CASE 4 GREATER THAN PARTS

Dammam, Saudi Arabia

City of Mega-Projects

Antar AbouKorin, Abdulrahman Alsayel, and Hazem Abdelfattah

WORLD BANK GROUP

Editors
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CASE STUDY 4: METROPOLITAN DAMMAM

City of Mega-Projects

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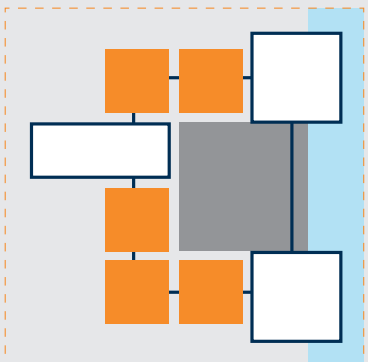

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The Synthesis Report offers a range of integrated solutions (Mehrotra 2020).

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THE SOLUTION

Decarbonizing by metropolitan densification and national diversification

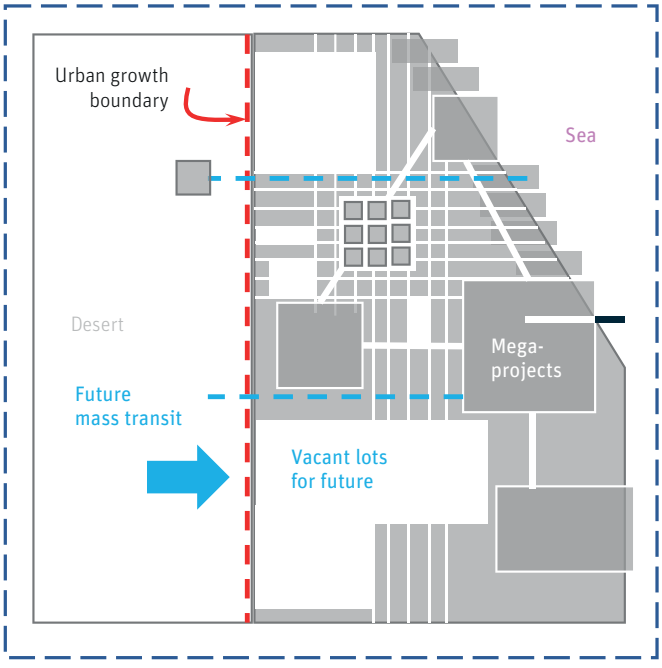


Figure 1
Integrated planning model

Source: Mehrotra 2020.

KEY FINDINGS

1 Housing projects making use of existing arterial roads have increased the spatial integration of Dammam and neighboring Khobar. Large-scale transport infrastructure projects are central to metropolitan spatial and economic integration.

2 Almost all urban infrastructure and public services are funded by central government, although there is a desire to move towards fiscal self-reliance at the municipal level.

3 Infilling between urban centers has positively contributed to the Dammam Metropolitan Area's sustainability. Increased density has reduced emissions and the rate of fossil fuel consumption, while preserving agriculture land. Urban integration promotes economic agglomeration and sharing of metropolitan-wide water and sewerage infrastructure. Plans for wider public transport coverage may advance spatial integration between housing, jobs and amenities.

IDEA IN BRIEF

In a resource-rich economy, a mosaic of federally or privately funded mega-projects—ports, housing, coastal resorts, defense, education, industrial parks—can be spatially and sectorally integrated with transport infrastructure and can decarbonize by utilizing vacant land for densification and introducing mass transit systems.

City planners in Dammam combined integrated planning with incremental implementation through a series of development plans that set growth priorities and establish future development limits, particularly in the desert context, to prevent high-carbon-intensity sprawl. Concurrent with oil-production-related rapid urban expansion, the integration process began with the identification of growth centers, like neighboring towns, and connecting them along the coast. This metropolitan integration was then scaled up to the province level, and then along the Gulf internationally, utilizing transportation infrastructure and coastal mega-development projects.

To expand global environmental benefits, Dammam has plans to introduce mass transit, and it is incentivizing urban densification to balance the competing demand for fertile agricultural land and sensitive marine ecosystems at the metropolitan level. Nationally, policymakers are decarbonizing by diversifying the economy, growing non-oil segments like cultural heritage and sustainable tourism.

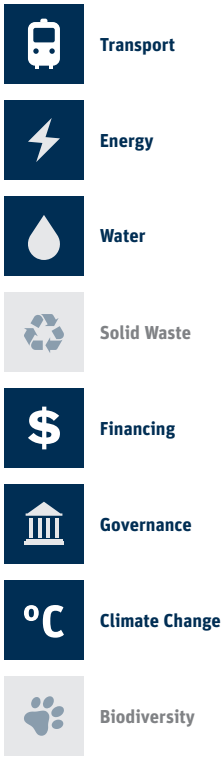


Figure 2
Sectors addressed by the case

The Metropolitan Context

BACKGROUND

THE DAMMAM METROPOLITAN AREA (DMA) is the capital of the Eastern Province of the Kingdom of Saudi Arabia. It lies at the heart of Saudi oil production and is the major gateway to the other Gulf Cooperation Council (GCC) countries. The DMA comprises Dammam, Dhahran, and al-Khobar. Although these were originally three small and quite separate fishing villages, they have expanded over the years and merged into the DMA (JLL 2014, 2016; MOMRA-KSA 2008)

The DMA is also the commercial center of the Eastern Province, which has historically been considered the economic powerhouse of the country, accounting for half of its total oil and gas reserves. Saudi Aramco, the world's largest and most valuable oil company, is based in the DMA.

From the 1960s and more markedly since the 1970s, Dammam has dramatically changed from a small, mainly rural community to a highly urbanized metropolitan area. The economic diversification of the national economy now being sought by Saudi Vision 2030 will inevitably reduce the DMA's traditional dependence on the hydrocarbon sector over time and will increase the importance of its other distinctive characteristic and its close connectivity with the surrounding GCC nations.

The population of the DMA has grown rapidly since the mid-1970s. Since 1974 it has increased sevenfold, from 263,000 inhabitants (Dammam Urban Observatory 2014) to 1.9 million as of 2019 (Dammam Urban Observatory 2019), so that it is currently the third-largest conurbation in the kingdom. The annual growth rate of the population in the DMA region between 2005 and 2015 reached 2.3 percent (General Authority for Statistics, Saudi Arabia 2017); were that rate to continue the region's population would be expected to reach 3.05 million in 2040. This would mean an increase of about 1.16 million people over the next 21 years, an increase of 62 percent over today's population. Such a huge increase in population means that about two-thirds of the current urban area, infrastructure, and services will be needed in the next 21 years. This situation increases concerns over the pressure that will be placed on existing infrastructure and services.

THREE VILLAGES

Damman's rapid urban expansion has occured primarily in the low-elevation coastal zone with a high concentration of mega-projects and critial infrastructure that may be at risk of coastal inundation due to storm surge and eventually sea-level rise.

POTENTIAL AFFECT OF 5 METER SEA LEVEL RISE

ARABIAN GULF

Ras Tanura Airport

RAS TANURA

2029 DEVELOPMENT LIMIT

SAFWA

QATIF

Trout Bay

Ras Tanura Port

1

QATIF

TAROUT

King Abdulaziz Seaport

Proposed shoreline

ANAK

SAIHAT

King Fahd International Airport

1 QATIF (2019)

2

First Industrial City

DAMMAM

2029 URBAN GROWTH BOUNDARY

GREATER DAMMAM

Dhahran (1960)

2 DAMMAM (2019)

Second Industrial City

King Abdulaziz Air Base

3

DHAHRAN

3 KHOBAR (2019)

Third Industrial City

MAP 1

URBAN EXPANSION AND SEA LEVEL RISE

1985–2015

Urban extent by year

1960 1985 1990 1995 2000 2005 2010 2015

2029 Urban growth boundary

Governorate boundary

Subdivision boundary

Primary road

SOURCES: GERMAN AEROSPACE CENTER (DLR); NASA SRTM 30m; OpenStreetMap Contributors

10 KILOMETERS

MAP PROJECTION: UTM ZONE 39N, WGS-84 DATUM

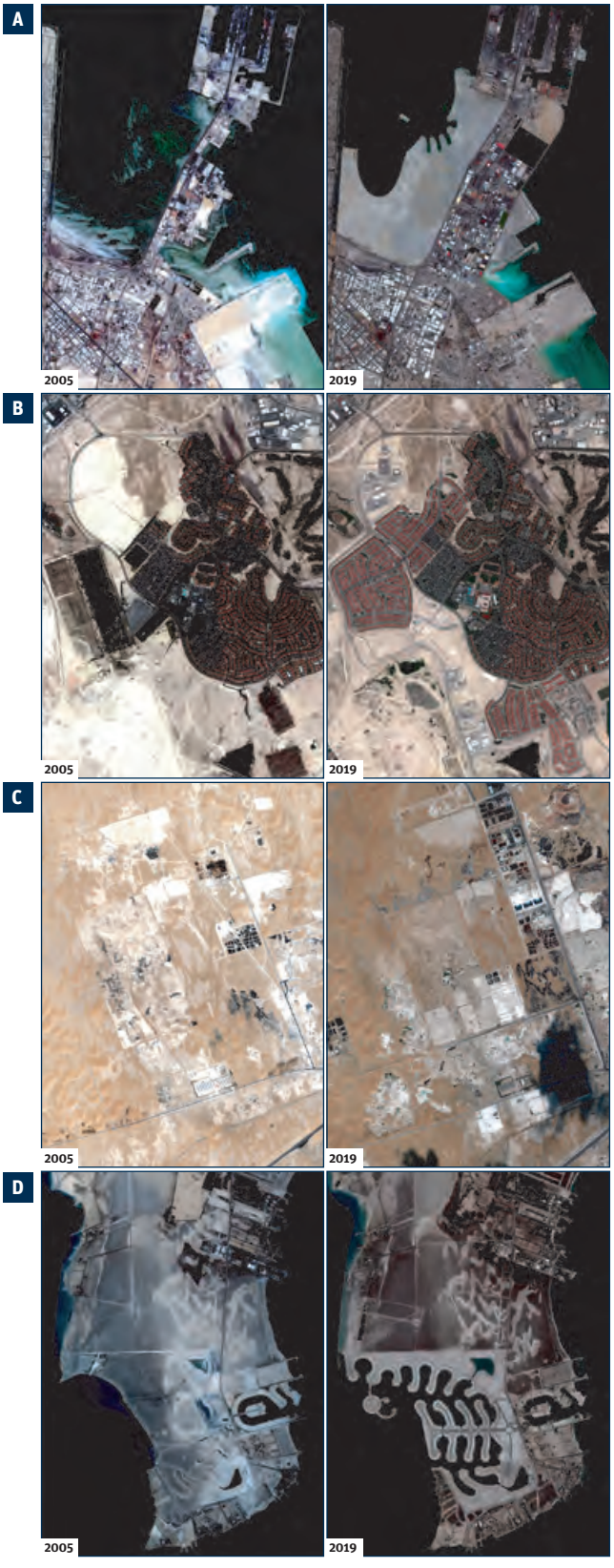


Figure 3
Then and now,
2005–2019

KING ABDULAZIZ SEAPORT

KING FAHD SUBURB

DHARAN INDUSTRIAL ACTIVITIES

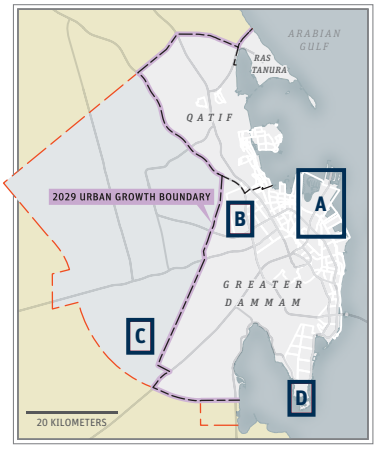
Different drivers of environmental degradation have been identified in this area. On the one hand, unsustainable growth patterns, and inadequate infrastructure are challenging future economic development and compromising existing natural resources. And on the other hand, climate change is a further burden on the environment. This growth is also enhanced by the fact that Dhahran is one of the richest regions in the world in oil and natural gas and in Dammam, there are no permanent waterways, and groundwater can be found located in water bearing rocks which are surface deep.

