



White Paper

Future Cities: Time to Smarten Up

Commissioned by: Hewlett Packard Enterprise

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July 2016

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IDC OPINION

For a long time now, major cities in the world's developed countries have been pursuing initiatives to transform themselves into so-called 'Future Cities', or 'Smart Cities' as they are referred to in some countries. More recently, urban centers in developing and emerging economies, particularly in Asia, the Middle East, Africa, and Eastern Europe, have also been embarking on ambitious plans to rapidly transform themselves or establish new Future Cities.

The fundamental driver for this change is fast-growing urbanization. According to a report from the United Nations ('World Urbanization Prospects – 2014 Revision'), the world's urban population is set to grow by 2.5 billion between 2014 and 2050, with Africa and Asia accounting for 90% of the increase. In order to address this daunting challenge, mega cities in these continents will need to transform themselves by leveraging digital technologies. Technology can enable 'smart' approaches for addressing and managing critical issues relating to urbanization such as city traffic management, waste management, utility management, and environmental sustainability. Another important factor that is shaping the Future City concept is the rampant adoption of digital technology by consumers. With Millennials bringing ICT technologies into every aspect of their lives, they expect a similar kind of seamless experience across various public service channels. They expect all government transactions to be online, real-time, and interactive. As such, the concepts of citizen centricity and experience have emerged as another driving force behind the development of Future Cities.

A slew of emerging technologies can enable the transformation of cities. Technologies that are based on what IDC refers to as the 3rd Platform – a combination of mobility, cloud, Big Data/analytics, and social media technologies – typically provide the core for the required technology framework. A number of other related technologies such as the Internet of Things (IoT), connectivity platforms, robotics, industry applications, edge computing technology, and advanced security are also required, along with associated consulting and professional services. Overarching these technologies is a need for pervasive and future-proofed network connectivity, which is necessary to transmit data, content, applications, and services between government workers, citizens, academia, and businesses. Progressive countries such as the UAE have realized the importance of this and have already started rolling out dedicated IoT networks, city-wide WiFi, and sophisticated data networks under the Smart Dubai project.

As the objectives of a Future City can vary from city to city (regardless of whether they are brownfield or greenfield projects), the extent of digital technology implementation can also vary significantly from city to city. Before emphasizing too much on the technology requirements, the relevant city authorities should be able to take a long-term approach, foresee potential issues that might crop-up, and define the vision for the Future City in question and its citizens.

A truly Future City model cannot be achieved without having the right leadership vision in place and the requisite support from citizens. The relevant authorities should also work towards harmonizing a culture where the right people are in place with the capabilities required to fulfill the vision, establish the right processes, and formulate open data and e-participation policies for involving citizens in the decision making process. In order to generate greater citizen involvement, government authorities should also undertake the necessary steps to create awareness of the Future City's objectives and developments, and fuel greater understanding around the usage and functionalities of the various Future City services that have been implemented.

IN THIS WHITE PAPER

This White Paper outlines the key factors driving Future City developments in the Europe, the Middle East, and Africa (EMEA) region and highlights the technological building blocks for developing sustainable Future Cities of the future. The report defines the Future City concept, discusses the key socioeconomic factors shaping Future City development, and explains the different elements of a Future City value architecture and the relevance of a digital overlay. It also shines a spotlight on the Future City developments taking place across the EMEA region, with a particular focus on the Gulf Cooperation Council (GCC) countries. The paper discusses the various digital transformation initiatives being implemented by GCC governments in support of Future City developments, examines the key administrative and technological challenges related to Future Cities, and presents IDC's future outlook for Future Cities in the region. The paper concludes with key guidance for city development authorities on ways to overcome some of the key challenges, and then presents an overview of Hewlett Packard Enterprise's positioning within the Future City ecosystem.

