Gulf States Smart Cities Index
Assessment of Strategy and Execution for 10 Cities

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Section 2
EXECUTIVE SUMMARY

2.1 Introduction

The momentum behind the development of smart cities continues unabated. City leaders around the world are committing to smart city objectives as they attempt to shape the development of their cities to meet social, economic, and environmental challenges. National governments are also encouraging cities to become centers of innovation and drivers of sustainable growth.

The cities of the Middle East are part of this global development. Cities of the Gulf region in particular have seized on the ideas behind the smart city as a means of improving the quality of life in cities, strengthening programs for economic diversification, and supporting environmental and sustainability programs. However, many of the smart city programs in the region are in their early stages and others are evolving as lessons are learned about the challenges involved. The World Expo in 2020 in Dubai and the FIFA World Cup in Qatar in 2022 will provide global showcases for the progress made by the region’s cities over the next few years.

This report assesses progress across the leading cities of the Gulf region, identifies successes, showcases key developments, and identifies limitations and barriers. It shows the desire of governments across the region to seize the opportunities presented by the technologies underpinning the smart city vision and also the challenges of developing the broad transformation programs needed to realize that vision.

2.2 Background to the Report

2.2.1 Aims of This Study

Navigant Research defines a smart city as the integration of technology into a strategic approach to sustainability, citizen well-being, and economic development. These policy objectives are being met through innovation across all aspects of city infrastructure and operations, including the energy and water sectors, urban mobility, smart buildings, government services, and developments in underlying data and communication platforms.

The aim of the Gulf States Smart Cities Index is to provide an assessment of the current state of smart city development in the region through a detailed comparison of 10 leading cities. The evaluation highlights their strategies, key projects, and overall readiness to develop their smart city visions. The study also highlights lessons to be learned from these early adopters and areas where cities, national governments, and other stakeholders need to act to accelerate smart city development.
2.2.2 Evaluation Method

The 10 cities in this report were assessed on the breadth and depth of their smart or future city strategy and specific programs in areas such as digital innovation, public safety, urban mobility, energy, and sustainability. The assessment also looks at support from national governments and the extent of their partnerships and collaboration with other agencies and with the private sector. A detailed comparison was made of the 10 cities to identify the current leaders and their closest challengers. The report also highlights significant work being done in a number of other cities in the region and in neighboring countries.

The leading cities are evolving their strategies and expanding out from ambitious greenfield developments.

The evaluations in this report are based on Navigant Research's corpus of smart city research; public documents on city strategies, projects, and performance; interviews with city leaders and project teams; and interviews with other key stakeholders in the development of smart cities from the public and private sector.

2.2.3 Evaluation Criteria

The city evaluations for this Index are based on two dimensions: Strategy and Execution. The Strategy dimension assesses each city's vision, goals, and objectives as they relate to its smart city program. The Execution dimension assesses the city's actual achievements from initial projects to full-blown deployment of innovative technologies and services.

Each dimension is split into five evaluation categories. The evaluation categories for the Strategy dimension are:

- **Smart City Vision**: Assesses the clarity, comprehensiveness, and depth of a city's smart or future city strategy.
- **Digital Innovation**: Evaluates a city's strategy to develop and exploit digital technologies and services.
- **Service Innovation**: Examines a city's strategy for innovations in local services that exploit improvements offered by smart technologies.
- **Sustainability Goals**: Assesses a city's sustainability strategy and the explicit targets set for energy consumption, greenhouse gas emissions, and related goals.
- **Stakeholder Engagement**: Examines the range of city stakeholders involved in the development of the smart city strategy.
The evaluation categories for the Execution dimension are:

- **Implementation**: Assesses a city’s overall progress in translating its strategy into action based on the number, range, and extent of projects implemented to date.
- **Digital Delivery**: Evaluates progress on implementing a city’s digital strategy, including pilot projects, smart city demonstrators, and full-scale projects.
- **Service Delivery**: Evaluates progress on implementing service innovations defined in a city’s smart city strategy.
- **Environmental Impact**: Looks at achievements against sustainability targets and implemented environmental and sustainability programs.
- **Community Reach**: Assesses engagement across multiple communities and stakeholders and the extension of projects into the wider city region.

Navigant Research scores the cities in the Smart Cities Index according to four categories: Leaders, Contenders, Challengers, and Followers. These categories are defined below.

- **Leaders**: These cities have differentiated themselves through the clarity, breadth, and inclusiveness of their smart city vision and planning. They are also leading the way in implementing significant projects at both the pilot and increasingly full-scale levels.
- **Contenders**: These cities have done much to establish their smart city strategies and have implemented some significant projects. However, there are still some gaps in their strategies, and the number of actual projects may fall behind that of smart city Leaders.
- **Challengers**: Challenger cities have laid down a vision for their smart city endeavors and begun to deploy projects, but execution still trails the vision outlined. They may have shown strong initiative in a few key areas but with less breath in their programs than the leading cities.
- **Followers**: These are cities that are beginning their smart city journeys. They may have made initial statements of intent and begun limited pilot projects and siloed operations, but they need to develop a more integrated view for city development and/or stronger leadership for their programs.

2.3 Gulf States Smart Cities Index

2.3.1 Summary of Rankings

Dubai in the United Arab Emirates (UAE) stands out in this Navigant Research ranking as a Leader among cities in the region. Its strategic vision is particularly notable, as is its understanding of the practical requirements to deliver on that vision. The foundation laid by Dubai’s leaders and the Smart Dubai Office provides an excellent basis to deliver a range of innovations that can have a significant impact on the city’s operations and quality of life.
The Dubai Data initiative and the new Smart Dubai Platform also place it firmly among the global cities driving innovation in urban technology.

Behind Dubai are two Contender cities that have ambitions to be among the global Leaders in smart city development:

- Abu Dhabi in the UAE has already made its mark with the ambitious Masdar City project, but it is now developing a number of initiatives that will have a wider impact on life in the emirate. The city’s focus on innovation in broader city infrastructure and services—notably in areas such as public safety, transportation innovation, and sustainability—will shape its future evolution as a smart city.
• Doha in Qatar is using its role as the host of the 2022 FIFA World Cup as a spur to a broader smart city transformation. It has the potential to be among the leading cities if it can realize and build on its ambitious digital and city infrastructure plans.

After the Leader and the closest Contenders are a group of Challenger cities led by Riyadh, the capital of Saudi Arabia. Riyadh has been making significant steps in terms of its urban development plans and the creation of a smart city strategy and is emerging as a future contender for smart city leadership in the region.

The other cities in the Challenger group—Jeddah, Saudi Arabia; Sharjah, UAE; Muscat, Oman; Yanbu, Saudi Arabia; and Manama, Bahrain—show a mixture of ambition, vision, and significant projects, but still have a way to go to be considered as major figures in smart city development. These cities need to develop more coordinated and actionable strategies and accelerate execution in a number of areas. In the Follower category is Kuwait City, which has laid some foundations but has only a nascent program in place for its development as a smart city.

2.4 Key Messages for Government and City Leaders

There is considerable diversity among the cities assessed in this report in terms of maturity of strategy and the deployment of smart city solutions, but there are some common themes that can be drawn from their experience and from cities facing similar challenges globally. Five themes are particularly relevant to the development of smart cities in the Gulf region.

2.4.1 The Importance of Leadership and Vision

Strong leadership from government and city leaders is vital to developing a coherent and sustainable smart city strategy. The strategy of the leading cities has been given impetus from the highest levels. In Dubai, for example, the Smart Dubai program was instigated by Sheikh Mohammed bin Rashid Al Maktoum, Vice President and Prime Minister of the UAE and Ruler of Dubai, and is part of his vision for the transformation of the emirate as a whole.

Vision statements provide shared goals and clear targets, but they have to be matched by a commitment to implementation and to building on successful pilots. Leadership from the top is important in maintaining momentum and in making sure that the overall goals are embedded in specific programs and supported through infrastructure investment. Agencies and departments responsible for delivering improvements need to understand and be aligned with the high-level objectives set by these strategies.

2.4.2 Focus on Local Priorities and Strengths

Each country and each city has its own specific challenges and opportunities. The smart city concept is not about following a single global or even national blueprint. Successful smart city programs build on existing assets and strategic priorities to develop a distinct smart city vision that is aligned with local needs and goals.
Smart city development is about adapting innovative technologies and solutions to meet local needs and possibilities. As shown by the cities profiled in this report, global events (such as the World Expo and FIFA World Cup), large-scale new building developments, a desire to shift economic focus, investment in digital infrastructure, or renewable energy programs can all provide the focal point for smart city strategies.

Smart city developments are particularly important to national strategies for economic diversification. The close alignment of technical innovation, improved services, sustainability, and economic development fits perfectly with the development requirements of cities in the Gulf.

2.4.3 Leveraging New and Existing City Development

Greenfield developments inevitably play a much greater role in the development of smart city ideas in the fast-growing and expanding cities of the Gulf region than in Europe or North America. The region is home to several iconic developments, including Masdar City in Abu Dhabi, Lusail City in Qatar, and King Abdullah Economic City (KAEC) in Saudi Arabia. Many other development projects at various scales are also looking to embed new technologies and new capabilities into their fabric.

A greenfield strategy has many advantages, not least of which is being able to avoid the problem of retrofitting new technology into legacy infrastructure. However, it also presents specific challenges. First is the challenge of matching ambitious masterplans against economic, commercial, and technical realities. Second, creating living urban environments with dense cultural and social connections takes time, a challenge to all new city developments. Third, lessons learned in these developments need to be carefully applied as programs are launched in historic areas of older cities and in downtown hubs, as in the renovations programs in Doha and Riyadh, for example.

It is notable that smart city programs across the region are now looking to make a broader impact on the quality of life in cities beyond these greenfield developments through developments such as new e-government services, transportation innovations, and resource management improvements. New developments will continue to be an important part of smart city innovation in the region but they will increasingly be integrated into more holistic views of city evolution.
2.4.4 Building Partnerships

Smart city solutions can only be delivered through a network of partnerships. The leading cities are notable for their ability to bring together national government and city agencies, the private sector, and academia. For the cities profiled in this report, coordination between national plans and objectives and the specific needs for city development are crucial. Cities carry much of the weight of meeting national goals for economic diversification and improvements to services and quality of life.

The focus on large-scale greenfield developments also means that collaboration is required across multiple stakeholders. A project like Masdar City, for example, depends on a wide range of local and international partnerships. Technology companies also have a key role in accelerating digital transformation. In addition to providing the necessary infrastructure, their experience is invaluable in effectively embedding smart approaches in new initiatives.

The role of academia is also important. The role of King Saud University in the development of Riyadh is one example, and other cities need to look at how they can better integrate academia as part of the shift to a more knowledge-based economy and to develop the necessary local skills in areas such as big data analytics and Internet of Things (IoT).

