Monitor
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Smart cities…
Not just the sum of its parts

In the Middle East since 1926

Smart cities: Where to?

Monitor Deloitte, Deloitte's strategy consulting practice, expects that in 2015 and beyond, the number and value of smart city initiatives will expand substantially. The majority of new smart city projects globally will continue to be led by a few European cities. However, as new smart city projects continue to develop and are further tested and scaled up, other cities will adopt pre-tested solutions to drive smart cities growth. Much of the expansion will occur in North American and advanced East Asian cities, followed by cities in the GCC. Although industry estimates as to the market value of smart cities vary greatly, there is no doubt that the smart cities market will increase significantly over the next five years to be anywhere from over US$400 billion[1] to over US$1.5 trillion[2] by 2020.

Substantial attention has been paid internationally to how new technological innovations can be used to solve the problems of modern cities. Governments and developers are increasingly adopting "smart" solutions in areas from traffic control to waste management. However, it is important for governments (and residents) to understand that the adoption of new technology does not necessarily make a city "smart." Rather, cities need to ensure that the soft infrastructure underpinning the smart transformation creates an environment that facilitates truly smart development.

The movement towards smart cities is growing, but there still isn't an accepted international definition

As "smart" technology proliferates around the globe, the movement within cities to apply these innovations to the most pressing problems has given rise to the concept of a "smart city" – a city, in common parlance, which uses information and communication technology (ICT) to improve its sustainability and efficiency and its services.

Smart cities market will increase significantly over the next five years to be anywhere from over US$400 billion to over US$1.5 trillion by 2020

Despite this common theme, there is no widely accepted, authoritative definition of what constitutes a "smart city," and the rules governing its use are ambiguous at best. Both ISO (International Standards Organization) and ITU (International Telecommunications Union) have recently published definitions and Key Performance Indicator (KPI) dimensions for smart cities (See boxes). However, these are both still in the process of being developed and finalized, and the KPIs that have been chosen are only categories for measurement rather than quantitative targets.

From a citizen-consumer standpoint, this is problematic because there is no metric with which to hold city authorities accountable. From an analytical perspective, it makes it difficult for businesses and individuals to understand just what the opportunities in the market are, since virtually any new technology intended for public use can be labelled a "smart solution." Still, there are a few key components of smart city development that have matured over the last several years and are becoming important components in several smart cities around the world.

ISO 37120, Sustainable development of communities — Indicators for city services and quality of life[3]

Description:
ISO (International Standards Organization) is developing an internationally validated definition for smart cities. ISO 37120, the first set of guidelines, was published May 2014; the full version, ISO 37101, *Sustainable development and resilience of communities*, is expected to be completed in 2016.

ISO 37120 provides a uniform definition of what is measured and how the measurement is to be undertaken, but it does not provide thresholds or target numerical values.

KPI areas:
- Economy
- Recreation
- Education
- Safety
- Energy
- Shelter
- Environment
- Solid waste
- Finance
- Transportation
- Fire and emergency response
- Telecommunication and innovation
- Governance
- Transportation
- Health
- Urban planning
- Waste water
- Water and sanitation

ITU's Focus Group on Smart Sustainable Cities (FG-SSC)[4]

Description:
ITU defines the purpose of FG-SSC as "an open platform for smart-city stakeholders – such as municipalities; academic and research institutes; non-governmental organizations (NGOs); and ICT organizations, industry forums and consortia – to exchange knowledge in the interests of identifying the standardized frameworks needed to support the integration of ICT services in smart cities."

FG-SSC amalgamated over 100 smart city definitions to create one comprehensive definition:
"A smart sustainable city is an innovative city that uses information and communication technologies (ICTs) and other means to improve quality of life, efficiency of urban operation and services, and competitiveness, while ensuring that it meets the needs of present and future generations with respect to economic, social and environmental aspects."