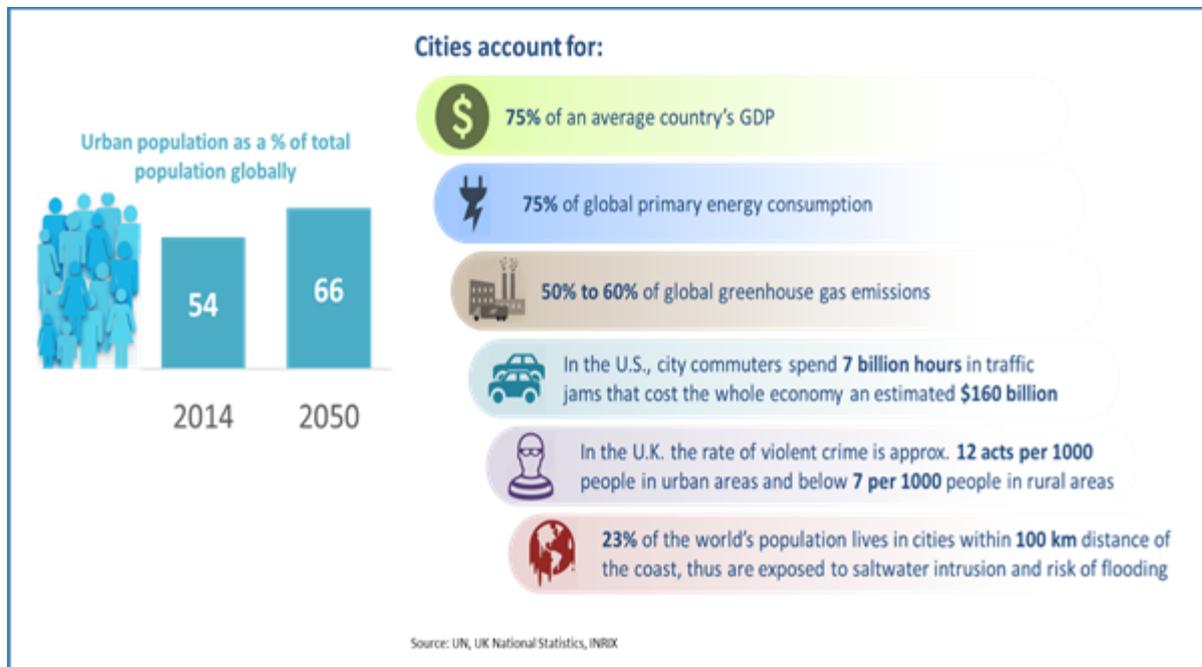
SITUATION OVERVIEW

The world is facing major challenges from unsustainable climatic conditions and rapidly growing urbanization. According to United Nations data, 54% of the world population was living in urban areas in 2014, up from 30% in 1950s. At this rate, 66% of the world's population is forecast to dwell in urban areas by 2050. As illustrated in Figure 1, cities generate 75% of the world's GDP but they consume 75% of the world's prime energy supply and alarmingly account for 50–60% of global Green House Gas (GHG) emissions, which continues to have adverse effects on the world's climatic conditions. It is evident that growing urbanization will bring new challenges along with it in terms of traffic management, clean and sewage water management, power management, waste management and pollution control, efficient yet effective administration, safety and security, education, healthcare and wellbeing, and the supply of food and consumables, among many others.

Future Cities: Addressing the Challenges of Urbanization

FIGURE 1

Solving Real Urban Issues



Source: IDC, 2016

Progressive cities in developed economies, as well as the greenfield cities that are cropping up in developing countries, are proactively overcoming these urbanization challenges by transforming themselves into Future Cities. Examples of such include the municipalities of cities such as Vienna (Austria), Toronto (Canada), Paris (France), New York (USA), Singapore, and Amsterdam (The Netherlands). While the objectives behind the ongoing Future City development projects have been quite varied, they typically revolve around the following three areas:

- **Economic Development:** With cities already accounting for 75% of global GDP, they are expected to account for even more by 2050 as the urban population rapidly increases. With this, there is an onus on city authorities to come up with much more sustainable economic models in order to support the demands of rapidly growing populations and reduce their reliance on federal grants and funds. The Future City concept offers an opportunity to diversify away from traditional sectors towards a more sustainable economic development model. This is possible as Future Cities typically aim to attract international business and boost investments in a variety of sectors by creating optimum conditions for working, living, and doing business.
- **Sustainability:** While economic sustainability is only one focus area of the Future City development model, there are other areas that are equally important for long-term success. For example, aspects such as energy, environment, and social sustainability (refers to the wellbeing of citizens) also determine success of a Future City. In order to achieve energy sustainability, Future Cities are looking at different ways to enhance energy efficiency and increase the use of renewable energy sources. From an environmental sustainability point of view, progressive cities have already embarked on an energy-neutral approach to significantly reduce their carbon footprints with the aim of making their cities more livable and visitor friendly. Cities across the EMEA region are also expected to undertake stringent steps to curb carbon emissions as per the 2015 Paris

Agreement on Climate Change (known as COP 21). Under this agreement, which was signed by 195 countries, the members will aim to limit the global temperature increase (in this century) to 1.5 degrees Celsius. Along with environmental sustainability, Future Cities will also need to work on areas such as food and water supply to achieve self-sustainability.

- **Higher Quality of Life:** The ultra-modern consumer technologies available today have radically transformed the lifestyles of city dwellers. With the arrival of a variety of smartphones, tablets, PCs, smart TVs, gaming consoles, and other consumer devices, the world's digital natives are increasingly becoming used to enjoying a seamless digital experience at home and at work. Such emerging consumer digital trends are having a considerable influence on the way that Future City solutions are designed in regions such as the Middle East and Africa (MEA), and particularly in the GCC. However, in Europe, where the population is ageing, Future Cities are being designed to accommodate such a demographic and provide amenities that are suited to their needs. As such, upcoming Future City projects in Europe feature citizen centricity at their core, with the aim of improving the quality of life and providing a better standard of healthcare. However, the benefits of Future Cities should not be limited to the most affluent members of society and should also improve the lives of the urban poor living in sub-standard conditions. It is outcomes such as improved transportation, sewage handling, and access to drinking water and sanitation, among many others, that will ultimately determine the success of Future City initiatives.
- **Safety and Security:** Ongoing cybersecurity breaches in the Middle East, particularly in the GCC region, and the recent terrorist attacks that have taken place in the Europe have made citizen safety and security the number-one priority for the local governing bodies. As such, solutions that ensure the safety and security of city residents and tourists alike are featuring high on the list of ICT development plans for upcoming Future Cities across both regions.

