accordingly, Doha's cultural identity has been neglected and was rarely considered. However, as part of QNV-2030, culture has become an important feature that will enhance community attachment in the city, thereby enhancing liveability and influencing urban sustainability.

Al Sadd District (Doha, State of Qatar)

This 1.351m^2 Al Sadd district lies within the Municipality of Doha, with residential blocks at its heart and mixed-use developments and institutional buildings at its periphery. It is described in more detail in the appendix titled *"The Land Use of the Al Sadd Area"*. Over the years, significant development has brought with it an influx of diverse national workforces to support the expansion process. The area's population has been dramatically increasing as a result. In 2010, Al Sadd contained 14,113 of Qatar's population. There were 6,089 housing units and 805 establishments, including Rumeilah Hospital, Centre Point, the Grand Regency Hotel, the LuLu Centre, the Royal Plaza and Sadd Plaza.

Fig-6: Al Sadd area location

Over the last few decades, urban authorities have sought to bring about a full-scale conversion of the Al Sadd urban area from basic low-rise buildings to high-rise contemporary buildings. Although population of this area consists of different nationalities and cultures attracted to the area's opportunities, the architectural features do not reflect this variety. Instead a Westernized approach was used that lacks the unique character reflective of Al Sadd. Most buildings city-wide are homogenous in style, colour and height [67, 68].

Jure Snoj estimated, based on official Ministry of Development Planning and Statistics (MDPS) informational indices, that the number of Qatari nationals was approximately 313,000 in 2016. Thus,

Qatari subjects represented 12% of Qatar's total populace in 2016. As the number of transients in Qatar continues to grow, the native populace is becoming an undeniable minority [69].

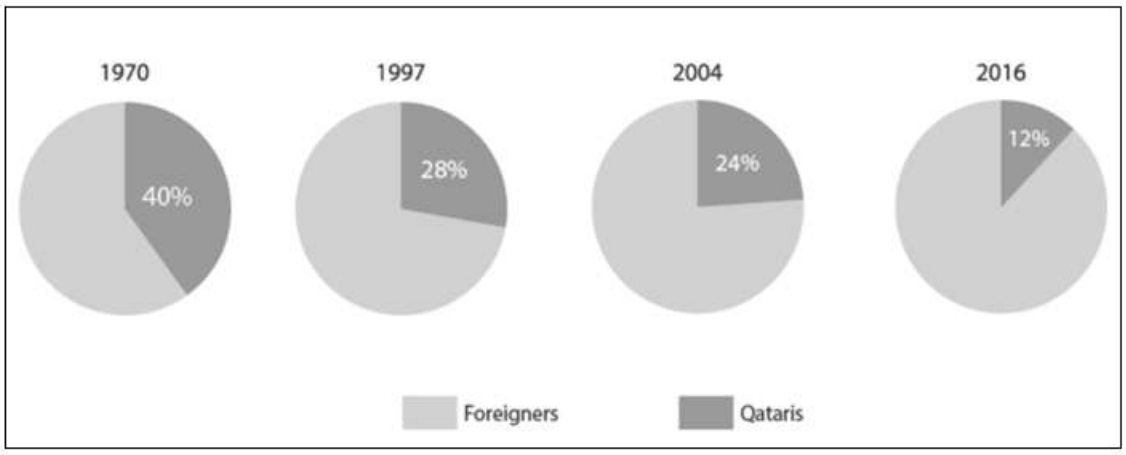

Fig-7: Population of Qatar, nationals vs. foreigners

As a result of the recent development of Qatar, many zones are occupied by the migrant working class. The Al Sadd area has become home to temporary employees (such as teachers, hotel guests, tourists and conference delegates). Thus, in virtue of the opportunities that have brought about this rapid increase in population, population density is very high compared to that seen in the remainder of Qatar. According to the Qatar Statistic Authority, in 2010, 14,113 individuals lived in a settlement; approximately 61% were male. Females represented 25% of the working populace. Additionally, 76% of inhabitants were more than 20 years old. The education rate was 97.9%. Therefore, the average inhabitant of the Al Sadd district is seeking a job opportunity in order to settle [70].