BEACH INFRINGEMENT SINCE 1955

- More than 485 ha of mangroves have been lost as a result of large scale beach infringement/land reclamation. The coastline is highly polluted and coastal marine life endangered.

- Beach infringement (aprox.) :14000 ha I Mangrove lost (aprox.)485 ha.

- Impacts: water stagnation, degradation of ecosystems and biodiversity threaten to local economy-fisheries, and large investments with limited positive consequences.



In terms of transportation, the DMA is highly connected at many levels—local, sub regional, regional, national, and international. Locally, connectivity and integration have continued to increase over time, with both existing and proposed road networks providing high connectivity to all parts of the region. The 2015 street connectivity study carried out by UN-Habitat concluded that street density in DMA reached values relatively close to the standard proposed by UN-Habitat's City Prosperity Initiative (UN-Habitat 2015).

On a sub-regional level, the DMA is connected to the Qatif and Ras Tanura governorates by several regional roads. Many other regional roads were proposed in the Structural Plan for Metropolitan Dammam and the Governorates of Qatif & Ras Tanura (hereafter, the Structural Plan) approved in 2008. On a regional level, the DMA is connected with the rest of the Eastern Province governorate by several regional roads, and via air transport with the governorates of Al-Ahsa (international airport) and Hafr Al-Batin (domestic airport). Railway lines—both passenger and cargo—also connect the DMA to Al-Ahsa governorate in the south. The Structural Plan proposed many other regional roads that would make DMA more integrated and connected to its region.

On the national level, the DMA is connected to the rest of the country by several national roads. The Dammam–Riyadh–Jeddah road is the country's main national road. In air transport, King Fahd International Airport connects the DMA to all the country's major cities. Passenger and cargo railway lines connect the DMA to the national capital, Riyadh. Finally, on an international level, the DMA is connected to the rest of the world in three ways: first, King Fahd International Airport connects the DMA to almost all the world's international airports; second, the GCC Road connects the DMA with all GCC countries; and third, the King Abdulaziz Seaport connects the DMA with almost all the world's ports. These mega-projects have shaped the metropolitan area. Figure 3 depicts the "then and now" situation of some large-scale infrastructure, residential, and service projects in the DMA.

From an economic point of view, the Eastern Province is the heart of the Saudi oil production and processing industry. State-owned Saudi Aramco runs the oil and gas sector, covering all stages from prospecting, exploring, and extracting to processing, refining, and finally distributing, shipping, and exporting. Consequently, the economy and physical development of the DMA is mainly dependent on the petroleum industry.

About 15 percent of the population in the entire metropolitan Dammam Metropolitan Area works for either Saudi Aramco or another petroleum-related business. The city also has a thriving manufacturing industry; by the end of 2013, the Eastern Region had 1,492 productive factories, representing about 23.4 percent of the total number in the country (6,364). The number of factory workers in the Eastern Region is about 214,000, representing around 25.8 percent of the country's total industrial manpower (MOMRA 2008).

URBAN EXPANSION AND DENSITY LOSS

Dammam's location—close to both the sea and the desert—has shaped the way the city expanded and where populations have decided to settle since its foundation. Most of the development is established in the old city centers of Dammam and al-Khobar. It is in these two urban cores where the highest densities occur: from 8,000 persons/km2 to 12,000 persons/km2 (MOMRA-KSA (2008). However, with the current rapid development, based on land speculation, occurring on the city's outskirts, the total density numbers for DMA continue decreasing.

According to the Dammam Urban Observatory, the gross population density in DMA in 2014 was only 2,171 persons/km^2, a lower density than that found in Riyadh, Jeddah, and Makkah (Dammam Urban Observatory 2019). In the same year population density in built-up areas, 5,300 persons/ km^2, was somewhat higher; nevertheless, it represents an immense drop in density since 1992, when it was 111,000 persons/km^2 (Map 2) (MOMRA-KSA 2008). Such generally low density means that there are still areas of Dammam where densities can be raised in order to accommodate more inhabitants.

Spatial expansion has been correspondingly rapid. The urban area of the DMA has increased more than tenfold over the course of the last four decades; from just 2,096 hectares in 1973, to 8,762 hectares in 1982, to 16,148 hectares in 2004. Since 2015, urban growth has continued at even a more rapid rate. (As for al-Khobar, it expanded from 5 to 291 to 3,400 hectares during the same period. (MOMRA-KSA 2008).

The growth of the DMA area was contiguous to the existing built-up area. While the initial expansion in these cities occurred along the coast, the last three decades witnessed a great deal of urban expansion through reclamation and filling of the Gulf beach, particularly in Dammam City, while expansion in al-Khobar was largely in the inland direction, as was the case in the cities of Dhahran and Al-Thuqbah, which began expanding after Dammam and al-Khobar. As for the whole DMA area, the current urban area of 20,000 hectares represents 84 percent of the total urban area included in the study area in 1423H, which makes it the main urban form prevailing over the study area.

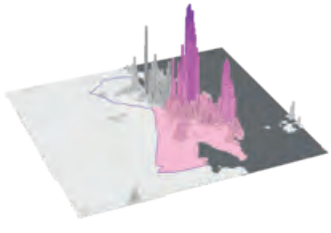


Figure 4
Population density diagram

LAND USE

The analysis of Dammam land use for the purposes of this case study, which compared existing with proposed land use plans, suggests that proposed land uses for the development of Dammam may be dangerously exacerbating some of the current problems stemming from its urban structure. Overall, the proposed land use significantly increases the percentage of land destined to become (exclusively) residential areas, expanding that category from 28 to 55 percent of the total urban area—nearly doubling it. This figure speaks to an increased urban sprawl, especially because of the spatial distribution of these new

ROOM TO GROW

Sea and desert have shaped the way Dammam expanded since the foundation of the city in 1934. Most of the development was established in the old city centers of Dammam and Al-Khobar. It is in these two urban cores where the city reaches the highest densities of more than 10,000 people per square kilometer.

1 URBAN CORE: 20,489 pp/km²

2 FIRST INDUSTRIAL CITY: 2,582

3 IN DEVELOPMENT: 228

To estimate population density, LandScan uses remote sensing imagery analysis to disaggregate census counts within an administrative boundary. As a result, built-up areas such as airports and industry may appear to have a residential population where there isn't one.

LAND AREA WHERE ELEVATION IS BELOW 5 METERS

ARABIAN GULF

Ras Tanura Airport

RAS TANURA

Ras Tanura Port

Tarout Bay

2029 DEVELOPMENT LIMIT

SAFWA

QATIF

QATIF

TAROUT

King Abdulaziz Seaport

Proposed shoreline

ANAK

SAIHAT

King Fahd International Airport

1

First Industrial City

2

DAMMAM

3

2029 URBAN GROWTH BOUNDARY

GREATER DAMMAM

Second Industrial City

King Abdulaziz Air Base

To Bahrain

DHAHRAN

KHOBAR

Half Moon Bay

Third Industrial City

MAP 2

POPULATION DENSITY 2017

Population per square kilometer

200 1,000 2,500 5,000 10,000 20,000

2029 Urban growth boundary

Governorate boundary

Subdivision boundary

Primary road

SOURCES: LANDSCAN; NASA SRTM 30m; OpenStreetMap Contributors

10 KILOMETERS

MAP PROJECTION: UTM ZONE 39N, WGS-84 DATUM

residential areas, together with exacerbating the tendency to expand the city following mono-functional area-planning (Dammam Urban Observatory 2014).

Currently, Dammam has only a very small area designated as mixed-use, representing barely 1 percent of the city's land. The proposed land use does not provide an incremental change to this figure. This lack of consistent and diffused mixed land use risks the overall socioeconomic performance of the city. According to UN-Habitat's international standards, a prosperous city has to allocate at least 40 percent of floor space for economic and commercial uses, including in residential areas. This stimulates local jobs, promotes local economic opportunities, and helps to reduce social gaps (Dammam Urban Observatory 2014).

Integration

Dammam has only a very small area designated as mixed-use, representing barely 1 percent of the city's land.

THE DMA STRUCTURAL PLAN IN THE CONTEXT OF OTHER PLANS

THE COUNTRY'S PLANNING SYSTEM, which follows a hierarchy of spatial levels and is predominantly top-down, influences the spatial system of Dammam. The National Spatial Strategy of 2001 is the guiding plan for the country as a whole. Within that overarching plan Dammam is covered by a regional and a local plan. The Strategic Urban Eastern Regional Plan of 2005 (hereafter, the Regional Plan) highlights the pivotal role that Dammam, as the regional capital, can play as the economic engine of the Eastern Province.

At the local level, the Dammam Plan identifies strategic land uses and infrastructure networks within the metropolitan area. It applies urban controls to urban land use and building regulations within the municipal boundary. The Dammam Plan has two components: a strategic component (the Structural Plan for Dammam Metropolitan Area and Governorates of Qatif & Ras Tanura, Saudi Arabia, or "DMA Structural Plan" for short) supported by a regulatory component (known as the Local Plan). The urban growth boundary aims to prevent urban sprawl in the outskirts of cities without adequate urban infrastructure, while the land subdivision plans are the basic building blocks that guide the development of Dammam.