2.4.5 From Infrastructure to Data

Cities in the Gulf region are expanding their digital infrastructure, developing new services, and investing in large-scale building programs. Obtaining the real value from these investments depends heavily on the ability to collect, manage, and analyze the data collected.

The emerging focus on open data and data analytics programs is an important step forward. The Dubai Data program is leading the way, but other cities are now thinking more specifically of the requirements for data sharing—first across government agencies and then with a wider group of stakeholders.

Creating a data platform is an important first step, but the value of such initiatives lies in the ability to use that data to improve the efficiency and quality of city services. This will be one of the most important developments in the next stage of smart city evolution in the region.
Section 3
THE RISE OF THE SMART CITY

3.1 The Importance of Cities

According to the United Nations (UN), the number of people living in cities will increase from 3.6 billion to 6.3 billion between 2010 and 2050, meaning that 70% of the global population will be urbanized by 2050. The growth in the urban population in just these 4 decades will be equivalent to the size of the urban population achieved throughout all prior periods of human history. Almost 3 billion additional people will require electricity, clean water and sanitation, efficient transport, homes, and public services such as health, education, and public safety.

Cities are a focal point for some of the most profound economic, environmental, social, and technological issues facing the world today. How cities can address these challenges and deliver services in an economically viable and environmentally sustainable manner is the question at the heart of the smart city movement.

3.2 Defining the Smart City

The smart city is a simple label for the complex forces shaping urban life in the 21st century. In Navigant Research’s definition:

“A smart city is characterized by the integration of technology into a strategic approach to sustainability, citizen well-being, and economic development.”

Technological innovation is a driver for the evolution of cities and a vital support for those looking to find new ways to manage resources and deliver services. Smart cities are being built on an intelligent urban infrastructure of connected devices. Ubiquitous communications services and the growing use of sensor technologies across the urban fabric are providing cities with new insight into how they operate. Much of the promise of the smart city depends on the ability to deploy, manage, and access the data from these devices and other embedded technologies to drive a new range of services. Smart cities are becoming one of the most important testing grounds for the IoT, enabling any element of the city architecture to become a potential source of data and a means of fine-grained control, thereby opening up a host of new opportunities for city management and services.

These technology innovations are being harnessed to three core policy objectives common to almost all smart city strategies:

- Sustainability is accepted as one of the critical goals for the modern city. Cities have historically drawn on the energy and material resources of a much larger local, national, and global environment. It is no longer possible for a city to disregard how it obtains and uses such resources. Sustainability programs cover a wide range of
ambitions, including reduced energy consumption, increases in local renewable power generation, improvements in waste recycling and water consumption, and changes in transportation patterns. The smart city aims to combine sustainability targets with continued improvements in services to its inhabitants and visitors and continued development of the local economy.

- Citizen well-being covers the broad range of functions and services that citizens expect from their city authorities and other providers. City leaders are only able to deliver change from programs if they can assure citizens that the programs will lead to an overall improvement in their quality of life through improvements in public services. These services cover the broad range of functions and operations that citizens expect from their city authorities and other providers, including public safety, health and social care, education, waste management, street lighting, and efficient transportation systems.

- Economic development is an intrinsic part of a city’s ability to deliver better services and to meet sustainability goals. A defining characteristic of the smart city movement is the importance given to the evolution of a city’s industries and commercial activities. Cities need to be centers of digital and clean technology innovation in order to provide employment and attract new businesses and new talent.

3.3 A Global Development

City leaders all over the world have embraced the smart city concept with enthusiasm. They are heralding innovative projects and laying out a vision for how cities can use technology to meet sustainability goals, boost local economies, and improve services.

While many of the drivers, service innovations, and technologies being deployed are common across the world, there are also considerable differences between regions—and between countries—in terms of the economic and political context, the history and future of urbanization, and the levels of existing and planned infrastructure investment.

The staggering rate of expected urban growth in Asia Pacific and Africa over the next 40 years is one of the prime drivers for interest in smart cities, along with recognition of the importance of cities to economic regeneration in North America and Europe. In Latin America, cities are trying to address decades of underinvestment in their urban infrastructure in order to boost development. Meanwhile, Japan is developing new ideas related to the nature of energy efficient and resilient communities. The Middle East also contains some of the fastest growing cities in the world—cities that are an important link between East and West and key players in global economic, technical, and environmental transformation.
Across the world, cities are playing a leading role in the mitigation of climate change and are increasingly focused on improving global adaptability to address its consequences. Demographic, economic, and environmental changes are amplified—and in some cases, driven—by the rapid changes in the technological fabric of the modern city.

The smart city is also evolving as a concept as many more cities, national governments, and technology and service providers add their voices to the discussions. There is a growing emphasis on resilience and climate adaptation in city strategies; a new focus on making smart city development relevant to citizens and their daily lives; a desire for more data-driven policymaking and operational control; and a recognition of the need for standards to help drive smart city programs to the next stage.

3.4 Smart City Development in the Gulf States

The Gulf states (defined for this report as the countries of the Gulf Cooperation Council: Bahrain, Oman, Kuwait, Qatar, Saudi Arabia, and the UAE) are already home to some notable smart city projects, including Smart Dubai, Masdar City, the Saudi Economic Cities initiative, and Doha’s preparation for the 2022 FIFA World Cup. City development is being used as a way of building a knowledge economy and further diversifying the region’s economic activities beyond energy.

However, there has sometimes been a gap between statements of intent and the actual delivery of programs for transformation. This is now being addressed in a number of countries and cities. Several governments have relaunched programs to give a new boost to their progress toward economic diversification and the creation of knowledge-based economies. There is a strong ambition to ensure that the region’s cities can match and even exceed other global cities in their adoption of smart city solutions.

Because of these developments, now is a good point to assess progress across the cities of the Gulf region. Both city strategies and the global smart city market have reached an important inflexion point. Navigant expects to see an acceleration in the adoption of smart city technologies over the next 2 years as IoT technologies mature and solutions become more reliable and less costly.

Initial enthusiasm around greenfield developments such as Masdar City and a new generation of Economic Cities in Saudi Arabia was tempered by the global financial crisis in 2008. However, momentum has been regained recently, and these projects and others have gained new drive. Oil price fluctuation has created new uncertainties but it is also spurring the move to service innovation and economic diversification. Currently, the evolution toward smarter cities is increasingly focused on the practicalities of services and operations in cities like Dubai, Abu Dhabi, Doha, and Riyadh. This includes projects that focus on the development of broader communications infrastructure and improved government services, as well as transportation, energy, and water infrastructure.
3.5 Assessing the State of Smart Cities in the Gulf Region

The Gulf States Smart Cities Index provides a snapshot of the development of smart city programs across the leading cities in 2016. Detailed assessments of the 10 cities are provided in Section 6, but some general trends are apparent across the evaluation criteria.

3.5.1 Strategy and Leadership

The leading cities have established smart city strategies, ambitious objectives, and agencies that can deliver on these programs. Dubai is the prime example with its Smart Dubai program overseen by the Smart Dubai Office. Dubai also shows how smart city strategies need to evolve and be refreshed to maintain focus and momentum. Similarly, Doha’s development is being shaped by a number of significant national strategy programs for innovation and infrastructure improvement. A number of other countries have also revised or refreshed their approaches, including Saudi Arabia, where the National Transformation Program is providing a framework for smart city developments.

3.5.2 Digital Innovation and Connectivity

At the core of the smart city vision are opportunities to exploit the connectivity provided by ubiquitous communication networks. Cities across the region are making strong progress in this regard, particularly with respect to cellular coverage and smartphone adoption. New developments such as the KAEC in Saudi Arabia and Masdar City in Abu Dhabi boast of their state-of-the-art infrastructure. However, broader programs are also required to enable easier connectivity, such as the city Wi-Fi programs in UAE or the digital inclusion projects in Muscat.

3.5.3 Safe, Clean, Accessible Cities

The main driver for investment in smart city technologies is to enable cities to deliver better and more efficient services. While much of the focus so far has been on new buildings and digital infrastructure investment, the region is seeing innovation in a range of operational areas. These range from intelligent traffic management in Abu Dhabi to smart waste collection in Sharjah. Public safety and security are also a priority for investment across the region, if not always so visible in public pronouncements. Urban mobility is also becoming an important focus for change—for example, Jeddah’s ambitious transportation program is poised to drive important changes in the city’s infrastructure, services, and land use policies and usher in a range of smart solutions.

3.5.4 Economic Diversification

In most local economies in the Gulf, the need to reduce reliance on oil & gas production is a strong driver for innovation around smart cities and an investment in the technology sector than can lay the basis for a more knowledge-based economy. Dubai’s leadership in smart city development is in part due to its early recognition of the need to build a diversified economy. Other countries in the region are now following and committing to a
future that is less dependent on oil & gas revenue. Smart city developments have a vital role to play in this process of diversification. The close alignment of technical innovation, improved services, sustainability, and economic development in smart cities fits perfectly with the development requirements of cities in the Gulf.

In addition, the need to integrate the public and private sectors and academia into innovative city programs provides a further boost for the move toward more knowledge-based economies. The role of the King Saud University in Riyadh’s plans for smart city development are a good example of how this can be achieved.

3.5.5 Sustainability

National governments and cities have set a range of targets to reduce their carbon emissions and improve their use of resources. In addition to the need to meet international commitments, these plans are also fit with the economic diversification strategies. Balancing an economic dependence on oil & gas with a shift to carbon-free energy is not easy. The countries of the Gulf region are all among the UN’s list of the highest per capita CO2 emissions. However, progress is being made. The UAE, for example, has been one of the early countries to ratify the COP 21 agreement and is developing an energy program that will help it meet these objectives, while Qatar is preparing to host the first carbon-neutral FIFA World Cup in 2022.

3.5.6 From Greenfield Investment to City Innovation

Smart city development in the Gulf region has until recently been largely associated with iconic greenfield developments like Masdar City, Lusail City, and the Saudi Economic Cities. This has raised the visibility of the region as a locus for innovation and helped develop better understanding of the possibilities of advanced technologies in areas like building management and transportation innovation.

Such developments will continue to a large part of the region’s smart city approach, but there are also signs of broader programs emerging that address requirements of the city as a whole. Smart Dubai is the outstanding example, as is the UAE’s broad range of e-services. Programs for the renovation of established city districts in Riyadh and Muscat are also relevant to this shift.

3.5.7 Global Events and Global Visibility

As cities like Barcelona, Beijing, London, Seoul, and Rio de Janeiro have shown, global events like the Olympics, the FIFA World Cup, and the World Expo can have a huge impact on the infrastructure and the image of a city. With Dubai hosting the World Expo in 2020 and Qatar the World Cup in 2022, the Gulf region will be host to two iconic events in the coming years, with preparations already underway well in advance. These events inevitably shape priorities and have an impact on the broader infrastructure of the city.
It is important that the investment being made in infrastructure and services for these events showcases the capacity of the host cities for innovation and their ambition to be among the world leaders. An important element of this must be a focus on the legacy these events will leave behind with regard to quality of services and technical infrastructure.