In December 2014, FG-SSC decided on KPI categories for SSCs. The KPI Dimensions and Sub-Dimensions are:

Dimension	Sub-dimension
Information and communication technology	Network and access
	Services and information platforms
	Information security and privacy
	Electromagnetic field
Environmental sustainability	Air quality
	CO_2 emissions
	Energy
	Indoor pollution
	Water, soil and noise
Productivity	Capital investment
	Employment
	Inflation
	Trade
	Savings
	Export/import
	Household income/consumption
	Innovation
	Knowledge economy
Quality of life	Education
	Health
	Safety/security public place
	Convenience and comfort
Equity and social inclusion	Inequity of income/consumption (Gini coefficient)
	Social and gender inequity of access to services and infrastructure
	Openness and public participation
	Governance
Physical infrastructure	Infrastructure/connection to services – piped water
	Infrastructure/connection to services – sewage
	Infrastructure/connection to services – electricity
	Infrastructure/connection to services – waste management
	Connection to services – knowledge infrastructure
	Infrastructure/connection to services – health infrastructure
	Infrastructure/connection to services – transport
	Infrastructure/connection to services – road infrastructure
	Housing – building materials
	Housing – living space
	Building

Major growth components of the new smart city

Smart solutions have emerged for a wide range of city infrastructure and services problems. The idea pushing these transformative components forward is the pursuit of greater efficiency and lower costs for governments, businesses, and consumers through the adoption of new and improved technology. While the number of smart solutions that have been developed is huge, a broad global scan reveals several major components of smart city infrastructure and services that have received significant attention.

Transportation

Traffic is a problem, if not a full-blown crisis, in major cities around the world, and attention has been focused on how to use new and emerging technologies to improve the traffic situation. Examples of smart solutions in this area include the installation of road sensors to measure the flow of traffic and provide real-time traffic reports; sensors in parking lots that inform app users where free spots are; and public transportation apps that tell you when the next bus or subway will arrive. A prime example is the congestion charge in London, which uses cameras on traffic lights to take pictures of every license plate going in and out of the city, linked up to an online pay system.

Government planning, administration, and operations

City authorities are tapping into the opportunities created by better technology to make municipal services and operations faster, simpler, and more cost-efficient. For example, governments can now create central knowledge systems that amalgamate information and data from all departments, providing residents with quick, easy access to government information and services. In New York City, the Mayor's Office created 311, a centralized system of all government information and non-emergency services that can be accessed online, or via text, call, or app.

Multi-trillion-point data sets and the Internet of Things are shifting the possibility frontier forward, and smart cities are a chief beneficiary of this

Big, open data

Multi-trillion-point data sets and the Internet of Things are shifting the possibility frontier forward, and smart cities are a chief beneficiary of this. Building a smart grid, either within a small area or across a whole city, can provide city authorities with a wealth of information on its residents' activities and needs, creating opportunities to improve services or build new ones. Smart grids are still new and few places have them city-wide. Still, the installation of sensors to measure individual areas (e.g., traffic) is already delivering huge results.

Energy and water efficiency

Going "green" is a huge trend globally, and many of the smart solutions being piloted are, at least in part, designed to positively impact the ecological footprint of the city and its residents. For example, reducing water use and waste through metering systems or pressure sensors in the water supply network to detect leaks, prevent overflow, or more efficiently manage water distribution. In Vienna, eco-friendly public trams can automatically adjust their heating and cooling systems based on the time of day, the heat outside, and the number of people in the car.

It is important to note that these major component areas have a significant amount of "cross-pollination." Traffic sensors work because of big data, and have a positive impact on pollution levels; big, open data helps governments improve services by better understanding citizens' needs. Because of this, a single smart solution has the possibility of creating positive outcomes in a variety of ways. It is therefore important to ensure the right systems underpin these technology innovations so that they work together and deliver greater results than possible as isolated initiatives.

The 10 drivers of success for smart cities

One of the most salient challenges for the development of smart cities is not the creation of new technologies, but changing the way that governments and organizations operate through technological innovation to make better, more efficient cities. The real benefit of smart cities is not the individual solutions, but the government-led creation of a holistic system where all solutions work together.