The DMA Structural Plan identifies the strategic land uses of the Dammam Metropolitan Area and Qatif and Ras Tanura governorates and addresses the infrastructure networks serving them within the coverage of the 2028 (1450 ha) urban growth boundary. It is obvious that almost 18 percent of the land within that boundary is allocated for residential uses to accommodate the expected population. The most significant issue is having almost 25 percent of the urban area preserved for oil pipelines, creating barriers between different development areas.

In harmony with the Regional Plan, the DMA Structural Plan highlights different objectives for the different cities that compose the metropolitan area. Dammam remains the administrative and services center, with an improved future focus on strengthening recreation and tourism in the Corniche area. The current agricultural land will be maintained and preserved in Qatif, with new services for fisheries and tourism. The actual industrial pole of Ras Tanura, linked to gas and oil extraction and the refineries, will be preserved. In the south, Azizya and Half-Moon Bay will accommodate the majority of touristic services and recreational activities.

Following the vision of the Regional Plan, which proposes to minimize the primacy of Dammam City through pushing development in second-tier urban centers in the province, the DMA Structural Plan and the Local Plan both enforce the different characteristics of each urban area while reinforcing new subcenters of activity. Additionally, the vision of the Regional Plan and the general structure of Dammam's metropolitan area differ from the same proposal in the National Spatial Strategy of 2001, suggesting an axial development along the main corridors.

This strategic proposal solution of the National Spatial Strategy has also been selected in order to mitigate the population and densification process in the center of Dammam, in comparison with other metropolitan areas.

Saudi Arabia has established initiatives and projects to build smart cities, such as an e-government initiative that has been implemented in public agencies in which more than 875 e-services are provided. Additionally some cities, including Dammam, have implemented smart city systems and applications such as a data center, fiber connectivity, enterprise GIS, digital mapping, traffic control and management, and digital signage and address, among others.

Land speculation is one of the drivers of accelerated urban expansion, and it influences rising housing prices in Dammam. Land is withheld from development by developers while the demand for land for housing development is on the rise. The national government has decided to introduce a tax on vacant land to curb this phenomenon (JLL 2017).

The government recently issued the White Lands Tax Law, which imposes an annual land tax of 2.5 percent of its value on "white land," defined as vacant land located in populated areas zoned for residential or for dual residential and commercial use. The aim of this law is to increase the supply of developed land to better address housing shortages and make residential land available at reasonable prices. Furthermore, the White Lands Tax Law aims to combat monopolistic practices. The Ministry of Housing, which is the implementing authority, will implement the law in three cities in its first stage with Dammam Metropolitan Area as one of the three cities (Deloitte 2013).

The urban development vision of the DMA Structural Plan was set aiming to incorporate the DMA into the Eastern Province, the Kingdom, and the Arabian Gulf region. This vision is based on the importance of DMA not only for the Eastern Province but for the entire kingdom. Within this comprehensive framework of the DMA Structural Plan, the process of urban development for this region has two major objectives: to make the region competitive in the provision of educational and health services, not only at the level of the kingdom but at the level of the Arabian Gulf and the Middle East; and to be an advanced center for research and development, especially in the fields of energy, technology, and coastal development.

HOW INTEGRATED PLANNING IS DEFINED AND ADOPTED

Integrated planning and implementation are at the heart of the 2030 Development Agenda and the "New Urban Agenda" adopted in 2016 under Habitat III. The changes needed to adapt and apply inclusive green-economy approaches as a means for achieving sustainable development are universal and interlinked. Transitioning to more inclusive, greener economies as an approach for achieving the sustainable development goals (SDGs) will only succeed if addressed at a systemic, whole-economy, whole-society level (UNDESA 2019; PAGE 2016; UNEP 2015a). This requires moving away from the dominant fragmented style of planning and implementation and toward inclusive processes that bring together sectoral and central government agencies as well as other national stakeholders at all levels (UNEP 2015b). Integrated policy formation underpinned by inclusive stakeholder consultation and analysis of biophysical and socioeconomic systems, capacity, good governance/political will, and sustainable financing are the prerequisites for integrated planning and implementation (UNEP 2015c; German Association of Cities 2011).

In urban studies, integrated planning is widely seen as an effective approach for dealing with the complex nature of cities and as a necessary approach for creating sustainable and resilient settlements (Connective Cities 2019; Urbact 2019; GPSC 2019). Implementing such integrated urban planning is directly connected to the socioeconomic conditions, legal frameworks, technology, and professional and educational potentials of societies, which differ for each country (Milojevic 2018a, 2018b). Thus, it is necessary to constantly work on improving the adopted methodology of integrated planning, education, and the training of planners and stakeholders. Of equal importance is strengthening the institutional and socioeconomic preconditions for its implementation, particularly in rapidly urbanizing developing countries such as Saudi Arabia.

In the case of DMA, integrated urban planning is not explicitly stated as an adopted approach. However, and because of the comprehensive nature of the adopted planning approach, some of integrated planning's spatial integration objectives have been reached.

DEVELOPMENT OF SPATIAL INTEGRATION IN DMA AND AT BROADER LEVELS

The first signs of spatial integration occurring in DMA date to 1976, but such integration has become more apparent in the last three decades. Before 1976, all available maps and photos affirm that Dammam, al-Khobar, Dhahran, and Qatif were small, isolated villages without any sign of integration.

Early signs of spatial integration on the local level (1976)[1]

The main objective of these plans was to manage urban growth for the cities of Dammam, al-Khobar, and Qatif. Concerning the adoption of integrated planning, a review of these plans reveals that there was no explicit statement of "integrated planning" as an adopted planning approach but that, rather, these plans dealt with Dammam and al-Khobar as a unit and with Qatif as a separate unit. Before the 1976 study, Dammam, al-Khobar, and Qatif were separate isolated cities; the study aimed at strengthening interconnections between Dammam and al-Khobar, though it sought much less connection with the Qatif settlements, revealing that this was the earliest stage of DMA formation. Regional spatial integration between Dammam and al-Khobar, on the one hand, and Qatif, on the other, was not the main objective. Dammam and al-Khobar were planned as a joint industrial center, while the Qatif settlements were developed as small, rural, peri-urban settlements. These plans were the first to direct urban growth by land-infill into the Gulf. Although this was largely unsustainable, it fostered linear growth along the coast, connecting al-Khobar, Dammam, and Qatif.

Intensification of spatial integration on the local level (1982)[2]

The main objective of this 1982 plan was to manage urban growth in the Dammam area (CH2M Hill International and CEG 1982). Although there was no explicit statement about integrated planning as an adopted approach, this plan built on the outlook of the previous plan in looking at Dammam, al-Khobar, and Dhahran as a single entity. It also intensified development in vacant areas between these settlements and along the coast. The plan promoted integrated planning at the local level in the Dammam area but did not look at the DMA region (including the Qatif and Ras Tanura governorates). The Dammam area was then developed in isolation from the rest of the DMA region.

THE DMA STRUCTURAL PLAN, 2008

All previous spatial integration efforts took place at the local level; but spatial integration under the DMA Structural Plan occurs at sub-regional, regional,

[1] This subsection is based on Candilis-Metra International Consultants (1976).

[2] This subsection is based on CH2M Hill International and CEG (1982).

national, and even international levels.[3] The plan was the first to promote spatial integration across all levels, through a clearly stated vision. It aimed at two main objectives: first, it aimed to gain the advantages of an "agglomeration economy" by utilizing the diversified economic potentials of the different parts of the region, that is, of the coast, the oil industry, agriculture, and the desert nomadic economy; second, it aimed to benefit from the economic advantages of urban agglomeration, because a large metropolitan area is more economical, in terms of infrastructure and services provision costs, than a set of small, dispersed settlements.

At the sub-regional level

The DMA Structural Plan was the first to promote the spatial integration of DMA with Qatif and Ras Tanura governorates. Qatif and Ras Tanura governorates were included, as integral parts, in the DMA Structural Plan. The structural plan incorporated the DMA urban area into its larger region of Qatif and Ras Tanura governorates. According to this plan, urban expansion should be contiguous in all these areas.

In addition to the proposed improvement of existing roads and the proposed new roads, the DMA Structural Plan proposed a new causeway connecting DMA and Tarout Island in Qatif governorate. The plan has integrated vast hinterlands within the development limit, almost twice the size of the DMA region. New regional services have been added in these areas, including a regional park and reserved areas for regional functions, services, and utilities.

Also, this plan has added another vertical spine of spatial integration along the GCC Road and parallel to the old coastal spine. This new spine has increased spatial integration between DMA and the Qatif and Ras Tanura governorates. It has also directed urban growth to the west of the GCC Road into the desert, instead of promoting land-infill in the Arabian Gulf waters as was practiced previously.

At the regional and national levels

The DMA Structural Plan has promoted spatial integration among all governorates of the Eastern Province through upgrading the level of the GCC and Dammam–Jubail roads to improve connectivity with Eastern Province governorates in the north, and by also upgrading the level of the Dammam–Buqayq–Al-Hofuf Road and proposing a new road to Hofuf to improve connectivity with Al-Ahsa governorate in the south. Development of these three locations as commercial and business centers along the GCC Road for the provi-

[3] This subsection is based on *Structural Plan for DMA & its Region 2008*, which was prepared by AMCDE & Parsons Brinckerhoff (after 30 years of the previous plan). The 2008 plan was prepared as part of the project, Preparation of Local Plans for Dammam Metropolitan Area and Cities of Qatif & Ras Tanura Governorates.

sion of higher-level regional services is expected to improve sectoral integration of DMA on a regional level. Finally, the role of DMA has also further improved as a provider of regional services for all Eastern Province governorates.

At the national level

The DMA Structural Plan has promoted spatial integration with all other regions of the kingdom by increasing the efficiency and capacity of King Fahd International Airport as well as by increasing the efficiency and capacity of the Dammam–Al-Ahsa–Riyadh passenger and freight railway lines. New national roads connecting the DMA to Riyadh, the north governorates, Al-Ahsa, Buraydah, Al Qassim Province, and Northern Border Province have been proposed. In addition, existing regional roads connecting DMA to other regions of the Kingdom were upgraded.

King Fahd International Airport provides connections to all airports in the kingdom, which enhances DMA integration at both the national and international level. Similarly, integrating King Abdulaziz Seaport in Dammam with the cargo line has greatly integrated DMA, spatially and economically, with the country and with the outside world (SAGIA 2010).

The DMA Structural Plan was the first plan to have a clearly stated vision calling for international integration at the level of GCC countries.

At the international level

The DMA Structural Plan was the first plan to have a clearly stated vision calling for international integration at the level of Gulf Cooperation Council (GCC) countries. This vision aimed to spatially and functionally integrate DMA, as a regional development hub, with neighboring development centers in the Arabian Gulf. DMA is connected to all GCC countries, via the GCC Road and King Fahd Causeway.