3.6 Challenges and Barriers

While there are some notable developments across the region, overall, smart city programs are still largely immature. To accelerate progress, there are a number of issues that both the leading cities and those following them need to face.

3.6.1 From Vision to Execution

If there is one major weakness in the approach to smart cities in the Gulf region, it is the gap between ambitious visions and the reality to date of program delivery on the ground. There is no shortage of statements as to the intent of national governments and cities to be among the world’s leading cities for quality of services and level of innovation. However, these have taken longer to become practical programs for change. Similarly, idealistic pictures of the benefits and services offered by greenfield developments have not always matched what is actually delivered.

As shown in the Smart Dubai program, grand strategies need to be embedded in detailed programs for change, and progress has to be monitored and adjustments made to ensure that execution can match the promises of the vision. Other governments and cities are also moving to clear benchmarking of progress and a focus on the practical transformation of city services.

3.6.2 Financial

Compared to some other areas of the world, finance has not been such a fundamental barrier to urban development in the region. However, the impact of the financial crisis of 2008 on developments in the market meant a scaling back on the ambitions of projects like Masdar City. The recent drop in oil prices has also created new financial pressures in the region, but it has also accelerated the drive for diversification and for increased efficiency in the delivery of services.

Although the need to extend the capacity of cities and the desire to invest in new developments continues to transform city landscapes, that does not mean that infinite resources are available or that resources do not have to be used wisely. Government and investors need to see a return on their investment—in both financial and social terms—and ambitions have to be matched to financial reality.

One advantage of looking at less capital-intensive projects—including mundane city services such as lighting, traffic management, and public safety—is that they can maintain a sense of progress alongside longer term (and more high-profile) new developments.
3.6.3 Building on a Digital Infrastructure

The cities in the region are expanding their digital infrastructures, developing new services, and investing in large-scale building programs. Obtaining the real value from these investments depends heavily on the ability to collect, manage, and analyze the data collected.

The emerging focus on open data and data analytics programs is an important step forward. The Dubai Data initiative is leading the way, but other cities are now thinking more specifically of the requirements for data sharing, first of all across government agencies and then with a wider group of stakeholders.

Creating a data platform is an important first step, but the value of such initiatives lies in the ability to use that data to improve the efficiency and quality of city services. This will be one of the most important developments in the next stage of smart city evolution in the Gulf region.
Section 4

BACKGROUND TO THE ASSESSMENT

4.1 Aims of This Study

The aim of the Gulf States Smart Cities Index is to provide an assessment of the current state of smart city development through a detailed comparison of the leading smart cities in the region. The evaluation highlights these cities’ strategies, key projects, and overall readiness to develop their smart city visions. The study also highlights lessons to be learned from these early adopters and areas where cities, the national government, and other stakeholders need to act to accelerate smart city development.

4.2 Evaluation Method

The 10 cities profiled were selected on the breadth and depth of their smart or future city strategy and specific programs in areas such as digital innovation, urban mobility, public safety, energy, education, and sustainability. The assessment also looks at the extent of their partnerships and collaboration with other agencies and the private sector. A detailed comparison was made of the 10 cities to identify the current leaders and their closest challengers. The report also highlights the work being done in a number of other cities in neighboring countries to provide a broader perspective on regional development.

The city evaluations in this report are based on Navigant Research’s corpus of smart city research; public documents on city strategies, projects, and performance; interviews with city leaders and project teams; and interviews with other key stakeholders in the development of smart cities from the public and private sector.

4.3 Evaluation Criteria

The city evaluations for this Index are based on two dimensions: Strategy and Execution. The Strategy dimension assesses each city’s vision, goals, and objectives as they relate to its smart city program. The Execution dimension assesses the city’s actual achievements from initial projects to full-blown deployment of innovative technologies and services.

Each dimension is split into five evaluation categories. The evaluation categories for the Strategy dimension are:

- **Smart City Vision**: Assesses a city’s smart or future city strategy, including an assessment of the clarity, comprehensiveness, and depth of the strategy. An assessment was also made of the leadership commitment in each city and the level of engagement with all stakeholders.
• **Digital Innovation:** Assesses a city’s strategy to develop and exploit digital technologies and services, including plans for the development of a city’s communications infrastructure, its open data policy, and plans for developing the local digital economy.

• **Service Innovation:** Assesses a city’s strategy for innovation in local services that exploit improvements offered by smart technologies, including plans in the areas of city services, public safety, health and social care, education, and transportation and urban mobility.

• **Sustainability Goals:** Evaluates a city’s sustainability strategy and the explicit targets set for energy consumption, greenhouse gas emissions, and related goals in the areas of waste management, transportation programs, air quality, and other environmental initiatives.

• **Stakeholder Engagement:** Examines the range of city stakeholders involved in the development of the smart city strategy, including citizen engagement programs, business involvement (particularly local small and medium enterprises but also significant partnerships with larger players), and the involvement of local universities and other research organizations.

The evaluation categories for the Execution dimension are:

• **Implementation:** Assesses a city’s overall progress in translating its strategy into action based on the number, range, and extent of projects implemented to date. It also assesses forward momentum in terms of projects currently underway and the near-term pipeline for new projects and programs.

• **Digital Delivery:** Evaluates progress in implementing a city’s digital strategy, including pilot projects, smart city demonstrators, and full-scale projects spanning all forms of digital innovation, including IoT projects, open data platforms, and other big data programs, digital inclusion projects, and improvements to the city’s communications infrastructure.

• **Service Delivery:** Evaluates progress on implementing service innovations defined in the city’s smart city strategy, including improving access to core services, innovative projects for health and social care, improvements in skills and education related to the use of digital technologies, urban mobility innovations, innovations to support local businesses, and programs aimed at providing improved information and services for visitors and residents.

• **Environmental Impact:** Looks at achievements against sustainability targets and implemented environmental and sustainability programs, including smart energy projects, low-carbon transportation initiatives, energy efficiency programs (such as smart street lighting and smart waste projects), and other environmental programs.
• **Community Reach**: Assesses the engagement across multiple communities, the involvement of local businesses and academic communities in smart city projects, and the extension of projects into the wider city region and other local agencies.

## 4.4 The Index Rankings

Navigant Research scored the cities in the Gulf States Smart Cities Index according to four categories: Leaders, Contenders, Challengers, and Followers. These categories are defined below.

### 4.4.1 Leaders

Leaders are cities that scored 75 or above in both Strategy and Execution. These cities have differentiated themselves through the clarity, breadth, and inclusiveness of their smart city vision and planning. They are also leading the way in implementing significant projects at both the pilot and increasingly full-scale levels.

### 4.4.2 Contenders

Contenders are cities that scored above 50 in both Strategy and Execution but are not yet Leaders. While these cities have done much to establish their smart city strategy and have implemented some significant projects, there are still some gaps in their strategy, and the number of actual projects may fall behind that of the smart city Leaders.

### 4.4.3 Challengers

Challengers are cities that scored higher than 25 in both Strategy and Execution but are not yet Contenders for leadership. While these cities have laid down a vision for their smart city endeavors and begun to deploy projects, execution still trails the vision outlined by a significant margin in some areas. They may have shown strong initiative in a few key areas but less so across the broader smart city areas.

### 4.4.4 Followers

Followers are cities that have initiated some smart city projects but have not yet established themselves as leading innovators or developed extensive smart city strategies. These cities score below 25 in either Strategy or Execution. Follower cities need to move beyond initial statements of intent and limited pilot projects and siloed operations to develop a more integrated view for city development and/or stronger leadership for their programs.
Section 5

SUMMARY OF THE ASSESSMENT

5.1 The Gulf States Smart Cities Index

5.2 City Rankings

Overall, this study shows considerable progress in the Gulf region and important indicators of a new phase of innovation, but there is still much to do. Much of the focus is still on deploying information and communications technology (ICT) infrastructure and core services. There is an opportunity for the cities in the region to also be leaders in the development of more advanced solutions for city management in areas such as smart street lighting, intelligent traffic management, public safety, and smart buildings.

Chart 5.1 Gulf States Smart Cities Index

(Source: Navigant Research)
5.2.1 The Leaders

Dubai stands out in this Navigant Research ranking as a Leader among cities in the Gulf region. Its strategic vision is particularly notable alongside its adaptability, and the city understands the practical requirements to deliver on that vision. The foundation laid by Dubai’s leaders and the Smart Dubai Office provides an excellent basis to deliver a range of innovations that can have a significant impact on the city’s operations and quality of life.

5.2.2 The Contenders

Behind the Leaders in the Index are two Contender cities that are also developing strong smart city projects and driving innovation in a number of areas.

- Abu Dhabi has gained global visibility for smart city innovation with the Masdar City development. Despite the challenges of such a development in the tough global economic environment of recent years, the project will continue to be a reference point for new building innovation, and it will be interesting to see how it evolves as a working and living environment over the longer term. However, Abu Dhabi is not just about Masdar City, and its future focus is on broader innovation across city infrastructure and services, notably in areas like security, transportation, and sustainability.

- With a unique opportunity to reinvent itself as host of the World Cup, Qatar is embracing smart city projects and programs in order to meet the delivery of the event in 2022 and to leave a valuable legacy afterwards. Through this catalyst, the capital Doha is being transformed into a smart economic and sustainable city underpinned by investment in ICT, city infrastructure, product innovation, and smart grids.

5.2.3 The Challengers

A number of Challenger cities have developed interesting approaches to city innovation, but to date these programs lack the breadth and cohesion of the leading cities or are still in the early stages of execution.

- Riyadh is the base for a number of smart city initiatives that are essential to its transformation. Developments like the Riyadh Techno Valley (RTV) and the city’s Information Technology and Communications Complex (ITCC) are helping establish Riyadh as a hub of ICT and new city technologies.

- Jeddah has established an ambitious program to transform its transportation services. The development of a multi-modal transportation system can be a catalyst for Jeddah’s broader transformation into a smart city, supported by new initiatives to expand the city’s cloud and IoT capabilities.

- Sharjah lacks the high profile of its larger neighbors in the UAE, but the city has been implementing a number of notable projects, including e-services, smart waste collection and traffic monitoring programs.
• Muscat was an early leader in the development of a long-term smart city plan. However, limited progress was made after the publication of its first strategy in 2003. The city is now moving forward again. A number of e-government initiatives will be boosted by recent efforts to improve IT literacy, and there is activity across a number of different departments.

• Yanbu is a key part of Saudi Arabia’s national industrialization plans and is now planning its evolution to a smart city. Yanbu has the potential to become a pathfinder for smart city innovation in the country if it can build on its initial communications infrastructure and energy efficiency investments.