In order to fulfill these objectives, the relevant city government bodies should reimagine their existing processes around service planning, management, and operations and think of disruptive technologies that will help them achieve their targets. To this end, they require a technology value architecture that will form the basis for their Future City development roadmap.

IDC's Definition of Smart Cities

According to IDC, a Smart City (referred to as a Future City in this white paper) can be a district, town, city, county, municipality, or metropolitan area that has its own governing authority and is built on an ICT foundation layer that allows for efficient city management, economic development, sustainability, innovation, and citizen engagement. The Smart City ecosystem is developed with the fundamental objective of improving the quality of life of city residents. A Smart City can be characterized as a long-term initiative involving technology-driven projects.

According to IDC ('Worldwide Smart City Taxonomy, 2014' by IDC Government Insights), a project is categorized as smart when it possesses at least two of the following attributes:

- Data is gathered and transported in real time or near real time via pervasive broadband networks. Data is gathered from the Internet of Things, a variety of devices (such as sensors, radio frequency identification [RFID] transmitters, video cameras, parking meters, license readers, smartphones, or rugged handheld or other mobile devices), and directly from citizens via social media and social applications.
- The breaking down of data siloes and collaboration across systems and departments is fundamental to Smart City projects. Processes, software, and services must be in place to cleanse, consolidate, and understand collected data and integrate disparate data and new data with historical data sets, if applicable.

- Trends are discovered and/or outcomes are predicted from the information using analytics software, including predictive analytics and social analytics (analytics software running on top of the social business networks) software.
- To support enhanced decision making, information is displayed using business intelligence (BI) tools for visualization via dashboards, system management tools, alerts, and so forth for responding to the collected and analyzed information.
- Automated mechanisms and business processes are in place to respond to the analyzed information. For both automated responses and those that require human intervention, processes are in place to act on and respond to information and execute an optimal response.
- Optimal responses to the analyzed information lead to more sustainable urban development (economic or otherwise), more efficient uses of city resources, and a better quality of life for citizens. Optimal results often include changes in behaviors by citizens and government workers.
- Processes are in place to measure outcomes of a solution. For example, Smart Cities focus on a reduction in serious automotive collisions as opposed to the number of speeding tickets issued.

The Elements of Future City Value Architecture

In order to function, a Future City requires a robust value architecture. This should comprise the following elements:

FIGURE 2

IDC's Future City Value Architecture



Source: IDC, Methods and Practices: IDC Government Insights' Worldwide Smart City Taxonomy, 2014, #GI244956

Figure 2 (above) illustrates the value architecture of a Future City founded on key enabling technologies like IoT and the four technology pillars of IDC's so-called 3rd Platform – Big Data, mobility, cloud computing, and social business. However, the 3rd Platform technologies are heavily dependent on an overarching connectivity layer. Telecom operators, private network operators, or

municipality network operators are laying the ground by rolling out WiFi, fiber, WiMAX, and cellular networks to support a complex set of use cases and workloads in the Future City context. These 3rd Platform technologies together with connectivity help Future Cities to meet business imperatives like being more innovative, improving productivity, and providing better citizen services. A brief description of the foundation technologies is presented below:

- **Mobile:** Mobility solutions include the devices, software, and infrastructure that enable mobile data services, including tablets, e-readers, portables, smartphones, other smart devices, and the applications that enable them interact with each other. In the Future City context, mobile networks form the basis for connecting the intelligent devices that make up the Internet of Things to enable a number of Future City use cases.
- **Social:** Social technologies facilitate collaboration between internal stakeholders, partners, vendors, and customers, and also help to extract data from these communications. Key technologies include social media platforms, enterprise social networks, and socialytics. With the government's plans to involve the general public at large in the decision making process, the role of social media technologies is going to grow in the Future City context.
- **Cloud Services & Infrastructure:** Cloud services offer a shared, standard IT service that is packaged as a turnkey solution featuring self-service provisioning and management, elastic resource scaling, a published service interface/API and elastic, use-based pricing. With a number of new devices being deployed in Future Cities and the volume of user and citizen-generated data, the ICT network requires agile and scalable storage capacity solutions. The cities would also require more cost-effective and on-demand technologies to render software and computing needs of the government departments. These requirements will be fulfilled by cloud technology. Cloud infrastructure refers to system and network management software, security software, storage software, system software, and cloud-based servers, storage, networks, and clients.
- **Big Data:** Big Data technologies and analytics tools enable customers to economically extract value from very large volumes of data from a variety of sources by enabling high-velocity capture, discovery, and/or analysis. Future City administrative authorities find ways to use Big Data technology to analyze the volumes of structured and unstructured data being generated and stored for making real-time and more informed decisions. By combining historical trends with current data, city authorities are able to undertake analysis that delivers a variety of descriptive (to know what is happening), predictive (to know what is likely to happen), and prescriptive (to know which decision to make) outcomes.