Thus, smart cities need to make sure they build the right 'soft' infrastructure to underpin their smart solutions. Monitor Deloitte has identified 10 important features that drive the success of smart cities, allowing for an integrated, responsive, forward-looking, well-implemented, efficient public ecosystem for the development of a smart city.

The real benefit of smart cities is not the individual solutions, but the government-led creation of a holistic system where all solutions work together

1. A clear vision

The city government should develop a holistic plan for smart city development to ensure projects are being rolled out effectively and serve a larger goal. Best practice for this driver is to establish defined objectives and priorities, and KPIs for each; a funding plan with financing options and a realistic estimation of short- and long-term costs; a clear business case for all projects; and a plan for facilitating communication and coordination between all stakeholders, both public and private.

There has been mixed success in this area. Many cities that are making smart transitions have developed a strategic plan, but the comprehensiveness varies, as does the length of future vision, plans for funding sources, and the extent to which it is actually a true plan and not simply a vague vision.

2. Public-private partnerships

Public-private partnerships (PPPs) can provide financing for cash-strapped municipalities to undertake innovative projects that would otherwise be out of reach. It can also give the private sector a guaranteed consumer on which to test new products. However, as with any use of public funds, governments must implement strong control systems to ensure they and their citizens are not defrauded.

Public-private partnerships have become a common feature of many smart cities around the world. Barcelona has had a series of successful PPPs: Cisco and Schneider partnered with the city to build an innovation district; Telefonica and abertis worked to integrate municipal ICT networks; and Endesa is working to upgrade the power supply system.

3. Integrated organization

In most city governments today, there is limited connectivity between each department. This silo mentality means that different projects are often disjointed and non-cohesive. A successful smart city must build a unified organization with the authority to coordinate, and potentially integrate, different city departments and effectively manage the multiple stakeholders involved in the smart city transformation. If city departments implement smart solutions individually, any new tools, devices, or platforms will be unintegrated, minimizing the compound effects.

A good example of a unified structure is the Center of Operations in Rio de Janeiro, which is a central command center coordinating the city's emergency response resources. It has coordinated the activities of more than 30 municipal departments, integrating their activities into a single location, and monitoring dozens of data feeds in real time in order to respond to needs and anticipate emerging threats.

4. Efficient smart city platform

The utilization of big data is dependent on implementing an effective software platform that can capture, manage, analyze, and display information. It should have a defined rationale for how it sorts and manages data. Otherwise, given the astronomical quantity of data that will be collected, it will be of no functional use, or its use will be limited by a lack of transferability to other systems.

The Greater London Authority has created the London Dashboard, a centralized data repository that is presented to Londoners free of charge. The data is organized around key public services, and Londoners are encouraged to develop the raw data into new datasets, apps, websites, etc. The centralized information about public services and city data encourages transparency and better management by city authorities, and allows entrepreneurial individuals to use the data to develop new apps and services.

Technology adoption should not be an end in itself, but should be used to address the major pain points of the city, such as mobility, energy, water, public services, and so forth

5. Strong citizen engagement

Citizens can provide invaluable feedback for the betterment of existing services and the development of new ones. Smart city authorities should educate and inform citizens about the smart transformation and encourage feedback on pilot programs.

Seoul has developed a very successful online policy suggestion system that enables citizens to contribute ideas for new policies online and discuss them with city officials.

6. Technology as an enabler

Technology adoption should not be an end in itself, but should be used to address the major pain points of the city, such as mobility, energy, water, public services, and so forth. While technology has obviously been the central component of smart city development, cities have been less successful at deploying it in an impactful way. There are a large number of projects that "look cool," but have not had much effect on improving the lives of citizens.

A good example of a unified system is Amsterdam's Smart Mobility solutions. From an app that lets you book your parking spot in advance, to a system linking ambulances to traffic control, to an electric grid allowing electric car owners to store locally produced energy, these individual initiatives work together, improving transportation in the city while delivering positive knock-on effects in other areas, such as environmental sustainability.