• The Bahrain government has been exploring programs for developing the capital Manama as smart city, which would support its projects to diversify the economy, meet climate goals and challenges, and develop its ICT capability. It now needs to build on this exploration to develop a coherent program and investment strategy.

5.2.4 The Followers

Kuwait City is the only city in the assessment in the Follower category. It has some way to go in developing a smart city strategy and deploying smart city solutions. As it shares many of the same challenges as other cities in the region, there are opportunities for Kuwait City to learn from the early movers as it develops its own program for change.
Section 6
CITY ASSESSMENTS

6.1 Leaders
6.1.1 Dubai, UAE

6.1.1.1 Summary
Dubai’s strategic vision and established smart city program make it a clear smart city Leader. Dubai’s leaders have addressed the fragmented approach of earlier smart projects and are developing a coordinated and ambitious program as the city prepares to host the World Expo in 2020. While its smart city strategy is extensive, the challenge now is to continue to deliver practical projects that make a real difference in the city. The Dubai Data initiative is at the heart of the strategy and with the new Smart Dubai Platform can create a strong basis for future innovation and place Dubai among the leading global smart cities.

| Overall Score: 80.5 | Strategy: 83.7 | Execution: 77.2 |

6.1.1.2 Strategy
Dubai is one of the most forward-thinking cities in the Gulf region. It has experienced tremendous growth over the past 30 years, driven by the vision of Sheikh Mohammed bin Rashid Al Maktoum, Vice President and Prime Minister of the UAE and Ruler of Dubai, and his predecessor Sheikh Rashid bin Saeed Al Maktoum to transform the emirate into the leading trading center in the Middle East.

Dubai’s oil reserves are small in comparison to other Gulf states, and so it has diversified its economy into tourism, technology, media, and international trade. In 2015, the city attracted 14.2 million visitors, an increase of 1 million over the previous year. Some reports expect the number of annual visitors to grow to 30 million by 2020. Dubai’s economy has been developed through the creation of trade zones. Jafza, the first trade zone created, now claims 20% of the UAE’s foreign direct investment, supporting 135,000 jobs and more than 50% of Dubai’s exports. Jafza has since been followed by Dubai Silicon Oasis, Dubai Internet City, Dubai Media City, and Dubai Maritime City. One of the most recent additions has been the Dubai Design District (d3), which is encouraging the growth of the local creative and technology industries. Dubai will host the World Expo in 2020 and has the stated aim to be the center of the Islamic economy by this time.

However, this rapid expansion has brought with it a number of challenges. An expanding economy necessarily requires more resources, and more residents and tourists place
increasing demands on infrastructure and services. Energy consumption increased 5% in 2015, while peak water demand increased nearly 7%. Dubai is also experiencing an increase in the number of cars on its roads. Dubai’s Roads and Transport Authority believes the emirate's average annual increase of 8.2% is one of the highest in the world.

Launched in 2014, the Smart Dubai strategy builds on the emirate’s previous strategic plan, which covered the 2007-2015 period. The strategy, which extends to 2021, has the clear goal of making Dubai “the happiest city on Earth,” and is based on six dimensions:

- **Smart Economy**: A pivotal hub in the global economy
- **Smart Living**: Continuing to maintain an exceptional quality of life in a safe and secure environment
- **Smart Mobility**: A coordinated approach to the development of efficient and sustainable transportation infrastructure and services
- **Smart Governance**: Building on pioneering work on e-government and the new open data initiative
- **Smart Environment**: A sustainable program focused on energy, waste management, and environmental conditions for an improved quality of life
- **Smart People**: Creating a city of happy, creative, and empowered people

In addition, smart ICT infrastructure is seen as common transversal dimension supporting all elements of the Smart Dubai strategy.

The strategy has been developed with a cross-government partnership that includes many different departments, including Dubai Electricity and Water Authority, the Executive Council, Dubai Health Authority, Dubai Roads and Transport Authority, Dubai Tourism, Dubai Police, Dubai Municipality, Dubai Smart Government, Department of Economic Development, Dubai Silicon Oasis Authority, and the Dubai Design District. The program is overlooked by the Smart Dubai Office.

### 6.1.1.3 Key Initiatives and Projects

The Smart Dubai roadmap has targeted the delivery of 1,000 services by 2017 across 100 initiatives. As of September 2016, it had documented more than 500 current and planned smart services and initiatives, of which 150 have been completed. The strategy is intended to dovetail into UAE-wide initiatives such as the National Innovation Strategy.

A selection of these projects include:

- **Create an open data platform.** The Dubai Data initiative claims to be “the most comprehensive city-wide data initiative,” and opens up data to the public and private sectors. Under the new Open Data Law, non-confidential data will be made available
to third parties so that they can develop new services. The Smart Dubai Platform is being developed to provide a tailored, government-wide integration platform for smart city projects.

- **Use smart mobility solutions to address the increased demand on transportation infrastructure.** Dubai is creating a unified traffic control center to manage the city’s connected traffic signals and data from sensors measuring traffic volume across the network. Traffic light sequences can be optimized to manage traffic volume at specific junctions in real time. Drivers will also be able to locate congestion and other information through a mobile app.

- **Build a smarter grid that encourages solar PV adoption.** To counter the city’s growing demand for power and water, the Dubai Energy and Water Authority is developing a smart grid and enabling residents to install solar PV panels on their rooftops. In addition, 250,000 smart meters are being installed in residential, industrial, and commercial properties by 2018 to help residents monitor and better manage their power and water consumption.

- **Digitize government services.** Dubai’s e-government initiatives are already advanced. Many services are now available on mobile devices; using a single ID, citizens can access these services, as well as track transactions, procedures, and payments through a personal account. The government has also launched its CloudOne platform, which provides IT infrastructure to government agencies across Dubai.

- **Improve well-being with smart health initiatives.** The Dubai Health Authority has invested in a number of technologies, including an m-health app that can locate the nearest doctor in an emergency and smart hospital beds that monitor patient vital signs. The Authority is also investigating in-home technologies to help care for patients in their own homes. It is now focusing on the open data program to develop new e-health services in partnership with third parties.

- **Create a smart police force.** The Dubai police department has investigated a number of cutting-edge technologies to deliver better services, including Google Glass and AI robots. However, the main focus of the initiative is more prosaic: its mobile app processes fine payments, makes appointments at police stations, provides certification services, and includes an SOS button.

- **Improve citizen access to digital services by providing 200 free Wi-Fi locations across the city.** Subscription-based Wi-Fi is widely available through service providers Du and Etisalat.

Smart Dubai is also working with the International Telecommunication Union and the Dubai Statistics Center to develop the Smart Dubai Index to evaluate and measure how facilities and services in the city are contributing to the Smart Dubai vision.
6.2 Contenders
6.2.1 Abu Dhabi, UAE

6.2.1.1 Summary
Abu Dhabi has emerged as a leader in terms of smart city strategy and project development, largely through its well-known infrastructure projects such as Masdar City. While the Masdar City development provided Abu Dhabi with high visibility, the city is now engaged in a broader range of projects across the emirate, including traffic management, security, and e-government. The Abu Dhabi Vision 2030 provides much of the framework for growth in the city, with a significant focus on energy, transportation, and water efficiency.

6.2.1.2 Strategy
Abu Dhabi is at the center of the UAE’s efforts to diversify the economy away from oil exports and toward large investments in ICT and alternative energy sources for the government and private sectors. An abundance of Free Trade Zones (offering 100% foreign ownership and zero taxes) are helping to attract an increasing number of foreign investors.

As the capital of the UAE and a major contributor to the country’s GDP, Abu Dhabi is the wealthiest emirate of the UAE in terms of GDP and per capita income. Abu Dhabi is also a fast-growing city—from 1960 until 2014, the city’s population has grown at an average annual rate of 9.5%, one of the highest in the world (the Abu Dhabi emirate population is around 2.8 million). The city’s economy grew an estimated 2.2% in 2015, despite a drop in oil prices.

Abu Dhabi’s smart city program has been most visible in a number of major infrastructure developments, namely the $27 billion Saadiyat Island multiuse development and the $18 billion Masdar City development. These developments, in particular Masdar City, focus on sustainable design, construction, and operations.

Abu Dhabi has also been developing a broader strategy for future urban development. The Abu Dhabi Economic Vision 2030 and Environment Vision 2030 provide much of the framework for growth in the city, with a significant focus on energy, transport, and water efficiency. The plan embraces a number of sustainability objectives. To support these goals, the Estidama initiative has been established. The overarching aim of Estidama, which is the Arabic word for sustainability, is to embed sustainable design and planning in Abu Dhabi’s goal of being the sustainability capital of the Arab world.
Utilizing the experiences from Masdar, as well as the expertise from these institutions and partnerships, has helped Abu Dhabi expand its smart city deployments outside Masdar City to include other areas in the city.

Utilizing clean energy sources is a key element of the UAE’s strategy and helps provide the framework for much of the country’s renewable energy deployments. The UAE has a target to generate 24% of its energy from renewables by 2021 and it is currently on track to exceed this goal.

6.2.1.3 Key Initiatives and Projects

The Abu Dhabi Systems and Information Center’s Digital Transformation Leadership Team is leading several e-government initiatives, including a project that will exchange information and geospatial data between numerous government agencies in the emirate. This is expected to result in increased collaboration, productivity, and enhanced quality of life for citizens. Abu Dhabi is implementing another initiative to digitally map addresses and rename streets, linking the system with a digital signage program. This project is expected to improve emergency response times and utility services through accurate monitoring and identification of maintenance issues (i.e., defective water pipes). CityGuard is a mobile application available to all Abu Dhabi residents. The app allows the public to report incidents and submit complaints directly to the government. CityGuard aims to increase civic participation and collaboration between the public and the government.

The Urban Planning Council has also developed a tailored information system called CitySense. CitySense supports decision-making through the integration of a diverse range of information on city operations and projects and the support for in-depth analysis of key issues and trends. Data sources include real-time sensors (e.g., traffic monitoring and air quality sensors), movement tracking (e.g., mobile phones and buses), and citizen reporting and other crowdsourced information.

Abu Dhabi has been actively developing several transportation and security initiatives. In July 2016, the Abu Dhabi Monitoring and Control Center launched the Falcon Eye security system, which uses thousands of CCTV cameras to monitor roads and highways and manage traffic flows in and around the city. The system also monitors and identifies traffic law offenders. Traffic violations such as speeding, use of the hard shoulder, illegal parking, and the misuse of roads can be detected with Falcon Eye. Abu Dhabi is also a participant in the UN’s Decade of Action for Road Safety 2011-2020, which targets the reduction of traffic accident fatalities worldwide.