These technologies help cities compete more effectively with other cities, reduce operational costs, and create new products and services for citizens and local businesses to use. Value is provided to local businesses, citizens, and city visitors through specific services like intelligent transportation, smart classrooms, connected healthcare, and smart grids as well as through improvements to other systems such as CRM, human resources, finance and accounting, performance analytics, and permissions and licensing. It is from these city systems that the broader Future City goals are achieved.

Digital Overlay for Future Cities

In order for a city to transform successfully into a Future City, a number of technology components are required to work coherently over the 3rd platform. These specific technology investment areas are discussed in detail below:

FIGURE 3

Future City Technology Components



Source: IDC, Methods and Practices: IDC Government Insights' Worldwide Smart City Taxonomy, 2014, #GI244956

- **Intelligent Systems and Devices:** Devices in the Future City context include sensors, RFID tags, actuators, or other such wired or wireless-enabled devices, which are also referred to as the Internet of Things. IoT components are uniquely identifiable things/devices that are managed by intelligent systems and communicate over a network without human interaction using some form of automated connectivity. These devices autonomously connect to the Internet, execute native or cloud-based applications, and analyze the collected data. Intelligent systems operate as clients in the datacenter and in infrastructure systems. In the Future City initiatives, the intelligent systems communicate with each other without human intervention, automatically sending and receiving data.
- **Connectivity and Service Enablement:** The connectivity segment of the Future City market can involve any of the networks being rolled out by telecom operators, private operators, co-ops, or municipality-owned networks and may include different connectivity options such as Cellular (2G, 3G, or 4G), WiFi, Bluetooth, ZigBee (leverages low-power, low-cost connectivity that is primarily beneficial in short-range monitoring or controlling applications), Wireline, 6LoWPAN (IPv6 over low-power wireless personal area network), MQTT (Message Queue Telemetry Transport leverages an extremely lightweight publish/subscribe messaging transport).
- **Platforms:** Platforms in a Future City context can be divided into the following types: device enablement and application enablement. Each type of platform offers functionality to support an endpoint; however, while they are not interchangeable, they are interdependent.
 - **Device Enablement Platforms:** Device enablement is a combination of services purchased from vendors and service providers for their municipal customers, such as device provisioning and enablement, primarily for IoT. At its most basic level, device enablement is about device management and providing software that ensures the flow of data to and from the end device. Key components include activation, certification, diagnostics, enablement, provisioning, and application enablement.
 - **Application Enablement:** This focuses on the horizontal integration of enterprise applications and specific vertical use connecting a variety of endpoints, such as IoT. It also focuses on the growing area of analytics and the capability to build analytical tools for businesses to make real-time decisions about collected data. Key components of this platform solution include: Application Programming Interface (API) support, vertically focused applications, and analytics.

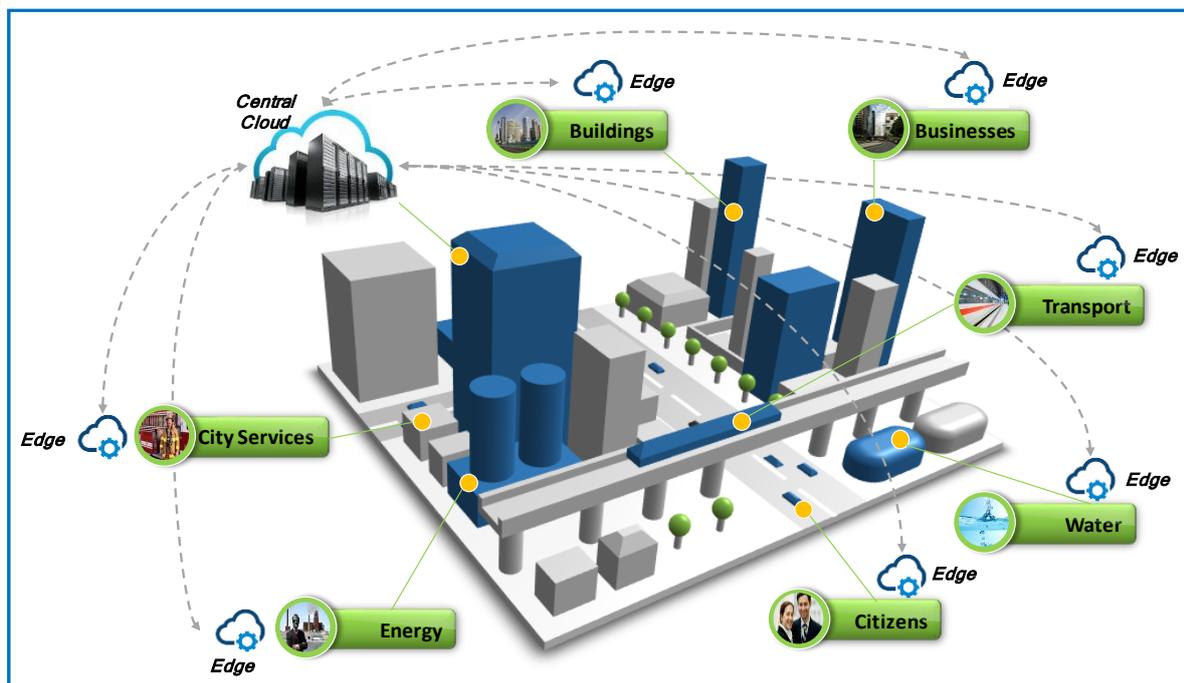
- **Analytics and Decision Support:** The analytics layer is essential for deriving the true business advantages of connectivity and volumes of data generated in Future Cities. It leverages the power of Big Data and can be extended to a number of Future City applications. The data collected from endpoints or IoT devices, as well as various social media platforms, is analyzed and turned it into actionable insights to Future City administrative authorities for better decision making.
- **Applications:** Future City applications are software and tools that either extrapolate analytics or serve as an input mechanism; that is the way for data from IoT, people, and locations to be used to conduct a specific function. They also include software development kits (SDKs) – tools that are useful for the application development of industry use cases including Future City solutions.
- **Storage:** Storage is another important element in Future City ICT infrastructure to host volumes of machine and human generated data. The storage element forms a part of the datacenter infrastructure and comprises storage mechanisms, storage systems, and storage network infrastructure.
- **Virtual and Software-Defined Networks.** The heightened network traffic generated by millions of IoT devices in a Future City can strain the communication and datacenter networks. A combination of software-defined networks (SDN) and network function virtualization (NFV) technologies can address this potential challenge. While SDN can decouple the network control plane from the data-forwarding plane to reconfigure the network elements such as switches and routers remotely, NFV replaces the dedicated network appliances, such as routers and firewalls, to optimize service creation, activation, and assurance by bringing the functionality of the cloud to the network. A combination of both the technologies will make the Future City networks more agile and can be reconfigured as per the changing data traffic requirements.