A good smart city regulatory environment will provide the protection that start-ups need while being adaptable enough to allow for the risk-taking and trial-and-error innovation requires

7. Risk management
Extensive collection of personal and business data, and the heavy reliance of governments on technology, creates major risks. Smart city authorities need to implement digital security practices that protect information and prevent against interruptions to service provision due to a security breach.

This area is generally lacking worldwide. With regular security breaches to both private and public databases, not only do solutions in this area need to be developed rapidly, they need to be communicated to the population to increase their trust that the government is adequately protecting the large quantity of data being collected.

8. Social inclusiveness
Creating a sustainable, economically healthy city is dependent on the engagement of all citizens. Smart services that target disadvantaged groups can make expensive social aid programs better and cheaper. Smart city authorities should make it a focus to improve quality of life and service delivery for all layers of society, and should use technological innovations to increase the accessibility of services to disadvantaged groups in society.

9. Project upscaling
Cities must be able to successfully bring projects from pilot to the city-wide scale in order to build long-term solutions. The ability to transition from pilot tests to larger scale is distinctly absent globally. This is in part a function of most smart cities being quite new and not yet past the test phase. Still, many smart city projects are largely an amalgam of small, limited initiatives. Maintaining efficiencies on a large scale can be challenging. A project built specifically to fit local demand might not maintain its logic on a larger scale, and funding a large roll-out can be difficult. To solve this, a plan for upscaling, including cost projections, must be included in the initial project design phase to ensure that the initiative is feasible on the large scale.

One city that has had success is Boston. Its Commonwealth Connect project, an app that allows citizens to report issues (Like garbage not being collected, graffiti, potholes, etc.) to the appropriate municipal authority, was successfully scaled up from being only available to residents of Boston in 2009 to over 60 municipalities in 2014, with funding released for its expansion in another 20. The app was well thought-out and supported by a long-term expansion plan, allowing it to be rolled out after it initially proved successful.

10. Supportive legal framework
A good smart city regulatory environment will provide the protection that start-ups need while being adaptable enough to allow for the risk-taking and trial-and-error innovation requires. This means creating the right Intellectual Property (IP) protection laws, the right legal framework to encourage start-ups and SMEs to take risks, and building government support systems.

London and the UK have had some success with creating an environment conducive to the development of smart solutions, through the Tech City UK organization. Their initiatives and lobbying efforts have included: regular conversation channels between the public and private sectors to ensure policy matches need (Tech City Breakfasts at No 10 include tech start-ups, large corporations, investors, and governments); a labor policy that ensures London has the best tech talent (Entrepreneur Visa and Exceptional Talent Visa have been expanded to include the tech industry); funding support for start-ups (The Start-up Loan Scheme will

provide £110 million over three years); and protection for innovation (The Patent Box programs reduces tax on intellectual property developed in the UK to 10%).

Many governments in the region are interested in developing smarter cities here

Monitor Deloitte expects that the number of new smart city greenfield developments in the GCC will double within the next two to three years. This follows the launch of six entirely new, master-planned smart city developments in the GCC over the past decade (See box). Going forward we also expect the majority of new city sub-developments will incorporate at least some element of "smart" infrastructure. The region's smart city growth will largely be driven by developments in the government planning, administration, and operations area, backed by significant GCC government investments in e-government and mobile services.

Stakeholders in the Middle East are paying significant attention to the growing smart city industry. There have been a number of smart city conferences in the last year, sponsored by both the public and private sectors. Governments have been shifting their services online and on mobiles. New construction projects often incorporate new "smart" dimensions.

This should come as a surprise to no one. There is ample opportunity in this region to develop smart technology innovations. In all four of the major emerging component areas, the countries of the Gulf Cooperation Council (GCC) present important market opportunities.

Government planning, administration, and operations have seen by far the largest investment to date. Governments in most countries have developed e-government portals, bringing information on government services, policies, and regulations into a single place, and allowing citizens to conduct certain procedures online. While the level of effectiveness and impact varies from country to country, there has been and continues to be a strong drive to use new ICT innovations to make government services more accessible to citizens.