DMA also has huge natural and demographic potential. The area occupied by DMA and its development hinterland together is equivalent to about half the area of Kuwait and Qatar and three times the area of Bahrain. The population of DMA and its region is about equal to the population of Kuwait and larger than the populations of Bahrain and Qatar combined.

To achieve its vision, the plan recommended that DMA should develop (i) a distinctive functional identity, and (ii) an urban identity. It aimed to achieve a distinctive functional identity by promoting the integration of regional functions, namely in regional health, commercial, educational, and recreational centers. To achieve this, the DMA Structural Plan proposed some important integration actions in the transportation and urban development sectors.

In the transportation sector, the DMA Structural Plan proposed increasing the capacity of King Fahd International Airport. This also entails upgrading the GCC Road to international status and increasing the capacity of King Fahd Causeway.

Additionally, a high-speed rail route along the GCC Road was proposed, linking the GCC countries, including the UAE and Kuwait.

In the urban development sector, the DMA Structural Plan proposed the development of the GCC Road as an international development spine. To do so, it proposed the development of three commercial and business centers along the GCC Road to house the proposed large-scale international functions: regional health, commercial, educational, and recreational services. It also proposed the development of unique touristic and recreation activities in the Azizia and Half Moon areas, which are known for their excellent environmental qualities.

TOOLS AND SECTORS INVOLVED

"Large-scale projects", projects with a service range that goes beyond the DMA to cover the GCC region, has been adopted as a strategy for achieving spatial and sectoral integration of DMA at all levels—sub-regional, regional, and national.

Large-scale residential projects. A number of large-scale residential projects emerged in the area between and around Dammam and al-Khobar during the 1980s and 1990s; these were based on the Candilis-Metra plan (1976), and increased the spatial integration of the two cities and formed the early phase of DMA emergence. Many of the projects were of a very large size. For example, the area of the King Fahd Suburb subdivision was 3,613 hectares (ha), while Al-Naseem was 3,339 ha, Subdivision no. 1156 was 2,440 ha, West Dhahran was 2,152 ha, and Al Manar was 1,020 ha, not to mention many smaller subdivisions. These large-scale residential projects pushed urban development into vacant areas between and around Dammam and al-Khobar and thus represented the early stage of spatial integration between Dammam and al-Khobar and the emergence of DMA.

The integration of the DMA at both the international and national level mainly occurred because of the following large-scale infrastructure projects built, and the subsequent development built around them.

At international level: the DMA is connected to the outside world through King Fahd International Airport, the GCC Road, the King Fahd Causeway, and the King Abdul Aziz Port. The airport, in Dammam, established in 1999, is the Kingdom's eastern air gateway. It is also considered the world's largest by land area, with 776 square kilometers of land within its zone. The annual passenger handling capacity reached 247,500 in 2018 (Saudi General Authority of Civil Aviation 2019). In 2018, this airport was selected by OAG[4] as the world's second-ranked medium-sized airport (Innovation-SA 2019). The GCC Road is an international road that connects the kingdom and DMA with all GCC countries. It connects DMA to Kuwait to the north and to Bahrain and other GCC countries to

776
km²
area of Dammam's airport—the largest by land area in the world

[4] OAG is an air travel intelligence company based in the United Kingdom.

the south through the King Fahad Causeway. The causeway, established in 1986 to connect the DMA to the Kingdom of Bahrain, is the most obvious example of the DMA's connectivity to the neighboring Gulf states. According to the King Fahad Causeway Authority, daily traffic through the causeway has reached 70,000 passengers, 28,000 cars, and 1,000 trucks (King Fahd Causeway Authority 2019). The King Abdulaziz Port in Dammam, established in 1949, is the kingdom's main port in the Arabian Gulf. The port is considered the main gateway through which cargo from all over the world reaches the Eastern and Central provinces. It also provides services for the oil industry and for all other major cities in the east and central regions of the kingdom. The port has four terminals and 42 berths, with a total annual capacity of 105.5 million tons (Saudi Ports Authority 2019).

At national level: the DMA is highly connected with other regions of the Kingdom via air, road, and rail. King Fahd International Airport connects the DMA to all airports in the Kingdom. There are three main regional roads: in the middle, the Dammam–Riyadh Road connects the DMA to Riyadh and Makkah and the western coast of the Kingdom. To the south is the Dammam–Hofuf Road, which connects the DMA to Buqayq and Hofuf in Al-Ahsa governorate. To the north, the GCC Road and Jubail road connect the DMA to the cities of Jubail, Khafji, Nairyah, Qaryat Al Ulya, Hafr Al-Batin, and the Northern Border governorate. In terms of rail, a railway line started service in 1951 between Dammam and Riyadh, and consists of both passenger and cargo lines. The passenger line connects Dammam to Riyadh via Al-Ahsa and Buqayq, and has a total length of 450 kilometers. The cargo line connects King Abdulaziz Seaport in Dammam to Riyadh via Al-Ahsa, Buqayq, and Kharj and has a total length of 570 kilometers. These two railway lines have spatially and economically integrated the DMA with the rest of the country.

In the DMA Structural Plan of 2008, various sectors of urban development were examined; these included housing, economic activities, services, and infrastructure. Because of their substantial role in the integration process, the different forms of infrastructure (energy, water, sewage, transportation, telecommunications) have been examined at the regional level and then at the local level of settlements (local plans were prepared in 2008 for DMA and cities of Qatif and Ras Tanura governorates). Infrastructure requirements have been defined at both levels.

Transportation plan. The transportation plan, prepared as part of the DMA Structural Plan, dealt with the whole region of the DMA, including neighboring cities and villages. The plan enhances the role of the GCC Road by connecting the DMA with all of the GCC. It has also added new regional roads outside localities by connecting cities with each other and with other major facilities. It establishes the role of the King Abdulaziz Seaport and Ras Tanura Port as

national ports while also providing a vision to add the first passenger port on the eastern coast. Finally, the plan also suggests new modes of public transportation for the entire region.

Integrated Regional Water Network. The water network has been planned to cover the whole region, including a national water desalination plant and a regional water line along the vertical spine of the DMA region running from the desalination plant in Azizya in the south to Ras Tanura in the north. Such network facilitates integrated coverage of water to all parts of the DMA region

Integrated Regional Sewage Network. A sewage network covers the whole region. However, because of population density, the sewage network coverage is less than the water network coverage.

There are four main parties involved in the urban development process in Saudi Arabia: civil society, the government sector, the private sector, and supporting international agencies.

Civil society. Civil society organizations define community needs, set the vision for planning as well as objectives, and engage citizen participation.

Government sector. Plan preparation, application, and monitoring are carried out by the Ministry of Municipal and Rural Affairs (MOMRA). Plan financing is handled by the Ministry of Economy and Planning. Infrastructure and housing provision are overseen by the ministries of Energy, Transport, and Housing. Service provision is overseen by the ministries of Health, Education, and Interior, among others.

Private Sector. Consultancies and contractors, as well as land developers (which may be either real-estate companies or individuals), are involved.

Supporting international agencies. Among the international agencies involved in planning in Dammam are UN-Habitat (Future Saudi Cities Program) and the World Bank.

Implementation

INSTITUTIONAL ARRANGEMENTS

ACCORDING TO THE MINISTRY OF THE INTERIOR'S administrative classification, the Eastern Province is divided into 11 governorates (6 Class A and 5 Class B), 71 Class A sub-governorates, and 36 Class B sub-governorates. Dammam, being the regional capital, is not included in this classification, but instead is governed as a municipality (*amanah*) headed by a mayor. This delineation is provided for by MOMRA, which gives Dammam the status of a Class A amanah. Given this structure, the amanah has been allocated funds by MOMRA for development

action and municipal services through an annual line-item budgeting, which is the sole fiscal means available to Dammam (UN-Habitat 2018a).

There are additional institutions in the Eastern Province that manage and regulate the development process. The Emirate (*amarah*) of the region is headed by the Regional Prince, who, pursuant to the Regional Law, reports to the Ministry of the Interior. The same law mandates the Emirate to oversee all authorities and institutions operating within the Eastern Province. This supervisory role is related to supporting citizens' welfare as well as mediating the disputes arising between two or more government agencies (Diwan 1993).

The Regional Council is based in the amarah and is required to identify the needs of the region, propose their inclusion in the National Development Plan, and identify beneficial projects for the region and propose them as activities requiring funding from MOMRA.

The Municipal Council is also located in the amarah, with two-thirds of its members elected by citizens' votes and the rest appointed by the Minister of the Interior. This council supervises the activities of the amarah and municipalities to make sure they conform to the Regional Plan and meet the current needs of the region. It approves the municipal budget, which is sourced from cash allocations from the national government. The Municipal Council also examines residential planning, focusing on whether any procedural violations have occurred, and on the scope of municipal services. Furthermore, expropriation projects are based on the mayor's priorities, and the budget is constantly revised to respond to those set priorities by the mayor for the Municipal Council.[5]

The High Commission for the Development of the Eastern Region was established in 2015 to contribute to the comprehensive development of the region.[6] The same law establishes a council composed of 14 members that should, among other things, draw up general policies for projects within the region and follow up their implementation in coordination with the Regional Council and the amanah.

INSTITUTIONAL ARCHITECTURE

The planning system of Dammam is derived from the de facto planning hierarchy of the kingdom. In other words, the system of spatial planning in the country does not exist by legal right but rather through established practice. In this framework, there are four different levels of spatial plans: national, regional, local, and district.

Regional planning represents the second tier of spatial planning in the country, which aims to address the natural, urban, social, and economic regional development aspects. The Strategic Urban Eastern Regional Plan of 2005 was prepared and approved by the Regional Council for the Eastern Region. This

5 Ministerial Resolution No. 66866 2005

6 Resolution of the Council of Ministers No. 64 of 2015.

plan aimed to take advantage of the region's strategic location at the Arabian Gulf as a link between the kingdom and the other states in the Gulf Cooperation Council, as well as Southeast Asian countries. It also aimed to enhance the contribution of the region's non-petroleum resources to national development to achieve balanced growth. The plan concentrated on ways to promote the expansion of projects in diverse industries, particularly those dependent on the region's non-petroleum resources.

At the *local planning level*, enhancing the participation of the private sector in providing education and training across the region was a major aim of the Dammam Local Plan, approved in 2006 by the amanah. This local plan also addresses the developmental concentration on the coastal strip to achieve more balanced urban development in the region. Moreover, the plan aimed to support a more balanced pattern of cities in the region.