Shifting Computing to the Edge

A majority of the computational functions in the Future City context can be offloaded from the central cloud to devices on the edge of an access network. This is called 'edge computing'. This helps in lowering latency and gaining direct access to the real-time radio network information – such as subscriber location or cell load in case of a mobile operator – used by applications and services to offer context-related services. In case of mobile edge, the technology allows content, services, and applications to be accelerated to increase responsiveness. In the Future City context, by opening up the access network edge to third-party partners, infrastructure companies will be able to deploy innovative applications and citizen services. Typically, edge computing is characterized by the following elements:

FIGURE 4

Edge Computing



Source: IDC, 2016

- **On-Premise:** The edge is local, which means it can run in isolation from the rest of the network while having access to local resources. This becomes important for IoT scenarios, particularly when dealing with security or safety systems that need high levels of resilience.
- **Proximity:** Being close to the source of information, edge computing is particularly useful to capture key information for analytics and Big Data. Edge computing may also have direct access to the devices, which can then be easily leveraged by business-specific applications.
- **Lower Latency:** As edge services run close to end devices, it considerably reduces latency. This can be utilized to react faster, to improve user experience, or to minimize congestion in other parts of the network.
- **Location Awareness:** When a network edge is part of a wireless network, whether it is WiFi or cellular, a local service can leverage low-level signaling information to determine the location of each connected device. This gives rise to a family of business-oriented use cases, such as location-based services and analytics.
- **Network Context Information:** Real-time network data (such as radio conditions, network statistics) can be used by applications and services to offer context-related services that can differentiate the mobile broadband experience and be monetized, while also enabling new applications to be developed (that will also benefit from this real-time network data).

At each of these layers, there is a need for holistic security solutions. With cities being connected with billions of devices, it is paramount to ensure multi-layered security at hardware/devices, connectivity, applications, storage and analytics, and presentation layers to make sure that the city administration does not come to a grinding halt in the event of a breach. Additionally, all these systems will need to be integrated meticulously with each other with help from a number of value chain partners such as consultants, domain experts, and systems integrators, to name just a few.

EMEA Future City Trends

Although most Future City initiatives look the same from a layman's point of view, no two Future City projects have the same set of objectives. Depending upon the specific requirements of each city, the city development authorities may choose different development projects. Although the resource requirements may vary significantly from one project to another, they all work towards fulfilling the vision and objectives set forth by the city development authority. As long as all the objectives have been fulfilled, the project should be deemed a success.

From a Middle East point of view, while Dubai is emerging as a role model in terms of achieving smart governance across all sectors with the aim of increasing the happiness index of its people, initiatives such as the Smart Hajj project in Saudi Arabia are aimed at providing better services for Hajj pilgrims. In such cases, the objectives set by the governing bodies and the resource requirements are drastically different.

At the European Union (EU) level, there is a significant push for Future Cities under what is called Program Horizon. This EUR 80 billion project is a funding instrument focused on 12 areas of development. Smart communities, energy efficiency, and mobility (transportation) for growth are some of the areas that are closely related to Future City developments in the EU, with the aim of transforming existing cities into sustainable and future proofed cities. Countries including the U.K., Spain, and Italy have put in place national strategies and funding programs to carry out their respective Future City projects.