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Smart Dubai

Smart Dubai was launched in March 2014. Its mission is to make Dubai the smartest city in the world by 2017. There are six main dimensions:

- Economy
- Governance
- People
- Living
- Environment
- Mobility

The processes for the transformation will focus on efficiency (Optimized use of city resources), seamlessness (Integrating daily life services), safety (Anticipating risks and protecting people and information), and impact (Enriching life and business experiences). A main point of focus is the integration of systems, both public and private, to increase communication between residents and Dubai's institutions, and to foster access to information. The government plans to make 1,000 government services available electronically through an online window within three years.

Various smart programs will be implemented by Dubai government departments under the Smart Dubai mandate. For example, the Roads and Transport Authority (RTA) will develop a "unified control center" for traffic and transportation control systems, and the Dubai Electricity and Water Authority (Dewa) plans to develop a "smart electrical grid" that encourages homeowners to use solar energy and sell the surplus to the government through the electrical grid[5].

Energy and water consumption, and waste generation, is among the highest in the world for most cities in the GCC, but there is a growing consciousness among citizens and the government that more sustainable ways of life have to be adopted

Transportation and big, open data also present important market opportunities specific to the region. Both areas are growing in relevance as cities' populations grow. Given the prevalence of personal vehicles, traffic will increasingly become a pressing issue that big data can help to solve. Big data is also especially critical for Dubai and Qatar, which are both hosting major international events in the next decade. They will need to develop the capacity to deal with the large numbers of visitors, and big data can help develop solutions before the events begin.

Finally, energy and water efficiency present distinct opportunities. Energy and water consumption, and waste generation, is among the highest in the world for most cities in the GCC, but there is a growing consciousness among citizens and the government that more sustainable ways of life have to be adopted.

But the soft infrastructure underpinning these developments is lacking

Despite high levels of interest, smart cities here seem to be falling into the trap of all flash and little substance. Their performance in most of the 10 drivers of success is weak, undermining the ability of the reforms they have put in place to deliver substantive change.

For example, while Dubai has taken significant strides to make government services more accessible to the population, the result has not been cohesive. A directive from the government for all departments to create an app for their services has led to a plethora of independent, unintegrated systems. Additionally, the lack of clear KPIs on what is required for the app, or how impactful it is expected to be, has led to substantial variations in the quality and usefulness of those apps.

In the same vein, Doha launched the Lusail smart city project in anticipation of the 2022 World Cup. This US$45 billion development project, which will build a fully integrated smart city from scratch, is not supported by a broad smart city plan for Doha. And despite hosting several smart city conferences, the capital does not have a defined vision for its transformation into a smart city, or deliverables against which its drive to become smarter can be judged.

Dubai Expo 2020[6]

Expo 2020 presents the opportunity to encourage the adoption of smart technology solutions in the public and private sectors in Dubai and across the region. The Expo itself will be an opportunity to showcase the latest innovations in smart tech, while the build-up to the Expo will give stakeholders the opportunity to test pilot projects and engage in the smart technology that will go into the actual development of the Expo.

The three themes of the Expo contain elements of the major smart city components, and can serve as a test bed for smart solutions in:

- **Sustainability:** Expo will be a monument to the green economy, building partnerships to find lasting sources of energy and water, and successfully managing existing resources
- **Mobility:** Building efficient logistics and transportation systems to connect people, goods, and services; developing new mobility innovations to create a more integrated world
- **Opportunity:** Developing new models for sustainable economic development and financial stability, and harnessing those new models to foster entrepreneurship and innovation

EXPO 2020
DUBAI, UAE
CANDIDATE CITY

There is room to get smart cities right in new greenfield developments

One of the most significant opportunities for smart city development in the Middle East is the chance to build a smart city from the ground up. Most global experience in smart cities to date has been in brownfield developments – adding smart solutions to cities that already exist. Cities have to retrofit existing infrastructure with new technologies to make it 'smart-compatible,' which can be expensive, time-consuming, and in some cases quite complicated.