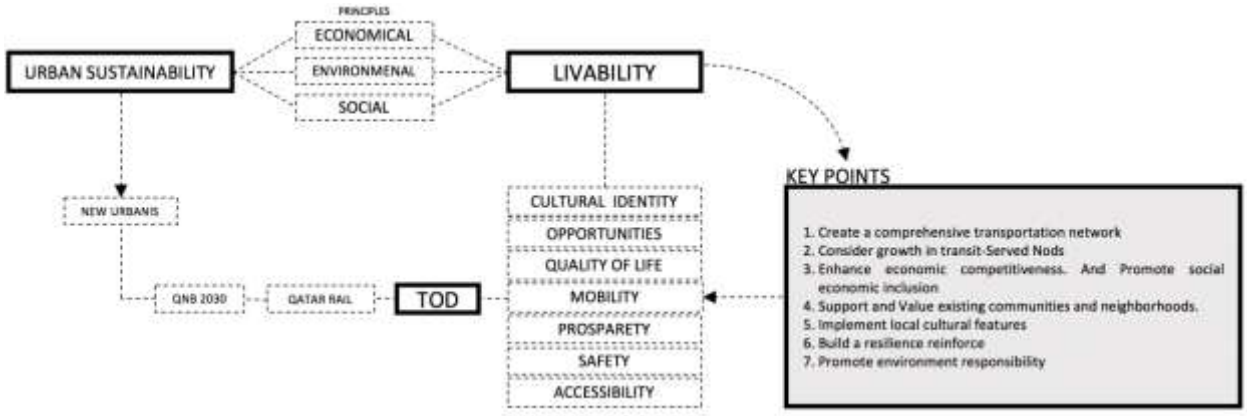

Fig-8: The conceptual framework for the development approach: The following diagram provides a conceptual framework based on specific factors derived from the literature review that can influence the conception of a comprehensive master plan for the district

The Research Design

This section presents the methods utilized to collect the relevant data for the study. As anticipated, the research study explores the Al Sadd district and its surrounding area, approximately 400m from the focal point (Figure-10).

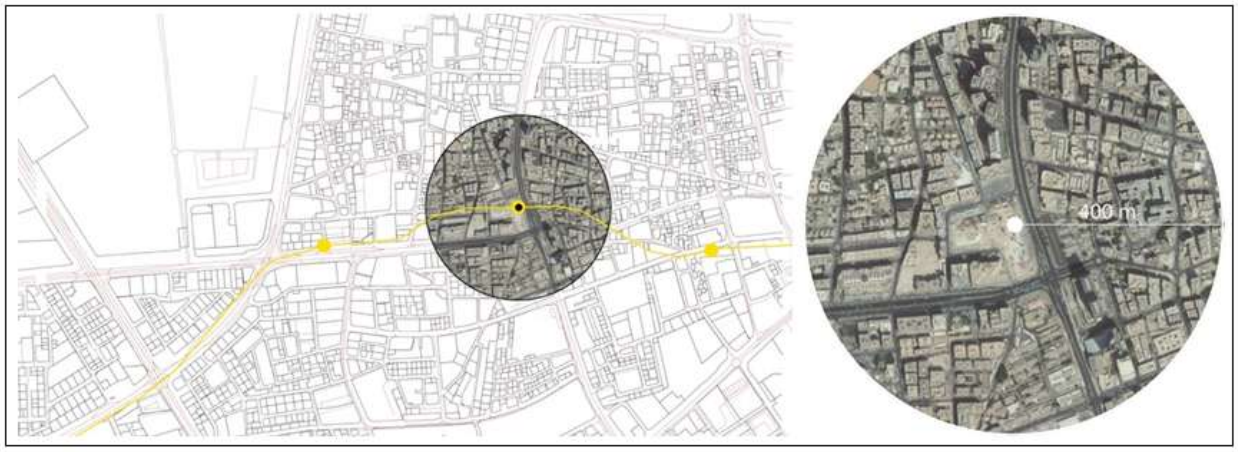

Fig-10: Al Sadd district (37) location, focus area (400m around the transit point)

Various approaches were possible for the collection of data relevant to the topic under investigation. Both primary and secondary data was collected. The former is the ideal method of conducting research, but, it is very time-consuming and expensive, while secondary data collection is low-cost and relatively convenient [71, 45]. The concurrent use of both, as Berg argues, can produce valuable results [72].