Some of the key objectives of Future Cities and the current developments taking place across the EMEA region are outlined below.

Future Cities as Economic Growth Engines: More So for GCC Countries

The countries of the GCC are oil-based economies that share the common characteristics of high disposable income levels, a very high proportion of young and educated population members, and high consumer technology adoption rates. The GCC countries have embarked on various Future City initiatives over the years to offer better citizen-centric services, position themselves as economic hubs, stimulate non-oil economic growth, and in some cases, to prepare themselves to host global events.

Although the progress of some of the Future City projects such as Smart Dubai is well on track, others have been slow to take off, and governments in countries such as Saudi Arabia are looking to revamp these projects and update their plans to make them more relevant to national visions such as Saudi Arabia National Vision 2030. These Future City projects are expected to directly contribute to the growth of the economy. For example, Saudi Arabia's General Investment Authority's initial estimates suggest that the country's Economic Cities (developments that are currently underway) will add \$150 billion directly to the Saudi economy by 2020 and another \$100 billion indirectly. Some Future City projects are being rolled out to prepare countries for international events such as Dubai Expo 2020 and the 2022 FIFA World Cup to be held in Qatar.

Energy Conservation and Environmental Protection

The GCC region is blessed with oil and gas reserves, and while their energy-conservation efforts might appear trivial from an outsider's perspective, the GCC countries are embarking on a comprehensive journey to reduce their environmental impact and to position themselves as world-class Future Cities. While continuing their oil and gas exports, these countries are making strides to gradually reduce their reliance on conventional energy sources and conserve energy and water in an effort to minimize their carbon footprint.

Some countries in the GCC have already started deploying alternative clean energy sources such as solar panels. For example, the UAE is committed to increasing the use of renewable electricity from less than 1% today to 24% by 2021. Masdar City, one of the first Future City developments in the country, is committed to investing \$1.7 billion to generate up to one gigawatt of clean (solar) energy in the country and become compliant with some of the major global climate-change agreements. Such developments may set an attractive precedence for other major GCC countries such as Saudi Arabia to follow.

As part of their ongoing energy conservation measures, the UAE and Qatar have already started implementing IoT-enabled smart meters, and Saudi Electricity Company (SEC) is in the process of rolling out a smart grid solution. Such measures are expected to yield positive results in terms of bringing down the carbon emissions of these countries. In Africa, electricity distribution authorities such as City Power (Johannesburg, South Africa) and Kenya Power (Nairobi, Kenya) are currently rolling out smart meters to increase the availability of electricity, rationalize its use, and reduce instances of electricity thefts. In Europe, the Sogrid smart grid project is underway in Toulouse (France), while Iberdrola has launched a similar initiative in Spain. Meanwhile, in Germany, two energy utility companies (Stadtnetze Neustadt and Stadtwerke Garbsen) have deployed smart grid solutions to comply with the country's Renewable Energy Act. With energy conservation high on the agenda in Europe, smart meters are also being rolled out across the region as part of alliances and national initiatives.

From an environmental protection point of view, the Carbon Neutral Cities Alliance (CNCA) was formed in 2014 with the common aim of substantially slashing greenhouse gas emissions; the larger target objective is to drive an 80% reduction in such emissions by 2050 in an effort to avert the adverse effects of climate change. The alliance currently has 17 participating city councils from 9 different nations, with Berlin, Stockholm, Oslo, Copenhagen, and London participating from EMEA. The alliance, which advocates policy change and the implementation of transformation change strategies, is working towards the development of a framework for long-term carbon reduction planning and the creation of an innovation fund. In Australia, CNCA member Melbourne is working to be carbon neutral by 2020, while Copenhagen (Denmark) has set 2025 as its target for achieving the same goal.

Smart Governance

Government services that are offered via an online channel (either through the Internet or via a mobile app) are referred to as smart governance services. Smart governance services have the potential to reduce operational costs, cut down the waiting times at government offices, and enable the status of transactions to be followed up online. Due to these convenient functionalities, smart governance is forming an essential part of the Future City services framework.

Dubai has been the first city in the region to roll out smart government mobile apps and an online 'eService' under its smart governance strategy. Under this initiative, Dubai has already rolled out approximately 2,000 eServices and offers 50 smart services through mobile apps for increasing citizen convenience and removing the need for paper work. Dubai also passed an Open Data law in December 2015, which allows the use of available government data through various government departmental portals to involve people in decision making, strategic initiatives, and policies. The law aims to foster innovation, economic development, competition, and help Dubai achieve its vision of becoming a Future City.

As part of the eGovernance project, the UAE's Telecommunications Regulatory Authority (TRA) also rolled out a secure cloud-based (compute and storage resources) network, called Federal Government Network (FEDnet), to interconnect all government departments. FEDnet enables mGovernment services and Big Data services, and allows the relevant entities to operate their own virtual datacenters (VDCs).