This isn't the case in the Middle East. Already several projects are taking place. Dubai Design District promises to be a smart district dedicated to design and creative industries. A Memorandum of Understanding (MoU) signed with Cisco in October 2014 will explore potential joint opportunities for smart infrastructure[7]. Dubai Silicon Oasis is building Silicon Park, set to be completed by the end of 2017, an integrated business and residential area that will include smart sustainability, mobility, and lifestyle solutions. In Saudi Arabia, the King Abdullah Economic City includes a smart city sub-section which will build in the latest ICT infrastructure.

These greenfield developments present two major opportunities. First, they present the opportunity to test new innovations at a lower cost, as building in brand new ICT infrastructure is less expensive than retrofitting older infrastructure. Secondly, and perhaps more importantly, they provide the opportunity to further develop already tested innovations, integrating them into the fabric of the city and assessing performance on a large scale.

One of the most significant opportunities for smart city development in the Middle East is the chance to build a smart city from the ground up

Masdar[8]

Masdar is a master-planned city development in Abu Dhabi relying only on solar and other renewable energy sources to power the city. It is a model for how intelligent design can create an urban environment accommodating dense populations with fewer resources. Masdar, once complete, will cover 6km^2 and be home to 40,000 people. Phase 1 is expected to be complete in 2015; the full development is slated for completion in 2020. Smart elements of the city will include:

- Reducing buildings' energy and water consumption by 40 percent through intelligent design
- An integrated smart network of transportation options, including a driverless point-to-point personal rapid transit system, an electric vehicle ride-share program, and a centralized zero-carbon automated public transportation network

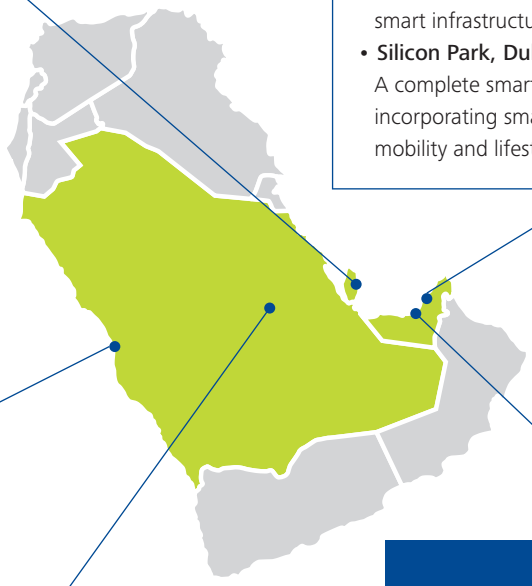
Masdar also serves as a testing ground for new renewable energy innovations. The Masdar Institute of Science and Technology acts as a design and innovation hub with a focus on the development of new green technology systems. The city then runs pilot projects to test the theories and optimize the engineering. Once the system is perfected, the pilot is upscaled to the whole city, in order to develop a commercialized version[9].

Doha

- **Lusail City**
  High-tehcnology city environment comprising both wired and wireless communication networks and operation control centre that will manage the information technology network covering th whole city

Dubai

- **Dubai Design District**
  A district dedicated to design and the creative industries, incorporating smart infrastructure
- **Silicon Park, Dubai Silicon Oasis**
  A complete smart city project incorporating smart energy, mobility and lifestyle solutions



Jeddah

- **King Abdullah Economic City**
  New city one hour north of Jeddah incorporating the King Abdullah Port, designed on social, economic, and environmental sustainability principles

Riyadh

- **Information Technology Communications Complex, within the King Abdullah Financial Centre**
  Offering world-leading ITC services and infrastructure, attracting international ITC companies and making Riyadh a hub for ITC services, education, research, and innovation

Abu Dhabi

- **Masdar**
  Master-planned city development in Abu Dhabi relying only on solar and other renewable energy sources to power the city

The bottom line

Smart cities have proliferated around the globe in recent years, providing new solutions to the problems of a modern city. However, the concept of what exactly makes a city "smart" is undefined. Equally, if not more, ambiguous is what city governments need to do to support these smart solutions and increase their impact. It is becoming increasingly important for governments to clearly define the goals, aspirations, systems, and organizations that will guide a city's smart development and help increase the impact of its smart solutions. The danger is that cities will end up with an amalgam of interesting innovations that have limited scope or impact, and which do not interact with each other or help any significant amount of the population.