This research has a very practical application, focusing on the functionality and conservation of urban areas within the context of sustainability centring on liveability. Two key constraints must be considered: sustainable urbanism and social maintainability, both of which govern the improvement of an urban territory from a liveability standpoint. Thus, the use of both quantitative and qualitative research techniques is critical to this study [73, 74]. Accordingly, the techniques used for data collection and analysis include urban ethnography and site visits/observations, and for secondary data, a comprehensive literature review was conducted.

The observation approach employed in this research paper increased knowledge about the studied area. It allowed for an examination of the nature of social networking within a selected neighbourhood and the measurement of the presence of community within a city [75]. Observations and data collection took place over a period of several weeks, for several hours a day.

The literature review facilitated the identification of key points and thus the development of a methodological plan for obtaining the findings (Figure-11).

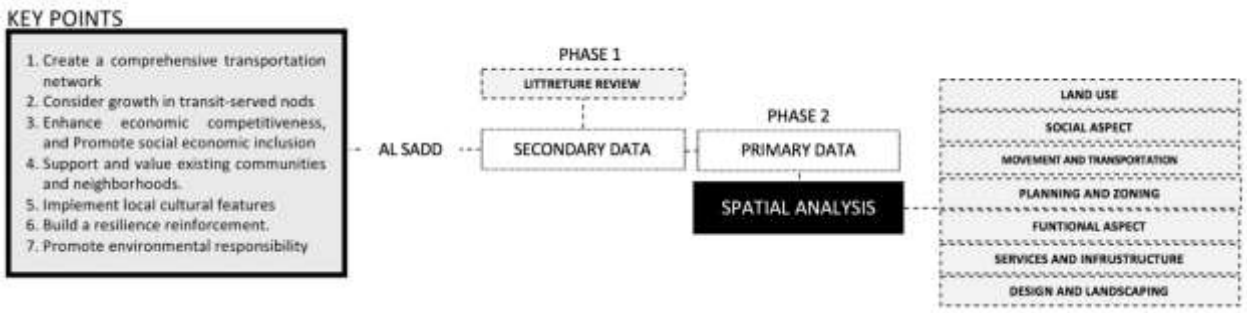

Fig-9: Research approach. Source: Author

Findings

Site Analysis

Land Use

This geographical area features different land uses that have together produced the mixed-use nature of the zone, as seen in its residential, commercial and governmental components, evident in the following figure. The area features many narrow roads and highways that are not only crowded with traffic but are also used in inappropriate way. This creates vibrant and active gathering points because of the presence of many commercial areas that must accommodate crowds. Many buildings have recently been demolished to accommodate both residents' and visitors' demands for parking space.