The recently developed bus network in Abu Dhabi has significant demand and plans are being developed to supplement buses with a light rail and metro system. The Department of Transport in Abu Dhabi operates under transportation mobility management initiatives to develop effective mobility strategies for the city. Key measures of the strategy include Park and Ride installations; carsharing schemes; flexible working hour policies; and information,
awareness, and promotion of Department of Transport infrastructure. The Department of Transport has also initiated its Walking and Cycling Master Plan to double the number of dedicated pedestrian and bicycle paths by 2020. Other specific initiatives include bikesharing, expansion of parking stations close to public transport terminals, and exclusive bus lanes.

Masdar City is the most well-known smart city initiative in Abu Dhabi. The greenfield development near Abu Dhabi’s main airport broke ground in 2008 with the goal of building the world’s most sustainable eco-city. It is being built by Masdar, a subsidiary of Mubadala Development Company, with a majority of the funding originating from the Government of Abu Dhabi. Masdar City was established to be the center of a global cleantech cluster and serve as a testing ground and showcase for renewable energy and other clean technologies. Masdar City is organized around several key institutions, including the Masdar Institute of Science and Technology campus, a sustainably designed incubator building home to an estimated 370 companies. The city also serves as the permanent headquarters for the International Renewable Energy Agency.

The city is partially powered by a 10 MW solar power plant that produces 17,500 MWh of electricity annually and diverts 7,500 tons of CO₂ emissions per year. An urban core design is being utilized that helps keep the city cool by combining traditional Arabic architectural techniques with modern technology (the city captures prevailing winds to keep the urban center naturally cooler).

Building energy efficiency is another key initiative of Masdar City, as buildings must meet a minimum certification comparable to a Leadership in Energy and Environmental Design (LEED) Gold specification and are constructed with low-carbon cement and 90% recycled aluminum. In terms of transportation, Masdar City is designed to be highly walkable, eventually offering a combination of metro, light, group, and personal rapid transit, public bus routes, and bicycling lanes. As of the end of 2015, Masdar City was estimated to have roughly 8,600 residents and 12,000 people commuting from Abu Dhabi. The final population is expected to be around 40,000 with around 50,000 commuting into the city, but full completion is not expected until 2025.
6.2.2 Doha, Qatar

6.2.2.1 Summary

With a unique opportunity to reinvent itself as host of the World Cup, Qatar is embracing smart city projects and programs in order to meet the delivery of the event in 2022 and to leave a valuable legacy afterwards. Through this catalyst, Doha, the country’s capital, is being transformed into a smart economic and sustainable city underpinned by investment in ICT, city infrastructure, product innovation, and smart grids.

6.2.2.2 Strategy

Qatar is home to 2.55 million people, and with 98.8% of the population living in urban centers (one of the highest in the world), smart city initiatives are essential to ensuring sustainable development that safeguards natural resources.

To meet its goal of hosting a carbon-neutral World Cup in 2022, Qatar is planning $120 billion worth of large-scale, state-of-the-art infrastructure projects, such as a metro system, port, sports-related infrastructure and stadiums, as well tens of thousands of new hotel rooms and thousands of new restaurants to accommodate the expected 500,000 visitors to the event. A wave of investment has been undertaken to develop Doha as a smart economic and sustainable city through the application of ICT-based infrastructural platforms. The focus has been provided by national strategic documents such as the Qatar National Vision 2030 (QNV), National ICT Plan 2015, and the Qatar National Broadband Plan.

Currently, the Qatar Ministry of Information and Communications Technology is developing a Qatar Smart Nation Program (QSNP), a digital response to the ambitious goals that have been set out in the QNV, aiming to harness technology and innovation to drive economic diversification and improve quality of life in the country. QSNP will focus on five key areas: Transport, Healthcare, Logistics, Sports, and Environment. The QSNP will be detailed in a 5-year roadmap and use case catalogue.

The National ICT Plan 2015 aims to achieve a target of granting 95% of households access to affordable and high-quality broadband service of at least 100 Mbps by 2016. For e-government services, the plan targets having 100% of government services be available online by 2020.
6.2.2.3 Key Initiatives and Projects

Qatar’s ambitions to be a leader in smart city innovation are demonstrated in a number of high-profile developments. In the center of Doha, Msheireb Downtown Doha (MDD) is a QR20 billion ($5 billion) development that will revive the old commercial heart of the city through new architecture that is based on community living. The MDD project will blend traditional Qatari heritage and aesthetics with modern technology and focus on sustainability and harmony with the environment.

At the heart of MDD’s IT infrastructure is MDD Service Catalogue, which includes a broad range of services for citizens, tenants, and businesses operating in the downtown development. Services featured include citizen contact services, communications infrastructure, ICT services, community portals, and various government and third-party services. The citizen contact component will include MDD’s general information portal, social media integration, news and events, and a shops and restaurant directory. Msheireb Community Portal/Smart Estates will focus on the sustainability feature of a smart development. MDD Service Catalogue will also connect to external services in the fields of health, education, utilities services, and others.

Education City, a new district on the outskirts of Doha, will have research labs, educational facilities, student housing, offices, athletic facilities, and physical plant utilities, such as district cooling plants (DCPs). The city’s smart city strategy adopted the plan to utilize eight planned DCPs to connect into a ring network and provide cooling to connected customers. The employment of a ring network ensures that each customer is capable of receiving energy from one of two DCPs. The DCP network will be managed by an Intelligent Operations Center that monitors the DCP sensors indicating which customers are being served by which DCP. This smart city initiative will also avoid the need to build additional expensive energy substations as the Education City grows.

Beyond Doha, Lusail is the most significant greenfield smart city development in Qatar. A $5.5 billion development currently under construction with an intended population of up to 260,000 residents, the development will have marinas, residential areas, island resorts, commercial districts, shopping, and leisure facilities when it is completed.

The development has built-in environmentally responsive protection policies and a controlled development strategy to transform an existing raw tidal basin into a smart city with sustainable features (such as building design) that use a building’s mass and shade to reduce heat and the need for cooling mechanisms.

Lusail will use a common network infrastructure to integrate various services and systems and control them from the Lusail Command and Control Center (LCCC). LCCC is a world-class operations center supported by sophisticated data center capabilities. The operation center provides a central monitoring and management facility for all smart services across Lusail.
6.3 Challengers

6.3.1 Riyadh, Saudi Arabia

6.3.1.1 Summary

A key element of Saudi Arabia’s development strategy is the shift to a more knowledge-based economy. As part of this strategy, the capital Riyadh is the base for a number of smart city initiatives that are essential to this transformation. Developments like RTV and the city’s ITCC are helping Riyadh establish itself as hub of ICT and new city technologies. The government is also developing an overarching smart city plan for Riyadh that will further accelerate innovation. These diverse initiatives make the city an emerging contender for smart city leadership in the region.

6.3.1.2 Strategy

The strategy of national economic management for Saudi Arabia has been focused on the development of a knowledge-based economy in the recent years. With 83% of Saudi Arabia’s population urbanized, a transformation of the country’s cities—especially Riyadh, the capital—into smart cities is critical to this development.

As the capital, Riyadh is aiming to be at the forefront of this change. In 2003, the Metropolitan Development Strategy for Arriyadh Region (MEDSTAR) (2004-2030) was approved by the High Commission for the Development of Arriyadh. MEDSTAR is the strategic reference plan that regulates future development of Riyadh and all the factors influencing metropolitan development. It is a regulatory, structural, planning, and executive framework of all authorities working in the city.

To further facilitate this adoption, the country’s Ministry of Municipal and Rural Affairs launched a smart city initiative across the Kingdom to allow local governing authorities to use ICT to achieve the explicit goals of improving the quality of life of Saudi Arabia’s citizens and creating sustainable economic development. These goals will be achieved via improved service delivery, more efficient use of resources (human, infrastructure, and natural), and financially and environmentally sustainable practices that support economic development.

King Saud University has started to take an active role in setting up new Riyadh’s smart city node. A focal point of this development is the RTV project; other developments in the district include the King Abdulaziz City for Science and Technology, the ITCC, the Saudi Standards, Quality and Metrology Organization, and the King Abdullah Financial District.

Overall Score: 47.4
Strategy: 51.6
Execution: 42.8
6.3.1.3 Key Initiatives and Projects

Saudi institutions of higher learning have done much to enhance the development of knowledge centers. Major research centers and institutes at Saudi universities are directing a substantial part of their R&D activities toward issues related to building a Saudi knowledge society and providing a foundation for a strong Saudi knowledge-based economy. King Saud University is key to these developments and is promoting the concept of Riyadh Knowledge Corridor in the area of Prince Turki Alawal road. Through this project, King Saud University aims to support the requirements of knowledge-based industries and to commercialize its research outcomes.

The King Abdullah Financial District (KAFD) is another landmark project for Riyadh. One of the world’s largest green building developments and worth $11.6 billion, KAFD is a new development under construction near King Fahad Road in the Asahafa area of the city. The project is being undertaken by the Rayadh Investment Company on behalf of the Pension Authority of the Kingdom of Saudi Arabia. From the original 34 buildings planned in a 1.6 million m² project area, the district is now home to 112 buildings spread over a 12 million m² area, with more being added.

The KAFD has set a goal of limiting energy consumption to 50% of the average usage in the city of Riyadh. All landscaping within KAFD will feature shading devices (e.g., movable awnings, canopies, and tensile structures) that optimize ultraviolet protection and reduce solar heat gain while accentuating crucial urban nodes and entry points. Green roofs and intelligent lighting will further reduce energy consumption.

Riyadh’s $1.65 billion ITCC is being built to attract the world’s leading technology companies by offering world-class ICT services and infrastructure. The complex’s four landmark towers contain two R&D facilities, two business technology centers, a library, a college, and other facilities. The ITCC will achieve at least the basic LEED certification through the use of gray water recycling, low energy lighting, low energy air conditioning, and reduction in solar gain.

Telecommunications and service provider Orange has been working with the Rayadh Investment Company for almost 5 years to develop the KAFD and the ITCC. Orange has undertaken consultancy, design, and supervisory work for the implementation of telecommunications services (including fiber, TV, voice over IP [VoIP], and data centers) and value-added services for the city (e.g., smart buildings and smart metering).
6.3.2 Jeddah, Saudi Arabia

6.3.2.1 Summary

Jeddah has developed ambitious plans to prepare the city for its continued expansion over the next 20 years. Major investments in the city’s infrastructure and transportation services are core to this evolution. In particular, the development of a multi-modal transportation system can be a catalyst for Jeddah’s broader transformation into a smart city. In addition, plans to develop the city’s cloud and IoT capabilities signal an increasing focus on these important areas. Integrating smart technologies into infrastructure developments and new services will be key to developing a successful smart city strategy.

6.3.2.2 Strategy

Jeddah is the largest city in the Makkah Province of the Kingdom of Saudi Arabia and the second largest city in the country after Riyadh. It has a population of more than 3.5 million people, which is growing rapidly and expected to reach 6 million by 2020. The city is an important commercial center as well as the principal gateway to the holy cities of Mecca and Medina.