The development of the Dammam Local Plan is complicated, as there are parallel structures set up by MOMRA and the Ministry of the Interior. While the legal mandate for planning clearly lies in the municipalities (under MOMRA), there are jurisdictional overlaps with the *mohafezat* (subregional governorates) and *markaz* (districts), which are set up under the Ministry of the Interior. In other words, the Ministry of the Interior is the oversight entity for regional project implementation, while MOMRA is the central spatial planning institution; but there is no clear coordination mechanism. This frequently leads to decision-making impasses that affect the delivery of technical standards within municipalities such as Dammam.

The Dammam Local Plan has no real mixed land-use strategy, even though such characteristics are still present in a few parts of the city, for example in the city center. However, the plan does not spread commercial activities across the urban tissue; instead, it proposes mixed uses along the main roads to preserve privacy in residential areas. This is one of the factors that engender car dependency and poor-quality public spaces. The plan is obsolete, not reflecting current urban dynamics, and it also includes massive expansion areas (between city footprint and urban boundary), which encourage urban sprawl.

SUSTAINABILITY

Although currently, to some extent, sustainable, Dammam can set itself on the right track toward a more sustainable urban development model, as there are potential solutions embedded in the challenges themselves. The DMA Structural Plan proposed four strategies for a sustainable development in DMA. These strategies are aligned with the visions and goals of the New Urban Agenda and achieving the three dimensions of sustainability, as per UN recommendations:

- *Social sustainability:* Securing social equity in the distribution of wealth and social services;

- *Economic sustainability*: Keeping stable economic growth while restructuring the productive system in order to save resources and energy; and
- *Environmental sustainability:* Maintaining safe and comfortable living environments through lower emissions and opting for ecological restoration and complex socioecological infrastructure that can devise basic services innovatively.

Achieving this in Dammam will require a strong political will coupled with a pragmatic approach to Dammam's socioeconomic and spatial restructuring. It will mean shaping new sustainable consumption/production patterns that can foster an enabling environment for the generation of both business innovation and basic livelihoods, while promoting, in parallel, inclusive urban economies and sustainable industrial development as well as resource-efficient and resilient infrastructure. To enact this vision, which aims to trigger an incremental but radical urban transformation, it is necessary to translate the four conceptual recommendations into a logical and scaffolded system of actions that sets clear priorities and builds on endogenous potential and competitive advantages.

A sustainable city is one where social, ecological, and economic systems are well balanced and mutually supportive of each other. In addition, ecological resources and the preservation of ecosystems become central in any development strategy guiding urban transformations. In Dammam, the different actions proposed in the structural and local plans, along the coastline and on the vacant land, will contribute in many ways to the city's journey toward sustainable development, as this will reinforce the natural coastal ecosystems and link Dammam with new green infrastructure. Building for coastal resilience will be required as future impacts from climate change, such as rising sea levels, will continue and mitigation strategies will be necessary.

A sustainable city is one where social, ecological, and economic systems are well balanced and mutually supportive of each other. In addition, ecological resources and the preservation of ecosystems become central in any development strategy guiding urban transformations.

Establishing a positive relationship with natural resources will translate into new economies. For instance, having a healthy coastal ecosystem will be reflected in sustaining fisheries, triggering an increase in local income for coastal communities by providing more economic activities (Colliers International 2012). Additionally, with more tourists visiting the natural areas and reserves proposed on the coast, the local communities will benefit with new employment opportunities. Lastly, the protection of biodiversity, and in particular the protection and increase of mangrove forests and the creation of a buffering, renaturalized urban waterfront, will contribute to the prevention of floods and associated risks, protecting the city from tidal surges, storms, and waves while naturally controlling the regulation of the water quality and sediments.

PRIVATE PARTICIPATION

Under the current centralized system, the central government funds most of the urban infrastructure and public services, with municipal governments playing

Metropolitan Dammam has historically focused investment along the coast. Large infrastructure projects have shifted the center of gravity inland, connecting a fragmented region into a more coherent agglomeration.

Credit: iStock.com/ AFZALKHAN M.

a minor role. Despite the concerted effort to improve fiscal health envisioned in the National Transformation Program 2020 (NTP 2020), fiscal self-sustainability at the municipal level will remain a challenge in the context of rising urban populations and unplanned urban development and expansion (Almalki, Fitzgerald, and Clark 2011).

The private sector also plays a vital role in Dammam's land development projects. For instance, the Saudi Arabian Oil Company (Aramco), while functionally independent from the Ministry of Energy, Industry and Mineral Resources, is directly overseen by the highest levels of government; the Ministers of Energy, Finance, Communication, and Information Technology are on the Board (Gately, Al-Yousef, and Al-Sheikh 2013; Shearman and Sterling 2016). Such large corporations have been criticized for contributing to indiscriminate land development, the rising cost of housing, speculative land markets, and urban sprawl due to their own construction and land-filling activities along ecologically sensitive areas and areas beyond the urban limit.

The transfer of local planning power, authority, and function from MOMRA to the amanah with provision for independent action has left cities without recourse to effectively address community needs. This is supported by the New Urban Agenda, which specifies that territorial urban design and planning processes should be led by subnational and local governments, while their implementation will require coordination with all spheres of government as well as the participation of civil society, the public sector, and other relevant stakeholders (UN-Habitat 2017). The legal framework also needs to preserve an acceptable mode of public participation in public decision making, to foster equality and inclusion. The consolidation of the urban legislation would also give legitimacy to the plans that Dammam relies on (UN-Habitat, DAMMAM City Profile 2018b).

TYPES OF SOLUTIONS AND PHASING

DMA Structural Plan

The DMA Structural Plan, which aims to identify key spatial structures as those provided for in the Eastern Province Strategic Plan of 2005, was prepared by the amanah. In line with the Eastern Province Strategic Plan of 2005, it highlights different objectives for the different cities located within the metropolitan area. For instance, the city of Dammam remains the administrative and services center, with an improved future focus on strengthening tourism in the Corniche area. However, this DMA Structural Plan differs from the National Spatial Strategy in proposing axial development along main corridors (Dammam–Dhahran–Khobar). In terms of land use, it identifies strategic land uses and

infrastructure networks within the metropolitan area of the 2028 Urban Growth Boundary (UGB) (Alhowaish 2015).

Within this growth boundary, 18 percent of land is allocated for residential use, whereas 25 percent is preserved for oil pipelines. The area allocated for residential purposes could contain double the projected population, because the plan promotes a low-density residential typology. Moreover, the areas now preserved in the DMA Structural Plan as buffers for oil and gas pipelines should in fact be used instead for a green network of open spaces that connect to a hierarchy of parks (city-district-neighborhood), with a link to the waterfront recreational strip. This plan does not promote a clear mixed-land-use strategy, as it encourages a "mono" land-use typology instead. Mixed land use (from commercial to residential) is only proposed along the major corridors. The plan also engenders incompatible building forms by introducing industrial land pockets in the urban cluster.

Dammam Local Plan

The Dammam Local Plan, which represents the other component of the Dammam Plan alongside the DMA Structural Plan, represents the third level of the urban planning system in the kingdom, and is largely focused on those areas of a municipality which are contained within the urban growth boundary with a special focus on housing. The Local Plan contains the Urban Atlas, which details the allowed land uses for every part of the city. It is complemented by a regulations report, which contains specifications on the permissible development rights, such as floor area ratio, street dynamics, building heights, and areas of special building regulations, and so on. The aims of the Local Plan are fourfold:

- To apply urban controls to urban land use and building regulations;
- To provide public services and infrastructure in a cost-effective and integrated manner;
- To set basic requirements for proposed road networks; and
- To help facilitate the development of public- and private-sector housing.

There is no legal framework, per se, to direct the plan's preparation and implementation. Rather, the plan is prepared by various consultants following the *Booklet of the Terms of Reference for the Preparation of the Local Plan*, which was formulated by MOMRA. This booklet was updated in 2015, and one key technical change made in that update is the requirement that the lifespan of new plans should be 14 years (for example, 2015–2029) (MOMRA 2005).

Like the DMA Structural Plan, the Dammam Local Plan has no real mixed land-use strategy, even though such characteristics are still present in a few parts of the city, for example in the city center. However, the Local Plan does

not spread commercial activities along the urban tissue, and mixed uses are proposed along main roads to preserve privacy in residential areas. Preserving residential privacy, however, is one of the factors that engender car dependency and poor-quality public spaces. Not only is the plan obsolete and failing to reflect current urban dynamics, it also includes massive expansion areas (between city footprint and urban boundary), which encourage urban sprawl (Aboukorin and Al-Shihri 2015).

Urban growth boundary

The urban growth boundary for Dammam, along with the growth boundary for other cities, was set simultaneously by MOMRA through a committee under the Unit of Coordination and Projects. The composition of the committee is not clear but, for instance, it did not involve the municipality of Eastern Province, which is responsible for planning at the city level. There is an understanding that the calculations for determining these boundaries for Dammam were based on factors such as historical growth and expected population growth in the city; however, there are no accurate published criteria on how the size of the boundary was calculated. Spatially, the committee was not guided by existing infrastructure and services, as the boundary was set symmetrically so that "all sides of the city" could benefit.

Although the growth boundary regulations set very clear rules for development not to occur outside the boundaries, there are some exceptions, such as housing projects, that undermine the effectiveness of the law. For example, in Dammam, there is evidence to suggest that the city has expanded outside the urban growth boundary (in locations between Dammam, Buqayq, and Al-Ahsa). This has caused socioecological and economic imbalance (incompatible land uses and land speculation), as well as unbalanced growth and development patterns (sprawl). The disparity between the size of the boundary and the actual demographic dynamics of Dammam, based on the committee's calculations, undermines the aim of densification. Consequently, based on current population growth projections, the 2030 density will be 642 persons per square kilometer, which is well below any recommended target, including UN-Habitat's recommendation of 15,000 persons per square kilometer.

RISK MANAGEMENT

Shifting the current growth trends so that they incorporate natural features, and incorporating ecosystems dynamics into the planning processes, are both paramount to making better use of existing resources and preventing pollution. Current patterns, however, are harming renewable water resources per capita, which are dropping at an annual rate of 2 percent. In Dammam City, although no

permanent water bodies exist, integrating the various water streams that enter the urban realm would have the potential to replenish water into the aquifers.

By contrast, the urban area has been waterproofed through impermeable surfaces and canalizations that have the effect of directing the water *out of* the city. In this process, water is usually polluted, having a negative impact on the soil and on the sea it flows into. This lack—and misuse—of water prevents green infrastructure growth, such as parks, tree canopies, and green plazas. In the Eastern Province, overgrazing has reduced vegetation cover to such an extent that previously stable fossil dunes have once again become active, having a negative effect on sand balance, and increasing sandstorms towards the Dammam area.

Another potential input increasing the sustainability of public spaces concerns the reuse of gray water from residential consumption. It is important to note that around 28 percent of Dammam (including al-Khobar, Qatif, and Seihat) rely on septic tanks, so disposal is a significant source of environmental pollution. Decentralizing water treatment and recycling at the neighborhood level could help to reduce water consumption, while supporting the creation of consistent green networks across the city.