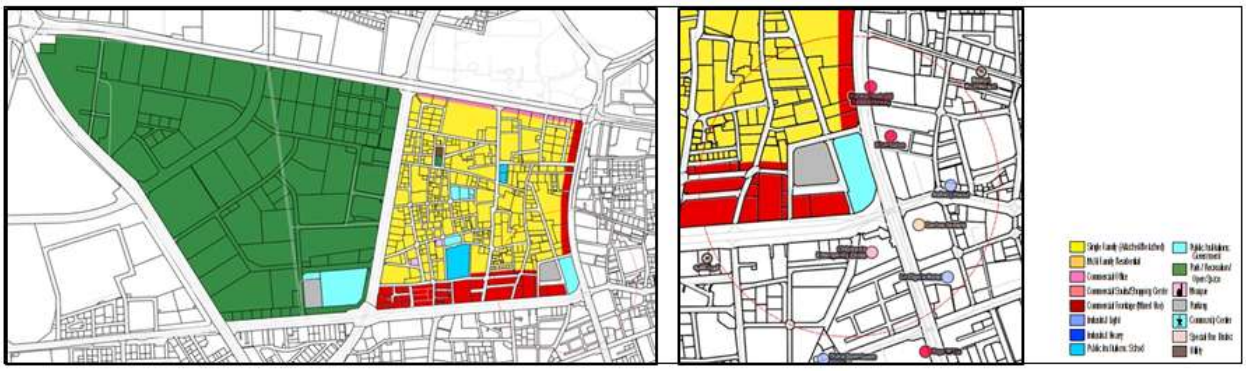

Fig-10: Al Sadd district land use

A lack of maintenance has resulted in the area being essentially neglected, and renovations are few and far between. What's more, the daily activity in the area indicates that the zone is neglected due to its increasing population exceeding the capacity of the residential areas.

Although the area to be studied is proximate to the transit point, a few landmarks must be considered in addition to the residential and commercial areas surrounding the metro station: the Paediatric Emergency Hospital, Al Sadd, QNB Shoumoukh Corporate, the parking area attached to the stadium, the commercial centre where the Blue Salon is located and the adjoining La Cigale Hotel.

Fig-11: Le Cigale Hotel

Fig-12: The Blue Salon (commercial

Fig-15: Children's Hospital

Social Groups and Way of Life

The various social groups originate from many different walks of life. Qatari locals reside in the area, amongst the migrants who form the largest component of Al Sadd's population, including Middle Eastern, Filipino, Indian, Pakistani, Nepalese and Indonesian. In recognition of this array of nationalities, announcements and other communications are made in various languages, with facilities provided for different cultural backgrounds, such as restaurants and supermarkets, as well as activities. However, amid such a concentration of residential space, activities are afforded neither the facilities nor the furniture required, and thus people can be seen occupying spaces informally. Safety considerations have made the area unsuitable for women and children, which in turn decreases the area's liveability—and, ironically, makes it a poor site for a children's hospital.

Fig-13: The Philippine Store, Al Sadd

Fig-14: Informal setting for gatherings

Services and Infrastructure

In general, streets are poorly maintained, with no measures taken to mitigate rainfall or water spillage, even in low-situated residential areas. What's more, several alarming obstacles are associated with use of infrastructure and services:

- Unpredictable and ambiguous future developments;
- Age of the existing infrastructure;
- Poor shape and layout of existing roads;

Thus, these and many associated issues are all being addressed through the construction works.

Movement and Transportation (Mobility)

While cars and buses are the leading transport methods in the Al Sadd area, the new rail projects are intended to alleviate a number of transportation issues. First, as already noted, parking areas abound to serve the large number of residents and the many commercial projects, yet the streets of Al Sadd are narrow. For the same reasons, high levels of car traffic are a daily reality. Members of low-income social groups usually depend on taxis or buses, yet taxis are not regularly seen unless called through network systems such as Uber. The metro station under construction in front of the C-ring road is intended to reduce the amount of traffic and will allow mobility without dependence on cars and buses.