Similar eGovernance services have also been launched across the GCC: Oman (45 mobile apps and 919 e-Services), Bahrain (60 services), Kuwait (118 service categories), Saudi Arabia (2,288 services), Qatar (1,131 services and 111 mobile apps). All these countries have also put in place open data policies similar to those enacted by the UAE.

Along similar lines, the European Commission (EC) launched the 'European eGovernment Action Plan 2011–2015' to rollout eGovernance services across the region. The plan included the development of cross-border eGovernment services for citizens and businesses, regardless of their country of origin. Under the next action plan (2016–2020), the commission has identified the following objectives for itself.

- Modernize public administrations using digital enablers such as like eID (electronic ID), eSignature, and eDelivery.
- Enable the mobility of citizens and businesses through cross-border interoperability.
- Facilitate digital interaction with citizens and businesses for the delivery of high-quality public services.

Intelligent Transportation

The per capita density of vehicles is high among the GCC countries. For example, the vehicular per capita density of Saudi Arabia is the highest in the world after North America, Australia, and Europe. High vehicular density is resulting in the rise of road accidents, traffic violations, pollution, and demand for parking and toll gate facilities. Management of non-road transportation options, such as trams, metros, water, and air transportation are becoming equally challenging.

Although a number of information- and transportation-related services are already available under the respective eGovernance services, the road and transportation authorities in these countries are constantly upgrading the infrastructure and the connectivity technologies to offer better citizen services as part of their Future City initiatives. These services ensure improved road safety, better traffic management, and easy and convenient payment options.

- **RFID and NFC:** With the aim of promoting cashless transactions and improving citizen convenience, Dubai introduced RFID-enabled toll gates way back in 2007. NFC-enabled payment cards, called Nol cards, are also in use for all modes of public transportation in Dubai to encourage cashless transactions. This is similar to services available in European cities such as London.
- **Fleet Management and Tracking:** RTA-run taxis in Dubai are fitted with tracking devices to check occupancy of the taxis and to track driving behavior. The taxis are fitted with cameras and sensors to track the driving habits and to alert the taxi drivers. WiFi services are also being offered in taxis and other modes of transport such as Dubai Metro, Dubai Tram, and Dubai Bus with the aim of ensuring the safety and convenience of passengers and managing the fleet more efficiently. In the business segment, a variety of IoT-enabled fleet management solutions are already in use across EMEA.
- **eCall:** In 2015, the telecom regulator of the UAE announced plans to introduce 'eCall' services (an auto-dialed SOS OR distress call to police and ambulance services in case of an emergency) with the aim of achieving zero road fatalities rate by the year 2021. In a similar move, the European Commission has passed a bill to introduce eCall services in all new cars and light commercial vehicles in the European Union by April 2018.

- **Speed Cameras:** IoT technology is being actively used by the RTA in curbing traffic violations and road accidents in the UAE in the form of speed radars (traffic enforcement cameras) and roadside mounted CCTVs. These speed radars not only detect the number plate of the violators, but also check for offenses related to tailgating, use of mobile phones while driving, and seat belt violations. Similar technologies are also in use in other MEA countries such as Saudi Arabia, Qatar, South Africa, and Nigeria. In Europe, the EC enacted a Speed Enforcement Law in 2009 that mandates the use of speed cameras in its member countries.
- **Smart Parking:** In August 2015, Dubai's RTA launched a Smart Parking App, which in addition to paying for the parking fee is also capable of finding maps of paid parking zones in Dubai, and finding vacant parking slots within the multi-level parking terminals and malls such as Dubai Mall. Smart parking services help reduce the waiting time for users and increase the utilization of the available parking slots for the authorities. Similar solutions are also being tested in European cities such as Copenhagen and have already been implemented in Barcelona (Spain), Birmingham (UK), Braunschweig (Germany), and Manchester (UK).
- **Future Plans:** Dubai's RTA is looking to establish a city-wide command and control center, similar to that of London, to integrate all transport networks and enable efficient management of traffic on roads. Similar plans are currently underway in countries such as Saudi Arabia and Qatar. Dubai is also testing driverless public road transport for commercial launch by 2030 with the aim of easing traffic congestion on roads and enhancing the citizen experience. In an environmentally friendly move, electric car sharing is catching on with services such as E-Car Club operating in London, Hertfordshire, Northamptonshire, Oxfordshire, Buckinghamshire, Warwickshire, and Fife in the UK, and Arriva operating in Copenhagen, Frederiksberg, and Tarnby in Denmark. Electric bus services are also being launched in the Gothenburg (Sweden) and Prague (Czech Republic).

City Management and Citizen-Centric Services

A majority of the GCC countries already rank high in terms of global connectivity. Leveraging that as a core strength, cities such as Dubai are looking to develop their Future City connectivity infrastructures. Dubai is further beefing up wireless connectivity in the city to support various Future City-related applications. For example, the UAE rolled out more than 300 public WiFi hotspots across the country as part of rendering citizen-centric services and also to push its mGovernance agenda as the WiFi service offers free unlimited and fast access to all government websites as well as Internet access at low bandwidths.