Jeddah’s strategic plan has been developed to manage the city’s expansion over 20 years. The plan takes an integrated approach to future development in the context of environmental, social, and economic factors. It provides the framework for policymaking and investment in the city. Closely aligned with the strategic plan is the Jeddah Transportation Master Plan, which addresses the pressures on the city’s transportation infrastructure. The transportation plan aims to reduce Jeddah’s dependency on private cars, increase mobility choices, and implement land use policies that support high-density, transit-oriented development.

6.3.2.3 Key Initiatives and Projects

A key area of improvement for the city is its transportation infrastructure. The Jeddah Public Transportation Program is a 7-year program approved by the government in 2013. The program lays out an investment strategy to develop the city’s transportation infrastructure to cope with a growing population and the city’s role as a tourism gateway and visitor center for pilgrims to the holy cities. Elements of the plan include a new metro network and new bus, rail, and tramway services. Connecting the whole system will be a new smart ticketing system and real-time travel information systems.

In April 2016, the city signaled its intentions to develop its smart city strategy with the signing of a memorandum of understanding with Nokia and the Saudi Arabian mobile network company Zain KSA. The agreement will see both companies working with the city
to exploit advanced networking, cloud computing, and IoT technologies to create a model smart city by 2018. The aim is to enable widespread connectivity for diverse smart devices. As part of the plan, Zain KSA will be enhancing its mobile broadband network in the city, with the plan to eventually provide 5G access while also expanding the utilization of small cells and Wi-Fi in the city to provide ubiquitous connectivity.

A major new development is the Jeddah Economic City (formerly Kingdom City) in Obhur, North Jeddah. The project will feature the Jeddah Tower, as well as approximately 5.3 million m² of new urban development. With a planned height reaching more than a kilometer, the tower will be the tallest in the world upon completion (now expected by 2020). One of the features of the tower is a high-performance exterior wall system that will minimize energy consumption by reducing thermal loads. Jeddah Economic City is expected to eventually accommodate around 210,000 residents and around 200,000 additional visitors. In October 2015, a memorandum of understanding was signed between the Jeddah Economic Company and French companies Engie and Suez to develop a roadmap for the provision of sustainable solutions for water and waste management, power generation and supply, city infrastructure, green mobility, and district cooling.

6.3.3 Sharjah, UAE

6.3.3.1 Summary

Sharjah is contributing to the UAE’s effort to diversify its economy away from oil by investing in ICT. In May 2016, the city announced plans to further develop its digital economy by establishing a digital government center. While Sharjah currently lacks a published smart city program, key initiatives are in the process of being developed. The city has ramped up its involvement with smart city projects through a smart waste program and other initiatives in government services, transportation, security, and wireless communications.

6.3.3.2 Strategy

With a population of 1.4 million, Sharjah is the third largest city in the UAE behind Dubai and Abu Dhabi. The city is a significant economic contributor to the UAE, accounting for over 6% of the nation’s total GDP. Sharjah has trade relations with over 125 countries and has embraced foreign investment in numerous sectors, including manufacturing, trade, and services. The Sharjah economy is well diversified and is one of the few in the region where no single sector contributes more than 20% of GDP. Notably, Sharjah accounts for roughly one-third of the UAE’s manufacturing sector.
While Sharjah currently lacks a comprehensive city-led approach toward smart city development, the UAE government has implemented several strategies to promote innovation. The UAE’s National Innovation Strategy requires all government agencies to cut spending by 1% and reallocate the money toward new research and innovation. A Dh 2 billion ($544.5 million) fund was created in 2015 to provide a key financing tool for startups and to support them with project implementation. Importantly, the UAE’s Ministry of Finance also guarantees commercial loans to finance projects.

An initiative to help develop Sharjah as a smart city is being led by the Sharjah Leadership Program (SLP) and the Sharjah Tatweer Forum, which have partnered to develop smart city initiatives. The partnership was announced in July 2016 and includes visits to California to discuss best practices with research centers, innovation conferences, and successful ICT companies. Specific smart city initiatives for Sharjah have yet to be outlined and will be based on proposed projects submitted by the leaders of the SLP.

### Key Initiatives and Projects

Sharjah was the first city in the Middle East to implement a solar-powered smart waste program. As of June 2016, the first 10 smart waste bins have been installed in the city. These bins offer open Wi-Fi access to the public, trash compaction via solar energy fed into an internal compactor (which allows the bins to collect 5 times more garbage before being emptied) and come equipped with sensors that notify operators when the bins are full. Several hundred Wi-Fi bins are expected to eventually be deployed as part of the program. The smart waste bins were designed and built by Bigbelly and installed by Bee’a, an environment and waste management company based in the Sharjah area. When full, the bins will be collected by Tandeef, the dedicated trash collection arm of Bee’a. Tandeef recently launched the Tandeef Smart Eco-fleet, which consists of electric waste management vehicles such as public cleaners, sweepers, and leaf collectors. Vehicles operating on compressed natural gas are also expected to be utilized. Additionally, most vehicles will be equipped with smart routing functionality and a GPS mapping system as part of the smart eco-fleet.

Safety and traffic mitigation are other key areas of focus for Sharjah. In August 2016, the city installed 10 new smart radar systems that detect, photograph, and fine drivers for illegal driving behavior. The systems monitor lane switching, use of the hard shoulder of the road, tailgating, speeding, and red light violations.

Sharjah has been active in increasing its investment in digital and broadband technologies. The city announced plans to establish a digital government center in May 2016. The Center of Excellence for Digital Government will be located within the American University of Sharjah Research, Technology and Innovation (RTI) Park. The primary purpose of the RTI park is to foster innovation and accelerate Sharjah’s development of its digital economy.
The first phase of the RTI Park is expected to be completed in 2018, with space to house roughly 200 companies. Additionally, in mid-2015, the Sharjah International Airport signed a strategic agreement with Nedaa to receive a new line of advanced digital wireless communications solutions. These communications solutions are expected to improve the efficiency of the airport’s operations and strengthen its security.

6.3.4 Muscat, Oman

6.3.4.1 Summary

Muscat was an early adopter of long-term smart city goals, but limited progress was made after the launch of its initial strategy in 2003. Muscat is now moving forward again. A number of e-government initiatives in the city will be boosted by recent efforts to improve IT literacy, and there is activity across a number of different departments. Muscat has made steady progress, but these initiatives are only a start. The city needs to pull together its different initiatives under an overarching strategic plan, examine the role of smart technologies, and develop policies that encourage private sector investment.

6.3.4.2 Strategy

Muscat is the largest and capital city of Oman, one of the more progressive Middle Eastern states. Ruled since 1970 by Sultan Qaboos bin Said Al Said, Oman has forged strong relationships with the wider world. While just under half of Oman’s GDP comes from oil, the country’s plan is to reduce this to 9% by 2020 by boosting its tourism and natural gas industries. Muscat had a population of just over 800,000 in 2015.

Muscat's smart strategy reaches back to the Digital Oman Strategy, which was endorsed in 2003. In 2008, Sultan Qaboos bin Said, the ruler of Oman, reiterated the need for the Omani government to digitize the delivery of services and simplify processes while improving the IT literacy of citizens. The Digital Oman Strategy was rebranded the e.oman strategy. The e.oman strategy is about laying the foundation stones that will enable smart services in the future through the promotion of IT literacy in the country and a focus on the enhancement of e-government and e-services. The strategy currently includes a limited focus on the deployment of smart technologies and opportunities offered by IoT. However, a number of initiatives are laying a foundation for smart services.
The most advanced strategy in Muscat is seen in urban redevelopment, which offers more of a greenfield opportunity for cross-disciplinary initiatives. The Madinat Al Irfan mixed-use urban redevelopment project will incorporate a number of smart city initiatives. Currently in the planning phase, the redevelopment asserts that it will transform Muscat by contributing 450 million-500 million OMR ($1.2 billion-$1.3 billion) to GDP. The redevelopment will use embedded sensors to introduce intelligent traffic light control, smart metering, and smart parking networks within the redevelopment zone.

6.3.4.3 Key Initiatives and Projects

Oman’s Information Technology Authority is responsible for the creation of a unified e-government architecture that enables departments to share IT infrastructure, applications, and data. Between 50%-70% of these services are estimated to be now available online.

The Omani government recognized that uptake of government e-services was being limited by low levels of IT literacy. In response, it distributed 100,000 free PCs to citizens. However, mobile penetration is high: half of citizens have a smartphone. Therefore, mobile transformation is seen as a key goal for the e.oman project. In 2015, 3.2 million people had access to mobile broadband. After the Oman Broadband Company (founded in 2014) signed a deal with Singapore’s ViewQwest in October 2015, 90% of homes in Muscat are planned to have access to fiber-based broadband services. Only 233,000 people had access to fixed broadband in 2015, but this figure is up from around 100,000 in 2012.

The country’s National e-Payment Gateway is a cross-departmental payment initiative that underpins a number of different services by providing a single, secure gateway for payments across services from multiple departments.

Oman’s eHealth Portal was launched in 2015 and offers over 100 services. Citizens who register with the service can use an Ask The Doctor function to diagnose symptoms, book medical appointments, view medical records online, search for healthcare facilities and pharmacies, and browse a library of health-related documentation.

Oman’s Open Data Portal is a platform for government departments to publish internal reports and statistics, rather than for other open data initiatives that seek to facilitate the creation of smart services. However, the Oman National Spatial Data Infrastructure project does aim to create a common platform for sharing data. The project focuses on geospatial data that will support a number of location-based government services, including the Tour Oman tourist app, GeoSmart Banking & Insurance, and the smart transportation app Waqudi.

Other smart transportation initiatives include a smart street light project that is being designed to incorporate cameras and sensors to support smart car parking and surveillance projects. The Mwasalat smart bus project aims to encourage the use of public transport.
transportation to reduce congestion and pollution by providing Wi-Fi, tourist information, real-time vehicle tracking, and an online ticketing app. In addition, the iMuscat smart parking app allows users to book parking spaces, send feedback on traffic conditions, and lodge complaints.

Oman is also branching out into renewable energy with its wind farm at Harweel in the south of the sultanate and a 1 GW solar PV installation—one of the world’s largest—at Miraah. This installation will produce steam for the oil industry.

6.3.5 Yanbu, Saudi Arabia

6.3.5.1 Summary

The city of Yanbu is a key part of Saudi Arabia’s national industrialization plans. The industrial city provides the basis for the country’s program to develop hydrocarbon-based and energy-intensive industries. It is now planning its evolution to a smart city. The first stage in this transformation has been the deployment of a core communications infrastructure and related services; the city is also becoming a focus for energy efficiency and renewable energy programs. Yanbu has the potential to become a pathfinder for smart city innovation in Saudi Arabia if it can build on this initial investment.