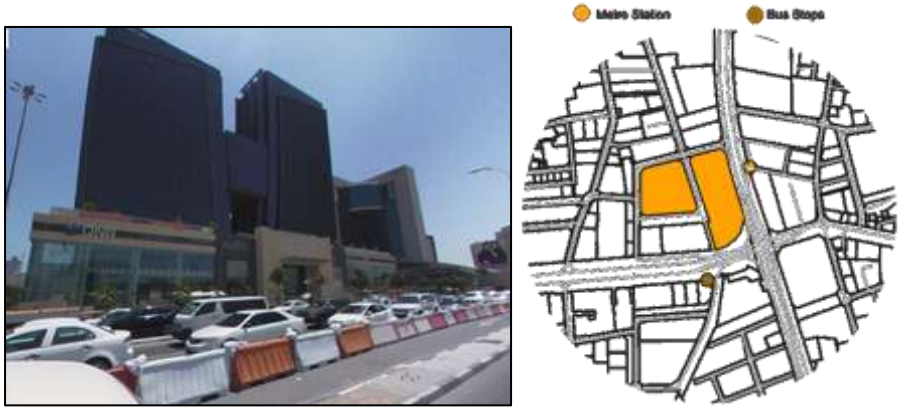

Fig-15: Traffic congestion amid construction

Within the boundaries of this study, there are two bus stops, as well as the heart of this project: the underground metro station seen in the following figure. The construction has worsened traffic congestion, including hindering bus traffic.

Landscaping

As mentioned previously, the streets lack furnishings to provide sorely needed amenities. Additionally, the combined lack of maintenance and high building density produce an unpleasant effect amid the narrow streets. Very little greenery is evident, which is an important consideration from the standpoint of liveability.

The high-rise commercial buildings in this area all have a Western design and are notably similar in appearance. Accordingly, the area lacks an identity of its own, which has caused many recent projects to focus on cultural aspects and traditional features in an attempt to develop a sense of identity.

Fig-16: Doha's high-rise commercial buildings

The presence of high-rise buildings offers one advantage: certain areas are in constant shade, encouraging movement in that vicinity.

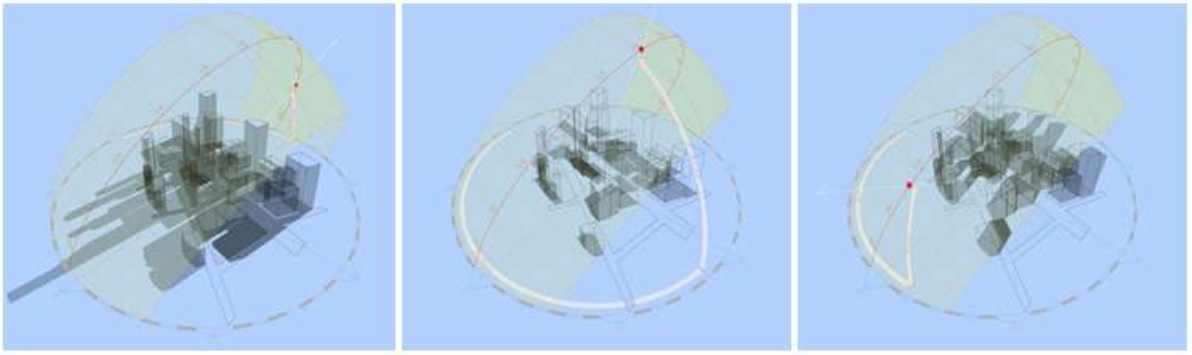

Fig-17: Constant shade caused by high-rise buildings

The Proposed Masterplan

This project seeks to transform Al Sadd into a transit -bicycle and pedestrian- oriented communal area situated in such a way so as to take maximum advantage of future commuter rail line stations. This research proposal supports the main purpose of the metro project: enhancing the transit location and promoting sustainable development through liveability.