To address this risk, city governments need to shift their focus to building the soft infrastructure needed to support these and future smart solutions. Monitor Deloitte's 10 drivers of success for smart cities provide a broad outline of key elements involved in this infrastructure. The development of integrated, efficient, adaptable, truly smart cities will depend on governments adopting these frameworks and systems to support smart city growth in the future.

Middle East perspective

Smart cities have gained increasing attention in the region over the past several years. Both governments and developers have tapped into this trend to engage citizens and develop new solutions. Developers especially are becoming increasingly interested in adopting the ICT infrastructure and master planning that will aid the development of modern smart cities. This presents key opportunities in both the private and public sector to leverage this trend and increase investment in new smart technology.

At the end of the day, though, a greater emphasis must be placed on how to leverage these developments to ignite a shift to better, smarter cities. While greenfield developments allow for a more integrated ICT infrastructure to be developed from the outset, creating the right 'soft' infrastructure to support it is in an even weaker position in the Middle East than it is globally. Governments will need to take an active role in ensuring the 10 drivers of smart city success are activated if they want to develop truly smart cities and be global leaders in this space.

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Deloitte in the Middle East

ME Regional office
Gefinor Center, Block D
Clemenceau Street
P.O. Box 113-5144
Beirut, Lebanon
Phone +961 (0) 1 748 444
Fax +961 (0) 1 748 999

Consulting
Regional office
Deloitte & Touche (M.E.)
Building 3, Emaar Square
Downtown Dubai
P.O. Box 4254 Dubai,
United Arab Emirates
Phone +971 (0) 4 376 8888
Fax +971 (0) 4 376 8899

Enterprise Risk Services
Regional office
Deloitte & Touche (M.E.)
Building 3, Emaar Square
Downtown Dubai
P.O. Box 4254 Dubai,
United Arab Emirates
Phone +971 (0) 4 376 8888
Fax +971 (0) 4 376 8899

Financial Advisory Services
Deloitte Corporate Finance
Limited - Regional office
DIFC, Currency House
Building 1
P.O. Box 112865
Dubai, United Arab Emirates
Phone +971 (0) 4 506 4700
Fax +971 (0) 4 327 3637

Tax Services
Regional office
Currency House
Building 1
P.O. Box 282056
Dubai, United Arab Emirates
Phone +971 (0) 4 506 4700
Fax +971 (0) 4 327 3637

The Deloitte ME Islamic Finance Knowledge Center (IFKC)
Al Zamil Tower. Government Avenue,
Manama, Kingdom of Bahrain
Phone +973 (0) 1 721 4490 Ext 2018
Fax +973 (0) 1 721 4550

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Bahrain
Manama
Al Zamil Tower
Government Avenue
P.O. Box 421
Manama, Kingdom of Bahrain
Phone +973 (0) 1 721 4490
Fax +973 (0) 1 721 4550

Egypt
Deloitte Saleh, Barsoum & Abdel Aziz
Cairo
Nile City South Tower
2005 A Cornish El Nile,
Ramlet Boulaq, Cairo, Egypt
Phone +20 (0) 2 246 199 09
Fax +20 (0) 2 246 199 04

Alexandria
Madinet El Sayadla
Building No 10,
Smouha, Alexandria
Phone +20 (0) 3 426 4975
Fax +20 (0) 3 426 4975

Iraq
Erbil
Vital Village, No. 42
Erbil, Iraq
Phone +964 (0) 66 257 6200

Jordan
Amman
Jabal Amman,
190 Zahran Street
P.O. Box 248
Amman 11118, Jordan
Phone +962 (0) 6 550 2200
Fax +962 (0) 6 550 2210

Kuwait
Deloitte & Touche
Al-Wazzan & Co.
Kuwait City
Dar Al-Awadi Complex
Ahmed Al-Jaber Street, Sharq
P.O. Box 20174
Safat 13062, Kuwait
Phone +965 2240 8844
Fax +965 2240 8855