The rise in sea level due to climate change is a major threat to both natural and urban assets along the coast. Sea-level-rise modelling, particularly for Dammam, was developed for scenarios of 0 to 2 meters, in order to have a rough estimation of affected areas. Under these scenarios, large coastline areas were identified as vulnerable to sea-level rise, dangerously impacting the national and local economy. Likewise, key infrastructure such as ports, airports, and trains are at risk, affecting the flow of products and people, while reclaimed areas are also highly exposed. Therefore, major efforts need to be deployed to develop mitigation strategies along the coastline that will reduce their exposure and vulnerability.

Through reclamation of land toward the Arabian Gulf, development is severely polluting coastal ecosystems. Since 1955, approximately 14,000 hectares of coastal land have been encroached on through backfill operations, leading to water stagnation and threatening marine wildlife (Our World in Data 2017). This also directly harms the local economy, as fisheries are being damaged due to the reduction of catchment areas. New patterns of development directed *inland* are highly recommended to protect from sea-level rise and to stop polluting the natural ecosystems that support not only fisheries but also tourism (Huber et al. 2017).

In addition, there is an urgent need to implement rehabilitation strategies in affected areas through adopting effective environmental protection measures, such as adequate land use planning. However, policy frameworks need to

28%

Dammam residents rely on septic tanks—disposal being a significant source of environmental pollution

be strengthened to promote the preservation and regeneration of the coast. Working on strengthening an appropriate legal framework, and the means for its implementation, is key.

GLOBAL ENVIRONMENTAL BENEFITS OUTCOMES AND SCALE-UP

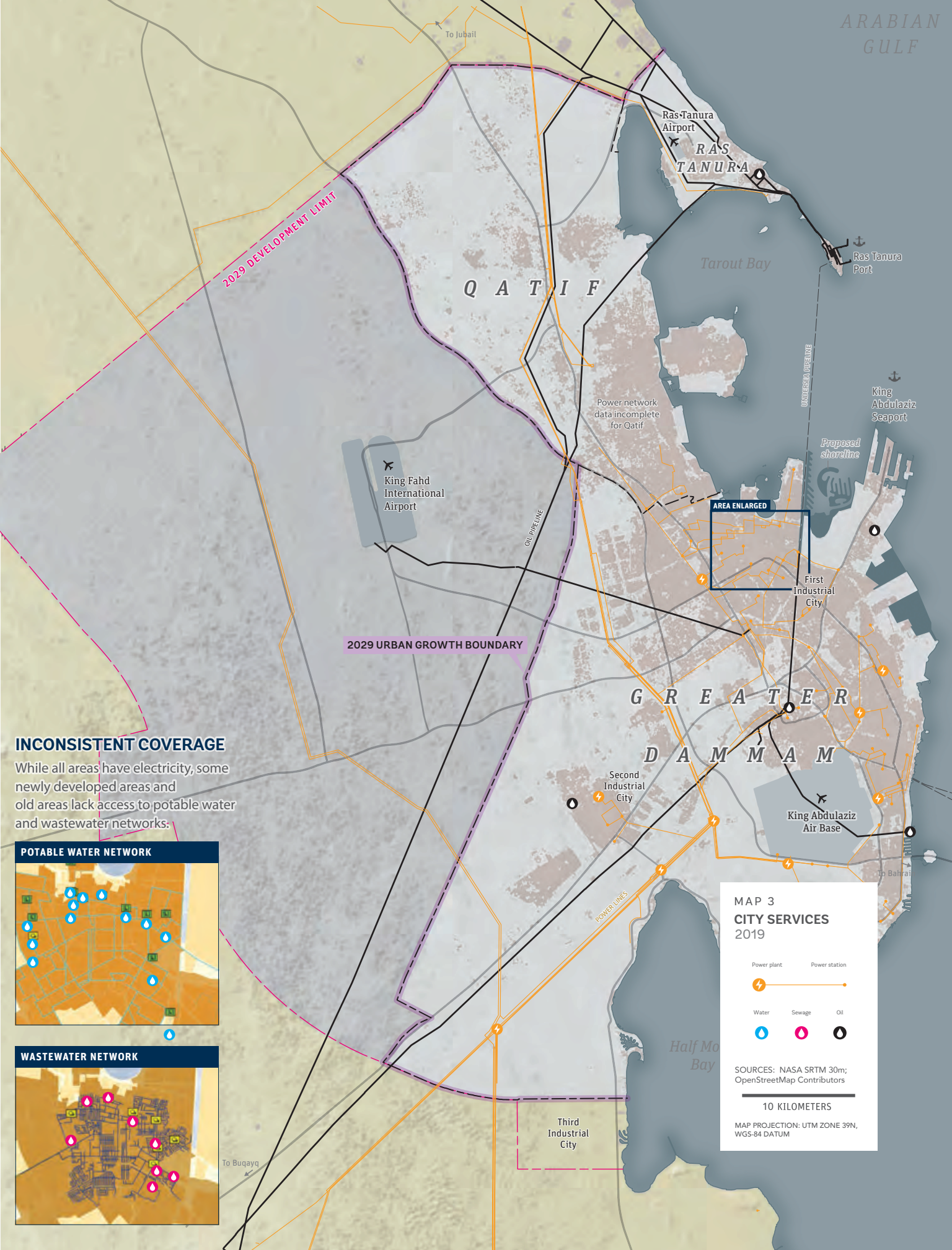
Environmental concerns are taking center stage in Saudi Arabia. The kingdom has made remarkable progress in strengthening sustainability in pursuit of Vision 2030 and targets in the National Transformation Program 2020 (NTP 2020; Saudi Government 2018). However, the environmental challenges remain persistent due to institutional policies that for decades have encouraged increased domestic consumption across sectors such as oil. The prevailing development patterns, characterized by the undermining of sustainability, have driven society toward excessive increases in production and consumption, causing the depletion of natural resources and adversely affecting the socioeconomic environment. For Dammam, all the environmental issues described in both the structural and local planning documents are highly relevant, including the problems of encroachment on agricultural land, the overdevelopment along the coast, and the environmental impact of land reclamation, as well as urban expansion in low-elevation coastal zones that are five meters or more below mean sea level, shown in Map 1.

The kingdom has made remarkable progress in strengthening sustainability in pursuit of Vision 2030 and targets in the National Transformation Program 2020.

The proposals within the DMA Structural Plan are for the most part in line with the problem analysis concerning preserving agricultural land in the Qatif area, protecting coastland, and suggesting new policies for the improvement of sewerage systems and utilities for new developments. They also suggest the possibility (although without enough detail) of building a green corridor linking different protected areas, including agricultural land, beaches, and marshes. The proposals also suggest that an inventory be made of the existing natural and environmental resources, which when linked with new environmental regulations could better protect these specific areas.

Furthermore, in the proposed land use plan within the DMA Structural Plan the land designated as “environmental areas” is dramatically reduced, from 19 percent to just 2 percent of the total area of the city. Failing to preserve more land as an ecological buffer to the current natural assets and failing to limit development in ecologically sensitive areas will have severe consequences for water quality, air pollution, the urban heat island effect, and coastal degradation (Ouda 2013).

Nevertheless, for the DMA, an integrated cross-sectoral approach to planning and implementation would be an appropriate approach for achieving the SDGs and for transitioning to more inclusive, greener economies,


ARABIAN GULF
To Jubail
Ras Tanura Airport
RAS TANURA
Ras Tanura Port
Tarout Bay
2029 DEVELOPMENT LIMIT
QATIF
UNDERSEA PIPELINE
King Abdulaziz Seaport
Power network data incomplete for Qatif
Proposed shoreline
King Fahd International Airport
OIL PIPELINE
AREA ENLARGED
First Industrial City
2029 URBAN GROWTH BOUNDARY
GREATER DAMMAM
Second Industrial City
King Abdulaziz Air Base
To Bahrain
POWER LINES
Half Moon Bay
Third Industrial City
To Buqayq
INCONSISTENT COVERAGE
While all areas have electricity, some newly developed areas and old areas lack access to potable water and wastewater networks.
POTABLE WATER NETWORK
WASTEWATER NETWORK
MAP 3
CITY SERVICES
2019
Power plant
Power station
Water
Sewage
Oil
SOURCES: NASA SRTM 30m; OpenStreetMap Contributors
10 KILOMETERS
MAP PROJECTION: UTM ZONE 39N, WGS-84 DATUM

reflecting the environmental, social, and economic dimensions of sustainable development and their complex interrelationships and trade-offs. This approach would be effective in addressing inequalities through applying a multi-actor and shared social responsibility approach (UNDESA and UNDP 2012; UNDESA 2015). It also would help in moving away from the dominant fragmented approach to planning and implementation. Integrated policy formation underpinned by inclusive stakeholder consultation and analysis of biophysical and socioeconomic systems, capacity, good governance/political will, and sustainable financing are pre-requirements for integrated planning and implementation. (PAGE 2016)

In the case of the DMA, the integrated planning approach has had many positive impacts. Integrated planning promoted more economic urban development, utilizing the main road connecting Dammam and al-Khobar and the infrastructure lines running along these roads. It effectively utilized the locational advantages of the areas between Dammam and al-Khobar, which, being very close to the coast of the Arabian Gulf, offer better accessibility compared to other locations. Developing areas along the main road connecting Dammam and al-Khobar made accessibility to existing services possible; thus, the need for immediate services was not acute. This accessibility resulted in less urban sprawl than would have occurred had urban development been directed to the vast areas to the west. Thus, spatial integration in the DMA has positively contributed to the area's sustainability in terms of increasing density and minimizing the rate of fossil fuel consumption and CO_2 emissions.

As part of all of this, the urban integration of Dammam and al-Khobar has also led to several positive outcomes, including the emergence of a large metropolitan DMA that has been shown to be more economically efficient, in terms of infrastructure and services provision costs, than small isolated settlements. Another outcome is the emergence and the economic functioning of high-level services such as universities, specialized hospitals, and commercial and recreational services. The integration has also led to the establishment of a fully equipped urban planning unit and the emergence of the Municipal Council for overseeing civil society's needs and aspirations in urban development plans. Additionally, the integration has also led to the development of major national infrastructure facilities such as King Fahd International Airport, the Dammam–Riyadh railway, and the King Fahd Causeway. The combined integration of the regions of Qatif and Ras Tanura has established the DMA as a growth pole on the eastern coast of the Kingdom, transmitting development to all areas of the Eastern Province.

In the case of the DMA, there has been significant progress in laying the foundations for a transition to integrated planning for sustainable

development. Significant components of the enabling policy and regulatory framework have been established. There is also evidence of the DMA moving beyond high-level national visions and strategies to the development of mechanisms to execute integrated planning.