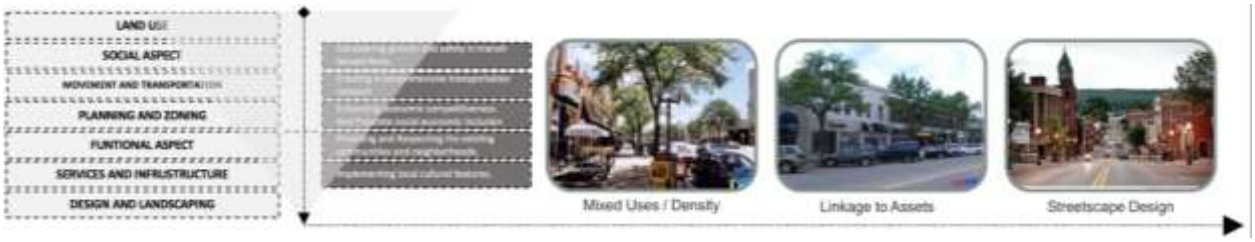

Fig-18: Design approach

Considering Growth and Safety in Transit-Served Nodes

A review of the literature reveals the burgeoning expansion in recent years, particularly of private residential zones. Accordingly, an increase in the number of building structures and the density of the lodgings is necessary inside the station centre, which should feature a dynamic ground floor outline. The movement station to the west has been refreshed with a footpath. The heart of the area brings together more than 30% of the buildings located in the residential zones, inside a blended-use progression featuring shops and organisations alongside rest areas. Sub-neighbourhoods are also situated beneath a quarter-mile walkway. Regular walkways and squares are provided throughout. These pedestrian areas are multi-story residential units that anchor each hub, in which several commercial spaces will offer additional retail shops and services.

Fig-19: Expanding the private residential zones is fundamental; increasing building structures/density lodging inside the station center

Diversions available inside a TOD site will include various public amenities such as outdoor/indoor dining, open doors for viewing and a variety of indoor amusements, including shopping and special events centring on notable individuals, sports and occasions. Every centre inside Al Sadd will be a home to some and a retail site to others, thus respecting the considerations of work as well as housing.

Creating a Comprehensive Transportation Network

The road structure depends on the creation of an arrangement of "outside rooms" as follows:

- The open-domain components of walkways, avenues and convergences as well as the private-domain components of neighbouring building dividers, windows and entryways must be user-friendly.
- Mandatory travel routes, improved laws, zoning regulations and other rules must be implemented to ensure the preservation of both the open and the private domain, thereby optimising pedestrian and bike activities.
- Areas suitable for inhabitants' and visitors' daily exercise include continuous wide walkways, narrow lanes that moderate automobile activity in the area and safe intersections that are easy for individuals of any age and physical capacity to cross.

Fig-23: Bus stops and metro station locations

Fig-24: Creating a complete transportation network

The inclusion of active edges will provide visual and physical communication between structures and the road.

- Development of structures extending to the walkway will create a constant "*road edge*", giving pedestrians and cyclists a comfortable and secure feeling of enclosure.
- The inclusion of connection points (bridges) as part of fundamental road lines will promote the use of various non-vehicular alternatives for movement by pedestrians and cyclists alike, while protecting those using crossings.
- As mentioned in the literature review, two bus stops are located within the analysed boundaries. In the proposal, the addition of bus stops is recommended to serve cyclists and pedestrians, while also acting as rest areas.