Lebanon
Beirut
Arabia House
131 Phoenicia Street
Ain Mreisseh, Beirut
P.O. Box 11-961
Riyadh El Solh, Lebanon
Phone +961 (0) 1 364 700
Fax +961 (0) 1 369 820

Libya
Tripoli
Tripoli Tower
P.O. Box 93645
Tripoli, Libya
Phone +218 (0) 92 370 1049

Oman
Muscat
MBD Area
Muscat International Center
P.O. Box 258
Ruwi, Postal Code 112
Sultanate of Oman
Phone +968 (0) 2481 7775
Fax +968 (0) 2481 5581

Palestinian Territories
Ramallah
Al Mashreq, Insurance Building
P.O. Box 447
Ramallah, Palestinian
Controlled Territories
Phone +970 (0) 2 295 4714
Fax +970 (0) 2 298 4703

Qatar
Doha
Al Ahli Bank Building
Sheikh Suhaim Bin Hamad Street
P.O. Box 431
Doha, Qatar
Phone +974 (0) 4434 1112
Fax +974 (0) 4442 2131

Saudi Arabia
Deloitte & Touche
Bakr Abulkhair & Co.
Riyadh
Prince Turki Bin Abdullah
Al-Saud Street
Sulaimania Area
P.O. Box 213
Riyadh 11411, Saudi Arabia
Phone +966 1 282 8400
Fax +966 1 282 8428

Al Khobar
ABT Building, Al Khobar
P.O. Box 182
Dammam 31411, Saudi Arabia
Phone +966 (0) 3 887 3937
Fax +966 (0) 3 887 3931

Jeddah
Saudi Business Center
Madinah Road
P.O. Box 442
Jeddah 21411, Saudi Arabia
Phone +966 (0)1 2 657 2725
Fax +966 (0)1 2 657 2722

South Sudan
Juba
Deloitte Complex, Plot No.160,
Block 3K-South
2nd Class Thong Ping
Residential Area
P.O Box 511
Juba, Republic of South Sudan
Phone +211 92 000 1024

Syria
Fardos
9 Fardos Street
P.O. Box 12487
Damascus, Syria
Phone +963 (0) 11 2456683
Fax +963 (0) 11 2221878

Rawda
38 Rawda Street
P.O. Box 30033
Damascus, Syria
Phone +963 (0) 11 3322303
Fax +963 (0) 11 3322304

United Arab Emirates
Abu Dhabi
Al Sila Tower
Abu Dhabi Global Market Square
Al Maryah Island
P.O. Box 990 Abu Dhabi,
United Arab Emirates
Phone +971 (0) 2 408 2424
Fax +971 (0) 2 408 2525

Dubai
Deloitte & Touche (M.E.)
Building 3, Emaar Square
Downtown Dubai
P.O. Box 4254
Dubai, United Arab Emirates
Phone +971(0) 4 376 8888
Fax +971(0) 4 376 8899

Fujairah
Al-Fujairah Insurance Co. Building
P.O. Box 462
Fujairah, United Arab Emirates
Phone +971 (0) 9 222 2320
Fax +971 (0) 9 222 5202

Ras Al-Khaimah
Ras Al-Khaimah, Insurance
Building, Al-Nakheel,
Ras Al-Khaimah, UAE
P.O. Box 435
Ras Al-Khaimah,
United Arab Emirates
Phone +971 (0) 7 227 8892
Fax +971 (0) 6 574 1053

Sharjah
United Arab Bank Tower
Al Buhairah Corniche
P.O. Box 5470
Sharjah, United Arab Emirates
Phone +971 (0) 6 517 9500
Fax +971 (0) 6 517 9501

Yemen
Sana'a
Sanaa Trade Center
Algeria Street, Sanaa
P.O.Box 15655 - Alsafyah, Yemen
Phone +967 (0) 1 448 374
Fax +967 (0) 1 448 378

Key contacts

Michael Romkey
Director
Monitor Deloitte
Deloitte & Touche (M.E.)
mromkey@deloitte.com