6.3.5.2 Strategy

In 1975, King Khalid assembled the Royal Commission for Jubail and Yanbu (RCJY) to develop and execute an infrastructure plan that would transform the town of Jubail, as well as the port settlement of Yanbu on the Red Sea, into the country’s premier petrochemical industrial cities.

The massive investment in this industrial city has as its major objective a reduction in Saudi Arabia’s dependence on oil revenue by gaining access to the world's petrochemical markets. This route to industrialization exploits the Kingdom's natural advantages in terms of cheap energy and cheap raw materials for petrochemical manufacture.

The Yanbu Industrial City overseen by RCJY supports an economic population of around 117,000, which is growing at around 5% a year. To support this expansion and to meet its environmental goals, the RCJY is focused on a program for “Greener Economic Development.” RCJY aims to develop the technological and social infrastructure in Yanbu to support three pillars of this strategy:

- **Residents (Quality of Life):** Including provision of broadband communications, eHealth, community portal, and home automation
• **Business (Enterprise Control):** Including smart metering, CCTV and security systems, and environmental monitoring

• **Public (Services Delivery):** Including traffic controls, public lighting, irrigation, and city operation centers

RCJY also has established its own dedicated energy efficiency task force (EETF) with the aim of improving sustainability across all city sectors. EETF initiatives include a reduction of power consumption in schools, the deployment of LED and solar-powered street lighting, the implementation of green building codes, and a rooftop solar program.

### 6.3.5.3 Key Initiatives and Projects

The RCJY signed a 20-year deal in 2013 with local telecommunications firm Bayanat-Mobily to aid the transition of Yanbu to a smart city. The first phase covers the development of the telecommunications infrastructure in the city. Subsequent phases will include the development of smart electricity grids and solar energy programs.

The first phase included the development of a 3,000-km long fiber network providing the capacity to accommodate the future residential, commercial, and industrial expansion of the city. Two data centers are being developed to provide the control and management of smart city applications as well hosting services to businesses in the vicinity. The RCJY also created the Wireless Network (MESH) project initiative to provide wireless Internet access for public areas of the city.

Deployed public services for Yanbu include a community portal and a mobile app (Yanbu Eye) for citizen reporting and engagement. There is also a unified operations center for building management and other services including firefighting and irrigation management. Yanbu is also deploying traffic management and CCTV systems.

In September 2016, Huawei and RCJY signed a memorandum of understanding to support development of smart city technologies in Yanbu. The two parties will design a joint strategy, which will include the development of a smart city competency center. The center will be responsible for research, development, deployment, operation, and maintenance of smart city technologies in Saudi Arabian cities.

The RCJY and the King Abdullah City for Atomic and Renewable Energy organization signed a cooperation agreement to prepare a feasibility study on the construction and operation of a solar plant in Yanbu with a capacity of 50 MW. Solar development is part of the Royal Commission’s Clean Development Mechanism to develop and utilize clean and renewable energy sources. In addition, the mechanism is targeting the replacement of sodium vapor street lights in the city with LED technology, which will result in a significant savings in electric power consumption and maintenance and a reduced carbon footprint.
6.3.6 Manama, Bahrain

6.3.6.1 Summary

Though Manama does not yet have a distinct smart city strategy, there are opportunities to build on Bahrain’s investment in e-government services and its open data portal. Manama and the Bahrain government are working toward the development of smart city policies and plans for the transportation, utilities, healthcare, and retail sectors. Bahrain’s particular challenges associated with the impacts of climate change are also key drivers for increasing interest in smart cities technologies.

6.3.6.2 Strategy

As the capital and largest city in Bahrain, Manama has a population of roughly 157,000 people. Manama’s development as a city is being guided by Bahrain’s Economic Vision 2030, which outlines three main principles:

- **Sustainability**: Preserving Bahrain’s environment and cultural heritage
- **Competitiveness**: Raise productivity and wages
- **Fairness**: Spread prosperity broadly across the population

The primary sectors prioritized for development under the 2030 Vision include financial services, professional and industrial services, logistics, education and training, manufacturing (e.g., aluminum, food and beverage, chemicals and plastics), and ICT.

Bahrain has a strong commitment to the development of ICT infrastructure. In 1995, Bahrain was the first country in the Middle East to launch an Internet service, and in 2006 it was the first to launch 3G and 3.5G high-speed mobile broadband services. In 2013, Bahrain launched a nationwide high-speed 4G network, enabling download speeds up to 100 Mbps faster than its previous 3G mobile network. Although the country has a strong commitment to ICT and is strategizing to further diversify its economy, Bahrain remains heavily reliant on petroleum, which accounted for 87% of budget revenue and 19% of GDP in 2012.

Through hosting several international conferences, Bahrain is developing strategies for smart city development. The Bahrain International eGovernment Forum in 2015 included officials from the European Union, the National Association of Software and Services Companies, and leading smart city suppliers (such as Microsoft). These partners shared experiences and expertise on topics such as ICT, open government data, digital strategy, and strategic technology trends.
Additional smart city strategies in Bahrain include the outsourcing of certain non-core government services to reduce costs and increase the quality of public services, and improving the planning processes for land utilization, transportation networks, electricity supplies, and safety and security measures.

6.3.6.3 Key Initiatives and Projects

There are several key challenges facing Bahrain that are leading to an increased interest in smart city technologies, namely waste accumulation and the country’s high susceptibility to the impacts of climate change. The country is having significant difficulty managing an increasing amount of waste, largely due to the limited land area available for landfills. As a result, Bahrain is moving toward privatizing more municipal and solid waste operations in an effort to increase efficiency and lead to more sustainable and integrated solid waste management programs.

Manama’s high summer temperatures and low-elevation island locale make it particularly vulnerable to severe flooding and high temperature risks associated with climate change. In response, Bahrain has taken steps to implement the UN’s Framework Convention on Climate Change and has adopted strategies including changing consumption patterns, enhancing awareness, and climate adaptation to implement the convention. The government of Bahrain is a signatory to the COP 21 Paris agreement and is targeting the improvement of transit infrastructure and the adoption of renewable energy resources as key objectives. Manama has installed a wind turbine on the World Trade Center in the city, and Bahrain has developed a national wind power assessment and implemented several other pilot solar and wind installations. Average annual solar radiation available in Bahrain is around 2,600 kWh/m²/year, giving the country strong potential to greatly increase its utilization of solar resources.

Bahrain’s Ministry of Transportation and Telecommunications (MTT) is the government body responsible for the development and regulation of the country’s transportation and telecommunications infrastructure and systems. Some of the strategic objectives of the MTT include providing high-quality public transportation services across the country that are affordable for all residents; enhanced land connections between Bahrain and its neighboring Gulf states; and the development of the port operations sector to establish itself as a major transshipment hub in the Gulf region.
6.4 Followers

6.4.1 Kuwait City, Kuwait

6.4.1.1 Summary

Although Kuwait City has made progress on its government services and communications infrastructure, it has some way to go to establish a smart city strategy that can support the city’s transformation and the country’s need for diversification. Mobile penetration is high in the city, and the Kuwait government has implemented a number of e-government services. This sets a foundation layer on which the city can build some truly smart services. However, a strong policy framework and partner network is required to deliver an effective smart city strategy.

6.4.1.2 Strategy

Kuwait City is both the capital and largest city in Kuwait. The country’s economy is heavily reliant on oil; Kuwait is estimated to own 6% of global oil reserves, and oil accounts for over 50% of the country’s GDP and 94% of its export revenue. Despite the recognition of its need to diversify its economy, the country is still in the early stages of introducing policies and programs necessary to support that evolution. Kuwait City is a microcosm on the country’s reliance on oil, and its evolution from a primary role as a functional hub for the oil industry will be key to that broader transformation.

However, there are some signs of progress. While the country remains heavily reliant on fossil fuel-based generation, it is starting on the transition toward renewables. While its targets are modest by international standards—15% of its power demand will be met with renewables by 2030—it is laudable that an economy so reliant on oil & gas has begun this transition. Part of the country’s plan includes the construction of 100 solar-powered fueling stations by 2020.

6.4.1.3 Key Initiatives and Projects

The most significant Kuwait smart city project of recent times is the proposed $4 billion development of South Saad Al Abdullah in Jahra, located 40 km to the west of Kuwait City. The development will cover 59 km² and include 30,000 housing units. The developers claim it will be one of first Middle Eastern city to be environmentally friendly and smart. The environmentally friendly aspect of the development mostly relates to the developers considering the use of solar to power homes; the smart aspect relates to broadband connectivity. While this is a large and exciting urban development project, it lacks the smart city characteristics and wider ambitions of other new developments in the region.
Kuwait has made progress on e-government and offers its citizens a number of services online, including online utility and telecom bill payment, online fine payments for traffic offenses, and visa-related services. Mobile penetration is high in Kuwait, but fixed broadband and fiber are not. The country’s communications regulator, Communication and Information Technology Regulatory Authority (CITRA), was established in 2014. According to CITRA, while the country had 8.3 million mobile subscribers in 2015, there are only 570,000 fixed broadband subscribers. While a national broadband plan is one of CITRA’s objectives, it has thus far released little information on its plans for national broadband infrastructure.

6.5 Other Notable Smart City Projects

In addition to the smart city programs examined in detail in this assessment, a number of other initiatives have been instigated in the Gulf region and in neighboring or closely aligned countries. Some of the most relevant developments are highlighted here.

6.5.1 Tehran, Iran

In 2015, Tehran established the first The Things Network (TTN) gateway in the Middle East. The first phase of the project was launched in Narmak, northeast of Tehran, and will eventually cover the whole of Tehran with an estimated 10 gateways throughout the city. Access to the open crowdsourced data network is expected to encourage IoT development and innovations in various areas. The TTN is a global community of more than 2,000 people in over 40 countries building a global IoT data network. TTN uses a long-range and low power radio frequency protocol (LoRaWAN) for long-range communications, and Bluetooth for short-range communications.

6.5.2 Amman, Jordan

In recent years, Amman has announced various plans to become a smart city, especially in the areas of infrastructure development and government system modernization. Amman faces climate-related challenges such as floods, and an influx of refugees is putting extra pressure on the city to address its infrastructure problems.

In 2014, Amman joined the 100 Resilient Cities Network, in which each city is eligible to receive grant funding to hire a chief resilience officer to lead the city’s resilience strategy. Also in 2015, Amman was selected as one of 33 finalist projects for the C40 Cities Awards. Additionally, the municipality signed a 3-year agreement with Optimiza, which will leverage its partnership with Microsoft to provide the city with enterprise business solutions to enhance productivity and facilitate workflow.
6.5.3 Karachi, Pakistan

Karachi, the capital of the Sindh province in Pakistan, is set to become the first smart city in the country. The city plans to introduce smart LED street lighting equipped with Wi-Fi units and CCTV cameras. The total cost of these projects is estimated to be $200 million. The Government of Sindh signed a memorandum of understanding with three companies based in Dubai, China, and the United States in 2015 for the installation of systems in 2015.