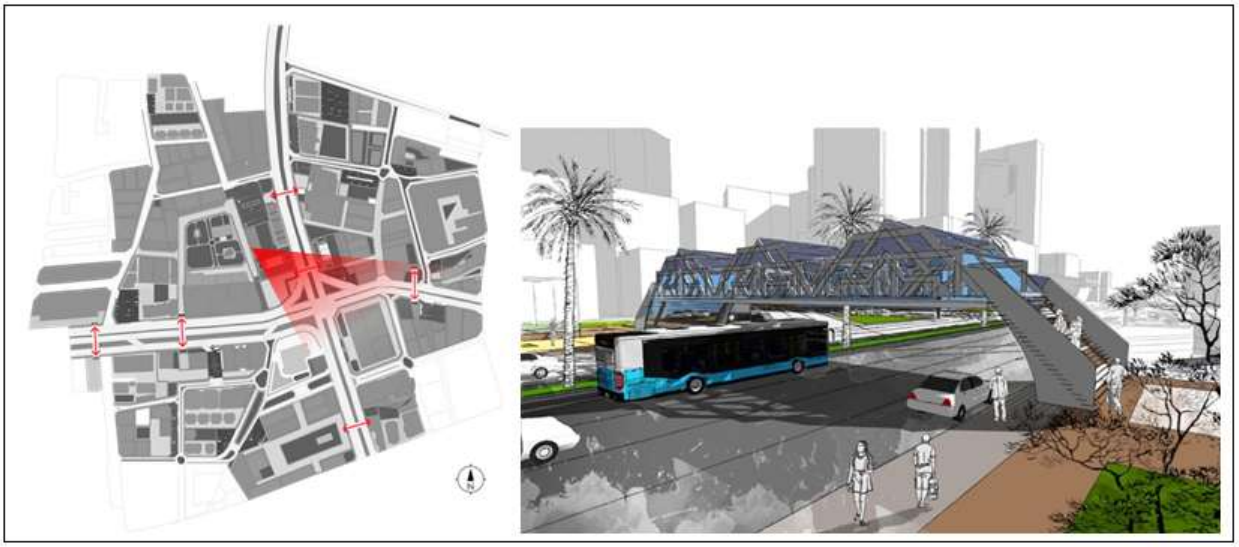

Fig-20: Pedestrian bridges

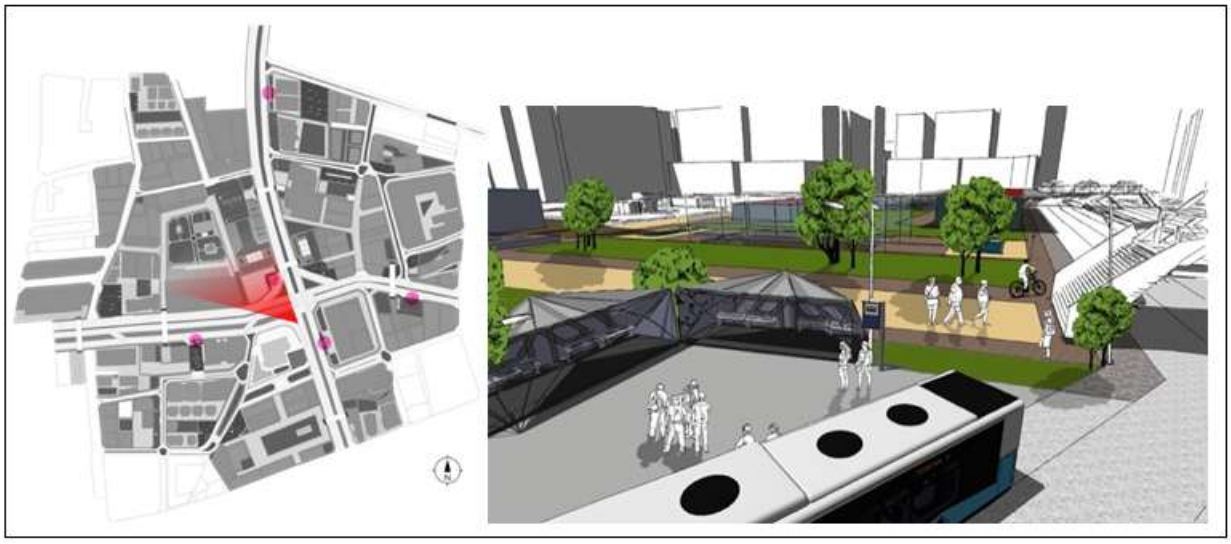

Fig-21: Bus stops

Respecting Existing Communities and Neighbourhoods

Common ground such as parks and social facilities will be located near the station. Where possible, park-and-ride offices should be disallowed. Where required, the fundamental parks will be situated within walking distance of stations, offering an inviting scene to those entering the area from the metro station. Parks should neighbour stations, offering access to shops and offices. Stop-and-ride facilities will be located at end-of-line stations to help prevent long car journeys. TOD and pedestrian access to the station should also be taken into account.

Enhancing Economic Competitiveness While Promoting Socioeconomic Inclusion

Urban Plaza

In downtown or shopping-centred TOD areas, which typically house various pedestrian pockets (both at corners and mid-block), large urban squares should be created to neighbour the station and the TOD area. These can serve as meeting spaces, offering a setting for business functions or festivities.