However, these processes are almost exclusively at the development stage and need to be supported, tested, and refined over the coming years. Notwithstanding the evident advancements, a significant gap exists between stated commitments to sustainable development and their implementation (UNDESA 2015; UNDESA and UNDP 2012). Recommendations toward this end are discussed in Section.

Financing

ACCESS TO FINANCIAL RESOURCES

ALTHOUGH DAMMAM is one of the highest-ranking cities in Saudi Arabia in terms of own-source revenue generation, only 19 percent of the amanah's budget in 2016 was own-source revenue, while the rest came from inter-governmental transfers and grants. As a result, the DMA and the Eastern Province are heavily reliant on the central government. While the budgeting process takes into account objective indicators such as population, the process whereby powerful governors influence how the budget is allocated is highly political. The Eastern Province therefore has an advantage, with high-profile members such as the Aramco chairman and the Minister of Energy on its municipal board.

Dammam's budget consists of operation and maintenance/programs and contracts, salaries, and operation expenses. While own-source revenues have increased over the last several years, their share of the total budget has not necessarily grown at the same rate. If the central authority pushes the 40 per-cent own-source revenue target, as proposed in NTP 2020, and does so without supportive policy incentives and intermediate goals, short-run incentives could push municipalities to promote certain types of land use and development projects that are suboptimal and create negative externalities.

Own-source revenue in the DMA increased from SAR 246 million to SAR 299 million between 2012 and 2016. Most of this has come from government land revenues. The introduction of a 2.5 percent White Land Tax (WLT) is also a testa-ment to the kingdom's recognition of land as a powerful revenue source. The WLT is expected to provide a significant source of revenue for the Ministry of Housing, curb land speculation, and promote the development of idle land within the urban

boundary. However, neither land leasing nor the WLT is a silver bullet to solve the challenge of own-source revenue diversification in the country (SAMA 2015). Land sales, rentals, and leasing are the simplest form of land-value financing, but these instruments do not generate enough revenue. A wide spectrum of land-based financing instruments exists beyond the current focus on leasing and WLT. In the age of decreasing oil revenue, Dammam will require greater revenue stability, predictability, and self-sustainability to meet its ever-growing expenditure needs. To this end, Dammam and its amanah must explore a variety of financing instruments and build the capacity of its existing land management system.

COMPOSITE REVENUE RESOURCES

The demand for capital to finance local infrastructure in emerging countries is becoming a priority, especially in cities like Dammam. To fill the financing gap and address these new development challenges, the financing options available to countries like Saudi Arabia have been rapidly expanding. Recent reforms are aiming to improve the Saudi capital market through increased market capitalization. For example, the Capital Market Law, the Securities and Exchange Commission, and a privately owned stock exchange were recently launched in Saudi Arabia with the goal of improving the domestic capital market.

Public finance and sound fiscal management are key to supporting local development goals and establishing a solid financial base that, in turn, will strengthen the public sector's role in supporting local economic development. Dammam is guided by the National Development Plan, a system that is highly centralized and dependent on intergovernmental transfers (vis-à-vis line item budgeting in the national plan) to fund local development activities and projects. In 2017, the central government allocated 5 percent of the total budget to municipal services, which also covered projects and programs managed by MOMRA. To reduce dependence on intergovernmental transfers and increase the performance of municipal services and activities, the government is exploring alternative means of generating revenue to support its development activities and improve services.

EVOLUTION OVER TIME OF THESE RESOURCES

Despite minor setbacks between 2015 and 2016 the reported data show a general growth trend in own-source revenue mobilization, which increased from SAR 246 million to SAR 299 million between 2012 and 2016. A more detailed breakdown of Dammam's own-source revenue shows the largest own-source revenue contributions come from the revenue collected from government land.

Over the last few decades, Saudi Arabia has engaged in a series of reforms that are now creating competitive and attractive conditions for capital and equity investors. This approach is expected to have wide-ranging impacts on the local economies of cities like Dammam in the future, increasing the availability of capital to fund urban development.

Regarding Saudi Arabia's debt market, the government began issuing bonds for debt financing in 1988. In the past 15 years the debt market has undergone a series of reforms, which changed the process for issuing bonds, pricing bonds, and setting bond maturity terms. One major purchaser of government bonds is the group Investors in Government Development Bonds (GDBs), which is made up of domestic financial institutions, banks, and foreign investors (Hentov et al. 2017). GDBs are Zakat-deductible for domestic investors and exempt from tax withholdings on income for foreign investors.

The Saudi Arabian capital market is becoming an example of efficient capital allocation driven by strategic reforms and increased market capitalization. Between 2011 and 2016, Saudi equities increased in value from just over 50 percent of GDP to almost 70 percent of GDP. Today, Tadawul is the sole Saudi stock exchange market and the largest equities exchange market in the Arab world (Jadwa Investment 2016). In addition to Tadawul, Saudi Arabia introduced Nomu, an equity market for small and medium-sized enterprises (SMEs). With fewer listing requirements, Nomu is a good option for SMEs that are interested in going public.

In addition to providing traditional banking services, Saudi Arabia's domestic banks went through a series of mergers and acquisitions, diversified their assets, and began to offer both conventional and Islamic investment products to a diversified investor base.

Conclusion and Replication

EXTERNAL VALIDITY

THE APPROACHES AND PROCESSES adopted to achieve spatial and sectoral integration in the DMA case can be tailored to suit similar urban agglomerations in the Middle East and North Africa. Integrated planning and incremental implementation are two approaches that proved to be effective in achieving spatial and sectoral integration in the DMA.

The spatial and sectoral integration in the DMA was incremental and gradual.

Integrated planning

Integrated planning objectives have been reached through the three consecutive plans prepared for managing urban development in the DMA and its region. These plans were comprehensive in nature, dealing with urban development as part of an integrated environmental, social, economic, and urban system.

In the case of the DMA, integrated planning enabled the area to promote a more economical urban development process and to utilize the economic advantages of urban agglomeration. This urban agglomeration in turn has enabled the emergence, and the efficient functioning, of national infrastructure facilities. The advantages of urban agglomeration have enabled the DMA to act as a growth pole, transmitting development to all areas in its region.

Incremental implementation

The spatial and sectoral integration in the DMA was incremental and gradual. It first happened at the local level, gradually integrating the urban areas of Dammam and al-Khobar. Second, spatial integration was achieved at the subregional level, integrating the DMA with the neighboring Qatif and Ras Tanura governorates. Third, spatial integration was achieved at the regional level, integrating the DMA with the Eastern Province. Then, spatial integration was pursued at the national and international levels.

Incremental implementation enabled planners and policy makers to review, evaluate, and modify the adopted approaches and methods, making the development process more efficient and economic. This approach was also appropriate regarding the gradual financing of the development process.

Key environmental challenges

The key challenges in the case of the DMA, which should be considered when applying these approaches to other cases, are raising the profile of the environment and achieving more integration among sectors involved in the development process. It is essential to rebalance the approach to development, both in order to reverse the ecological damage that has already been done and to protect and enhance natural assets in the urban context.

Overall, the proposed land use plan for Dammam needs to be reassessed, taking into account the many current and future challenges facing the Dammam Metropolitan Area—which range from protecting it from climate change, building coastal resilience, and addressing the need for ecological corridors to meeting the need for new mixed-use nodes. Modifying the proposed land use plan also presents an opportunity to redefine the Dammam Development Protection Boundary, reducing its extension and increasing the density within the existing urban footprint, by making use of the current vacant land within the 1450 urban growth boundary (Godschalk 2003).

INVENTORY OF SOLUTIONS

Through its different stages, this report has identified five keys areas where support from national and international agencies is needed to address the challenges facing the adoption of integrated approaches across the planning cycle in the DMA and similar cases. To address the challenges and bottlenecks facing the adoption of integrated approaches across the planning cycle in the region, policy support is needed in five key areas, as follows.

Strengthening institutions and governance systems

Although existing institutions, laws, policies, and strategies promoting integration provide an appropriate foundation, some institutions in the DMA are still weak and need support if they are to influence development policy. The development of fledgling institutions is understandably a slow process that entails going through stages of iterative learning and evolution toward

becoming fully integrated and holistic. A major challenge facing integration in the DMA is that planning institutions and processes still work along sectoral lines and no one institution has the mandate and resources to pull all actors together. Also, integrated planning and policy coherence is a new concept in the region; thus, integrated planning needs more efficient coordination mechanisms, budgets for cross-disciplinary work, and skills and incentives for working together. Making the transition to integrated planning and implementation in the DMA requires strengthening institutions and governance systems at all levels.

The assessment of integrated policy options is a challenge in the DMA due to a lack of data availability and sharing arrangements, low institutional capacities across the policy cycle, and insufficient communication between analysts, policy makers, and stakeholders.

Strengthening evidence-based, empirically backed policy options

The complexity of integrated planning, with its many drivers and actors, makes evidence-based policy making increasingly desirable. However, the assessment of integrated policy options is a challenge in the DMA due to a lack of data availability and sharing arrangements, low institutional capacities across the policy cycle, and insufficient communication between analysts, policy makers, and stakeholders. While better evidence is necessary to support and inform a consultative policy-making process, for such a process to be realized, mechanisms also need to be in place that ensure all parties have a voice in the process, especially the vulnerable sections of society. Support is needed to:

- Develop reliable and complete data;
- Promote appraisal approaches and system analysis tools to ensure that agencies, sectors, and civil society are better informed on the need for integrated policies and how they can be implemented;
- Develop and promote participatory approaches to evidence-building; and
- Build capacity across local government and specialized agencies in the broad range of tools that can inform integrated planning so that local government can independently undertake and periodically update assessments.

Development of budgeting and financial systems

The transformative post-2015 development agenda must be underpinned by a credible means of implementation, as explained in the Addis Ababa Action Agenda of 2015 (UN 2015). However, currently all countries, to varying degrees, face shortfalls in the funding required to meet sustainable development objectives, and all need to better leverage their existing funding. Clear lines of resource mobilization, along with realistic financing frameworks and responsibilities, will be imperative if a rapid transition to an inclusive green economy is

to be achieved. Stronger measures are needed to expand the tax base, remove perverse incentives, encourage private investments, increase efficiency, and address corruption.

Key areas of support and enabling factors include:

- Ensuring integrated planning goes hand in hand with budgeting, so that funds are available for implementation and programs are prioritized and phased in despite budget constraints; and
- Identifying and developing effective financing mechanisms to meet the costs of achieving the SDGs and transitioning to an inclusive green economy (UN 2015).