The connectivity and data will not only contribute toward technology advancement but will help prevent and monitor criminal activities as well. Police and law enforcement agencies can benefit from the CCTV systems. In addition, the government aims to eventually implement solar energy to power the city’s street lights.

Smart city concepts are also being adopted for new real estate developments in Karachi like Bahria Town Karachi and the Defence Housing Authority City Karachi.

6.5.4 Lahore, Pakistan

Lahore is the second largest city in Pakistan, and smart mobility has been one of its key areas of interest. While Lahore’s population grows steadily, the transportation demands placed upon it will increase at a faster rate. In 2010, the Government of Punjab requested the Japan International Cooperation Agency (JICA) to conduct a study on Lahore’s urban transport system. The study proposed a Long Term Urban Transport Master Plan up to 2030 and an Action Plan for priority projects up to 2020. Following the recommendations of JICA, Lahore has developed the country’s first bus rapid transit (BRT) system. Officially known as Lahore Metro Bus System, the project went into operation in February 2013. The project cost $303.6 million, which is significantly lower than other BRT projects around the world. Lahore continues to work on its urban transport master plan projects, which includes a planned rail-based public transportation system.

6.5.5 Islamabad, Pakistan

Islamabad, the capital of Pakistan, will be home to the first new development smart city in the country. Called Capital Smart City, the development will be located 4.4 km away from the new Toll Plaza of Islamabad. This is a joint venture among three entities from Pakistan and China, as well as developers and designers from the United States, United Kingdom, Singapore, and China. The city will include residential, farmhouse, education, entertainment (including a Disney Land resort), and commercial and health zones. Islamabad has also set out to launch a road infrastructure rehabilitation project in 2015, which will feature LED lighting and improved parking facilities. The development currently has a multitude of road and building construction as well as street lighting installation projects in progress.
6.5.6 Jubail, Saudi Arabia

The development of Jubail was instigated by the establishment of the RCJY in 1975. Jubail has grown into Saudi Arabia’s largest petrochemical center, responsible for approximately 70% of the Kingdom’s non-petroleum exports.

Given the city’s industrial focus, a key area for innovation has been in the area of automated asset management, including advanced building management systems. The RCJY has also invested in transportation systems with a single traffic monitoring and management center for the city.

Other areas of activity include the use of sensor technologies to monitor air quality and weather conditions. The 10 fixed stations are operating around the clock to collect air samples every 5 minutes, which are analyzed and sent to a central computer room as well as to two mobile stations for emergency cases. This is part of a program to monitor the city’s environment and maintain public health while maintaining Jubail’s growth as an industrial and residential center.

Jubail is looking to build on its investment in industrial and transportation infrastructure through further development of smart city capabilities that exploit the potential for ubiquitous connectivity. In September 2016, the RCJY signed an agreement with Huawei to collaborate on the development of smart city technologies that will enable the interconnection of every element of city operations.

6.5.7 King Abdullah Economic City, Saudi Arabia

The $86 billion KAEC development is one of four special economic zone cities being developed in Saudi Arabia. A private development listed on the Saudi stock exchange with $2.5 billion in paid-up capital, KAEC was conceived as Saudi Arabia’s Silicon Valley. KAEC’s developers have promised a smart city that is 7-24-60, as in services that are available 7 days a week, 24 hours a day, and are ready within 60 minutes.

KAEC spans an area of 168 km² and is expected to host a population of 2 million people. The venture’s vision is to create “a world class, fully integrated economic city,” focusing on manufacturing and logistics, shipping, light and processing industry, and financial services. KAEC has delivered approximately 15% of its development thus far, including a working port, residences, and community support projects like schools, hospitals, markets, and commercial buildings.

Implementing smart transportation systems and solutions is the initial focus for KAEC’s smart city strategy. Pilot tests of shipping container sensors are underway, which allow the tracking of palettes and containers through the distribution process in order to reduce costs and improve security, safety, and quality assurance. KAEC is keen on employing similar smart systems in areas such as traffic management, public transportation scheduling, congestion pricing, and driverless car systems.
The city will be wired with high-speed broadband infrastructure, while all urban operations will be managed through Integrated Operations Centers meant to act as the brain of the city. The local telecoms provider Mobily will provide advanced infrastructure for integrated telecommunications services, as well as data transmission services and a fiber optic network.

6.6 Summary of City Scores

Table 6.1 Gulf States Smart Cities Index Overall Scores

<table>
<thead>
<tr>
<th>Rank</th>
<th>Company</th>
<th>Score</th>
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</thead>
<tbody>
<tr>
<td>1</td>
<td>Dubai</td>
<td>80.5</td>
</tr>
<tr>
<td>2</td>
<td>Abu Dhabi</td>
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<td>3</td>
<td>Doha</td>
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<td>Sharjah</td>
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</tr>
<tr>
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<td>Muscat</td>
<td>43.3</td>
</tr>
<tr>
<td>8</td>
<td>Yanbu</td>
<td>42.6</td>
</tr>
<tr>
<td>9</td>
<td>Manama</td>
<td>35.2</td>
</tr>
<tr>
<td>10</td>
<td>Kuwait City</td>
<td>23.6</td>
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(Source: Navigant Research)

Figure 6.1 City Scores on Strategy and Execution Criteria

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<tr>
<th>Strategy</th>
<th>Assigned Weight</th>
<th>Abu Dhabi</th>
<th>Doha</th>
<th>Dubai</th>
<th>Jeddah</th>
<th>Kuwait City</th>
<th>Manama</th>
<th>Muscat</th>
<th>Riyadh</th>
<th>Sharjah</th>
<th>Yanbu</th>
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<tbody>
<tr>
<td>Smart City Vision</td>
<td>20%</td>
<td>74.0</td>
<td>68.0</td>
<td>94.0</td>
<td>46.0</td>
<td>20.0</td>
<td>24.0</td>
<td>38.0</td>
<td>54.0</td>
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<td>Digital Innovation</td>
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<td>88.0</td>
<td>50.0</td>
<td>28.0</td>
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<td>48.0</td>
<td>50.0</td>
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</tr>
<tr>
<td>Service Innovation</td>
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<td>80.0</td>
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<th>Execution</th>
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<th>Doha</th>
<th>Dubai</th>
<th>Jeddah</th>
<th>Kuwait City</th>
<th>Manama</th>
<th>Muscat</th>
<th>Riyadh</th>
<th>Sharjah</th>
<th>Yanbu</th>
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<tbody>
<tr>
<td>Implementation</td>
<td>20%</td>
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<td>40.0</td>
<td>50.0</td>
<td>50.0</td>
<td>40.0</td>
</tr>
<tr>
<td>Digital Delivery</td>
<td>30%</td>
<td>70.0</td>
<td>63.3</td>
<td>80.0</td>
<td>36.7</td>
<td>26.7</td>
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<td>40.0</td>
<td>40.0</td>
<td>36.7</td>
</tr>
<tr>
<td>Service Delivery</td>
<td>30%</td>
<td>60.0</td>
<td>50.0</td>
<td>74.0</td>
<td>42.0</td>
<td>24.0</td>
<td>36.0</td>
<td>42.0</td>
<td>42.0</td>
<td>46.0</td>
<td>38.0</td>
</tr>
<tr>
<td>Environmental Impact</td>
<td>10%</td>
<td>60.0</td>
<td>52.5</td>
<td>60.0</td>
<td>37.5</td>
<td>25.0</td>
<td>25.0</td>
<td>42.5</td>
<td>35.0</td>
<td>40.0</td>
<td>37.5</td>
</tr>
<tr>
<td>Community Reach</td>
<td>10%</td>
<td>70.0</td>
<td>56.7</td>
<td>80.0</td>
<td>43.3</td>
<td>26.7</td>
<td>33.3</td>
<td>43.3</td>
<td>46.7</td>
<td>50.0</td>
<td>40.0</td>
</tr>
<tr>
<td>Total</td>
<td>100%</td>
<td>66.0</td>
<td>56.9</td>
<td>77.2</td>
<td>39.7</td>
<td>24.4</td>
<td>35.6</td>
<td>40.2</td>
<td>42.8</td>
<td>44.8</td>
<td>38.2</td>
</tr>
</tbody>
</table>

(Source: Navigant Research)
Section 7

SCOPE OF STUDY

Navigant Research has prepared this white paper to provide an independent analysis of the current development of smart cities in the Gulf region of the Middle East. The report is intended for city leaders and managers responsible for smart city projects, government agencies and other bodies supporting cities, and for suppliers seeking to better understand the smart city market.

The major objective of this Navigant Research white paper is to provide a timely assessment of the leading smart cities in the Gulf region, including their strategy for smart city development and their execution against that strategy. Note that the city rankings capture the city's standing at the time of the report and are not a retrospective of past accomplishments or an indication of future success. The ratings are likely to change rapidly as cities accelerate their smart city plans and projects.

SOURCES AND METHODOLOGY

Navigant Research's industry analysts utilize a variety of research sources in preparing Research Reports. The key component of Navigant Research's analysis is primary research gained from phone and in-person interviews with industry leaders including executives, engineers, and marketing professionals. Analysts are diligent in ensuring that they speak with representatives from every part of the value chain, including but not limited to technology companies, utilities and other service providers, industry associations, government agencies, and the investment community.

Additional analysis includes secondary research conducted by Navigant Research's analysts and its staff of research assistants. Where applicable, all secondary research sources are appropriately cited within this report.

These primary and secondary research sources, combined with the analyst's industry expertise, are synthesized into the qualitative and quantitative analysis presented in Navigant Research's reports. Great care is taken in making sure that all analysis is well-supported by facts, but where the facts are unknown and assumptions must be made, analysts document their assumptions and are prepared to explain their methodology, both within the body of a report and in direct conversations with clients.

Navigant Research is a market research group whose goal is to present an objective, unbiased view of market opportunities within its coverage areas. Navigant Research is not beholden to any special interests and is thus able to offer clear, actionable advice to help clients succeed in the industry, unfettered by technology hype, political agendas, or emotional factors that are inherent in cleantech markets.
NOTES

CAGR refers to compound average annual growth rate, using the formula:

\[
\text{CAGR} = \left( \frac{\text{End Year Value}}{\text{Start Year Value}} \right)^{\left(\frac{1}{\text{steps}}\right)} - 1.
\]

CAGRs presented in the tables are for the entire timeframe in the title. Where data for fewer years are given, the CAGR is for the range presented. Where relevant, CAGRs for shorter timeframes may be given as well.

Figures are based on the best estimates available at the time of calculation. Annual revenues, shipments, and sales are based on end-of-year figures unless otherwise noted. All values are expressed in year 2016 U.S. dollars unless otherwise noted. Percentages may not add up to 100 due to rounding.
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Note: Editing of this report was closed on October 13, 2016.