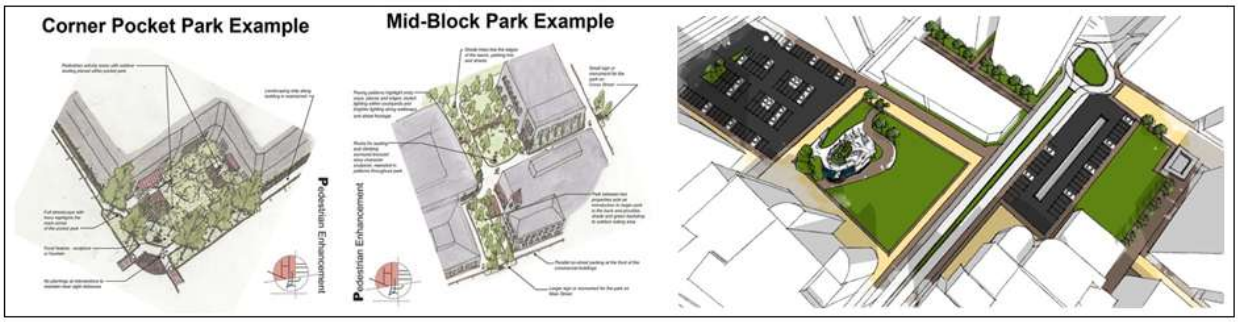

Fig-22: Urban pockets within pedestrian areas.

Employment

Including more commercial buildings around these squares will provide employment opportunities for TOD occupants and suburbanites from outside the TOD region. Businesses that have a high number of workers per hectare (medicinal, monetary, innovation and building workplaces, corporate home offices and open offices) are ideal.

Employment opportunities are best situated on high-activity roads, neighbouring other businesses, on medium-to-expansive plots. These sorts of organisations require strong brand representation if they are to succeed. They may be single-use structures or involve upper floors situated over ground-floor retail or business sites.

Fig-23: Example urban plazas

Implementing Local Cultural Features

Cultural borrowings (the use of the native forms specific to an urban setting) and the achievements of TOD, though seemingly at odds with one other, can join together to strengthen the project. One side of the railway station can be given an informal street design, with land use centring on establishments such as small cafés and community centres, and the other can be more formal, featuring contemporary workplace blocks and stores. In addition, iconic features of the locale can be reflected in many ways (as seen in the proposal) through incorporation of small elements within bridges and bus stops.

Fig-29: Design inspiration

Fig-30: Rest Stops and Bus Stations design proposal

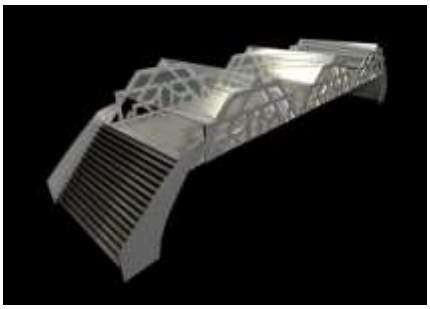

Fig-31: Bridge design proposal

Conclusion and Discussion

For the purposes of this proposal, developments will take place within the existing hubs of the Al Sadd district, which will comprise self-contained mixed-use development areas in which multi-story residential units will anchor each hub. Several commercial spaces within each hub will allow for additional retail shops and services. Each hub will centre on a public space such as a small park or an art installation and will be a home to some and a retail destination for others.

This approach to urban development can offer opportunities for employment as well as housing, creating a welcoming focal point for families and those seeking a liveable and safe environment. Overall, this study substantially improved comprehension of the advantages of TOD and the improvement of local stations. Furthermore, the revealed findings confirm the benefits associated with the redevelopment of the local Qatar transit stations. The advantages of TOD are wide-ranging and affect people of varying communities and nationalities. Rare are policies that can decidedly and simultaneously influence physical and mental prosperity, ecological wellbeing and economic power. The consolation of TOD in Qatari communities, however, allows for these developments and helps to implement changes to the areas under investigation.

Acknowledgments

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