Support for monitoring and evaluation

Monitoring and evaluation (M&E) systems—for social, economic, and urban development policies, plans and projects—are needed in metropolitan areas. These systems have to be fully effective and/or tailored or capable of being applied to integrated approaches and the SDGs. Monitoring and evaluation results should feed back into planning and policy making, fine-tuning and adjusting policy design and formulation, programming, and budgeting. Therefore, integrated planning systems require further support to fully develop the approaches and assessment methods required to establish program and policy evaluation processes and to measure progress toward the SDGs.

Capacity development

Capacity constraints limit integrated planning at all stages of the planning cycle, across all levels of government, localities, and among stakeholders. Individual and institutional capacity challenges common to the governments of developing countries include insufficient technical knowledge; weak assessment abilities; limited research capacity; limited monitoring and evaluation capacity; and a lack of public awareness of and support for sustainable development (UNDESA and UNDP 2012).

In addition, and to meet the objectives of the Addis Ababa Action Agenda, capacity building in areas such as public finance and administration, social and gender responsive budgeting, and financial regulation and supervision are sorely needed in metropolitan areas. Despite common challenges, capacity development must be country-driven, address the specific needs and conditions of metropolitan areas, and address sustainable development priorities.

This support needs to be tailored to the needs of individual metropolitan areas based on their development contexts and priorities, their institutional structures, and their capacities.

Density

High-population-density areas are concentrated along the coast. Between 2000 and 2017, Dammam's metropolitan population density has increased to about 590 people per square kilometer, albeit starting from a low level of 430 people per square kilometer.

Figure 5

POPULATION DENSITY, 2000

Municipal
- Maximum: 20,166 people/km²
- Minimum: 1 person/km²
- Average: 761 people/km²

Metro
- Maximum: 9,072 people/km²
- Minimum: 1 person/km²
- Average: 432 people/km²

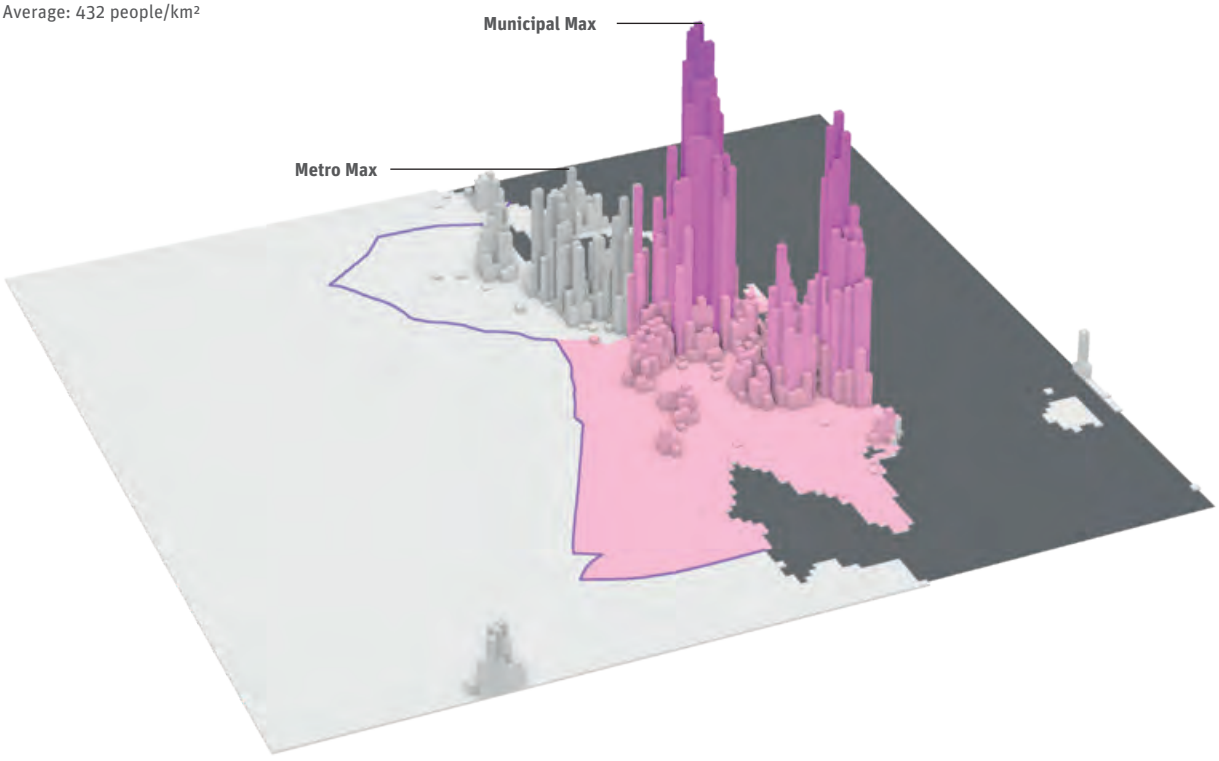


Figure 7
Overlay of density levels, 2000–2017

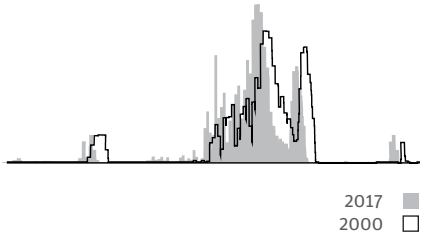
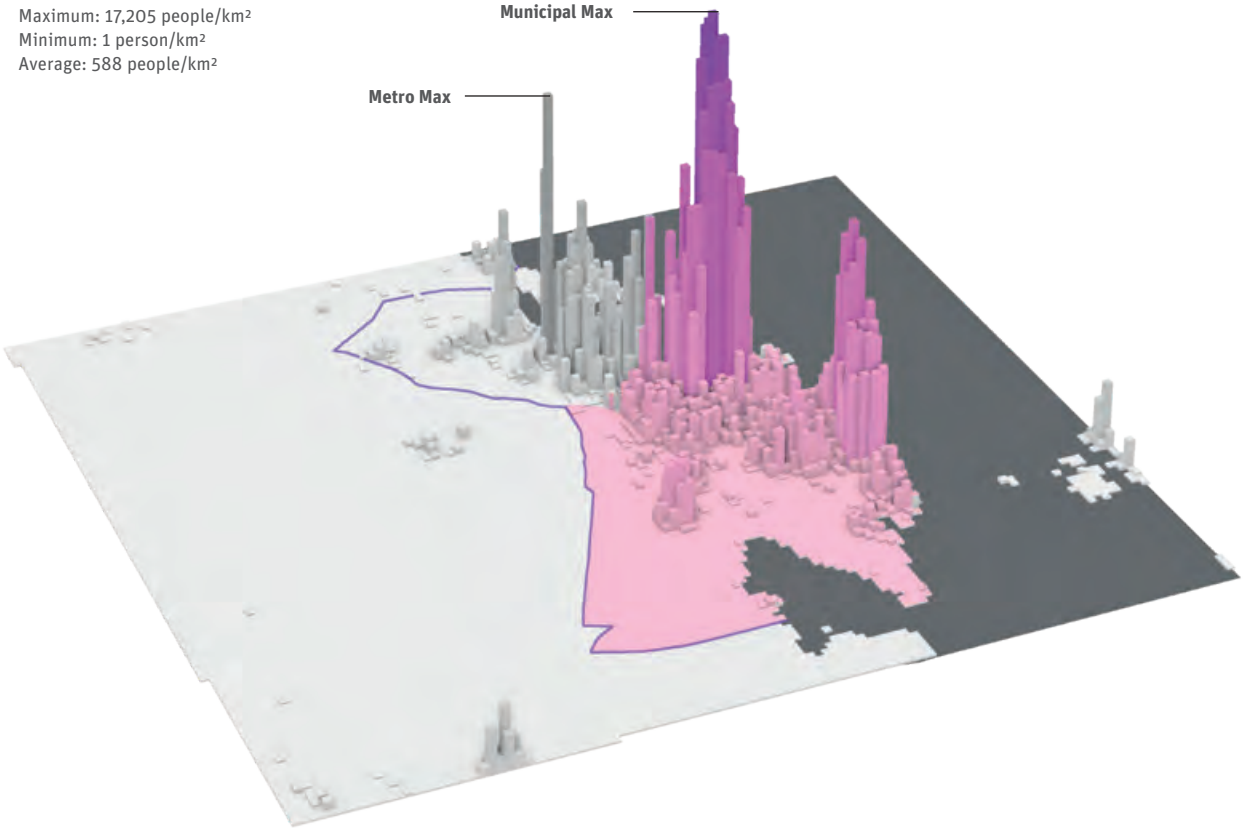


Figure 6

POPULATION DENSITY, 2017

Municipal
- Maximum: 24,379 people/km²
- Minimum: 1 person/km²
- Average: 894 people/km²

Metro
- Maximum: 17,205 people/km²
- Minimum: 1 person/km²
- Average: 588 people/km²



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ABBREVIATIONS

DMA	Dammam Metropolitan Area
GCC	Gulf Cooperation Council
GCC	Cooperative Council Road
GDB	Government Development Bond
SDG	Sustainable Development Goal
SME	Small and Medium-sized Enterprise
UGB	Urban Growth Boundary
WLT	White Land Tax

GREATER THAN PARTS

A Metropolitan Opportunity

How rapidly growing cities utilize integrated planning to decarbonize urbanization

Cities are the source of over 70 percent of the world's greenhouse gas emissions. Cities are also the engines of the global economy, concentrating more than half the world's population. By the year 2050, two-thirds of the world will be urban, with cities accommodating an additional 2.5 billion people over today's total. Nearly all of this urban growth will occur in developing countries. This concentration of people and assets also means that the impacts of natural disasters, exacerbated by the changing climate, may be even more devastating, both in terms of human lives lost and economic livelihoods destroyed. Earth is on a trajectory of warming more than 1.5°C unless important decarbonizing steps are taken.

Often urban policymakers prescribe integration as the solution to steering urbanization towards decarbonization to achieve greater global and local environmental benefits. However, little is known about the struggles—and successes—that cities in developing countries have in planning, financing, and implementing integrated urban solutions.

Greater Than Parts: A Metropolitan Opportunity presents nine diverse metropolitan areas as individual case studies each with a selection of urban innovations. From the analysis, the report derives models, poses guiding questions, and presents key principles to provoke and inspire action by cities around the world.

The main objective of this report is to understand how developing and emerging economies are successfully utilizing *horizontal integration*—across multiple infrastructure sectors and systems—at the metropolitan scale to deliver greater sustainability. Integrated planning processes extending well beyond city boundaries are examined to determine how they have been financed and implemented. The report's primary audience is therefore city decision makers, their financiers, technical advisers, and practitioners most interested in applying integrated approaches to sustainable urban planning in capacity-constrained environments.

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SUSTAINABLE DEVELOPMENT GOALS

11 SUSTAINABLE CITIES AND COMMUNITIES