In addition to public WiFi, Future Cities also need dedicated yet efficient communication networks to handle the proliferation of IoT devices or things. For example, the second UAE operator du rolled out a LoRa (Low Power Long Range) network in 2015 to support the growth of IoT devices. In a similar move, in February 2016, Etisalat announced its plans to launch a dedicated IoT network based on Narrow Band-IoT (NB-IoT) technology, which complies with the GSMA-approved LPWA (Low Power Wide Area) technology standards. The GSMA-approved technology is also being supported by European operator such as Deutsche Telekom, Orange, Telecom Italia, Telefonica, Telenor, and Vodafone.

Below are some of the potential Future City and citizen-centric services being conceived using dedicated IoT connectivity technologies to ensure energy savings, better utilization of resources, and efficient citizen services in the GCC:

- **Smart Lighting:** IoT-enabled technology used to switch street lighting on and off and control luminosity remotely based on traffic movement and traffic requirements. The technology helps in achieving power efficiencies while providing needs-based lighting. Dubai Silicon Oasis (DSO), a Future City development, is one of the first trade zones in the region to have implemented smart lighting technology. European cities such as Amsterdam (Netherlands), Helsinki (Finland), Glasgow (UK), and Bydgoszcz (Poland) have already deployed smart lighting technologies, while pilot schemes are underway in Copenhagen (Denmark).
- **Waste Management:** Trash bins around the city that are fitted with connectivity technology to automatically let their full or empty status be known to the municipality and collection trucks. The technology is used to spur the efficient use of collection trucks and manpower, resulting in cost and time savings for the relevant authorities. For example, DSO initiated a smart waste management project back in 2014, and it is planning to install 120 smart bins by the end of 2016. Measures are underway to rollout solar-powered smart bins that also double as WiFi hotspots across the UAE, starting with the city of Sharjah. Similar technologies also being tested in Copenhagen (Denmark), and they have already been implemented in other European cities such as Amsterdam (Netherlands), Helsinki (Finland), Stockholm (Sweden), Dublin (Ireland), and Strasbourg (France).
- **Smart Health:** This includes technologies such as clinical care, personal wellness, remote health monitoring, and telehealth systems. These technologies are useful for providing more accurate and timely healthcare services to patients with the ability to use doctors' services remotely. Dubai launched a smart healthcare initiative back in 2013, whereby patients will receive interactive services using a combination of mobile apps and self-help kiosks in the emirate's hospitals. Dubai Health Authority (DHA) has also announced its plans to introduce automated self-assisted kiosks and self-check booths under its smart health initiatives. A number of hospitals are already using telehealth systems to provide better solutions for remotely located patients. Remote patient monitoring solutions are also in use in Saudi Arabia. Meanwhile in Europe, IoT-enabled smart health solutions are being used by a number of hospitals in Bristol (UK), Bolzano (Italy), Turin (Italy), and Southampton (UK), as well as in France and the Nordic countries.
- **Smart Buildings:** IoT technology utilizes advanced automation and integration to measure, monitor, control, and save building energy utilization. Sensors are typically attached to heating, ventilation, and air conditioning (HVAC) and lighting systems, and also use motion detection and possibly weather information to gather and analyze data for optimizing energy usage. These systems can control HVAC and lighting based on historical data and current occupancy. There are a number of systems integrators in the GCC that are currently offering commercial smart building solutions. Honeywell, which is an active player in this segment in the Middle East, recently carried out a survey and came up with smart building indices ('Honeywell Smart Building Score of 2016') for all the region's cities. It gave Doha (Qatar) a score of 70 out of 100, Dubai a score of 65 out of 100, and Abu Dhabi a score of 48 out of 100, indicating high adoption rates in the GCC region. In Europe, Denmark is actively promoting the development of smart buildings in a bid to transform itself into a more environmentally sustainable country.

Security and Control

Public safety is one of the key components of the Future City ecosystem. As crime is no longer a localized or parochial occurrence, government departments such as the Police and Ministry of Interior are facing transformation pressures to digitize their operations. These departments must embrace new devices, work processes, data sources and information sharing models in order to protect citizens against threats and react more proactively.

From a device point of view, IoT solutions such as biomonitors, video and audio detection and relay, and video surveillance cameras will provide better, faster, more accurate, and granular information to the security and control authorities and enable them to react faster to situations. A combination of intelligent devices and digital technologies enable the authorities to speed up the identification of suspects and collection of evidence, as well as helping to control crowds in public spaces, deploy rapid response in case of disasters, and make authorities' activities more transparent to enhance public trust.

The UAE is at the forefront of launching public safety and emergency response technologies. For example, Dubai Police recently announced plans to launch safe city solutions for reducing and preventing crime and improving road safety. The technology uses IoT, cloud-based intelligent surveillance, social media technologies, Big Data analytics, facial recognition and number plate tracking, and biomonitors across the city in question. Similar projects are also being implemented by the Ministry of Interior and Abu Dhabi Police.

Additionally, the UAE is mandating the installation of CCTV surveillance cameras in all private and commercial buildings to be monitored by the Ministry of Interior from command and control centers in a bid to improve safety and security.

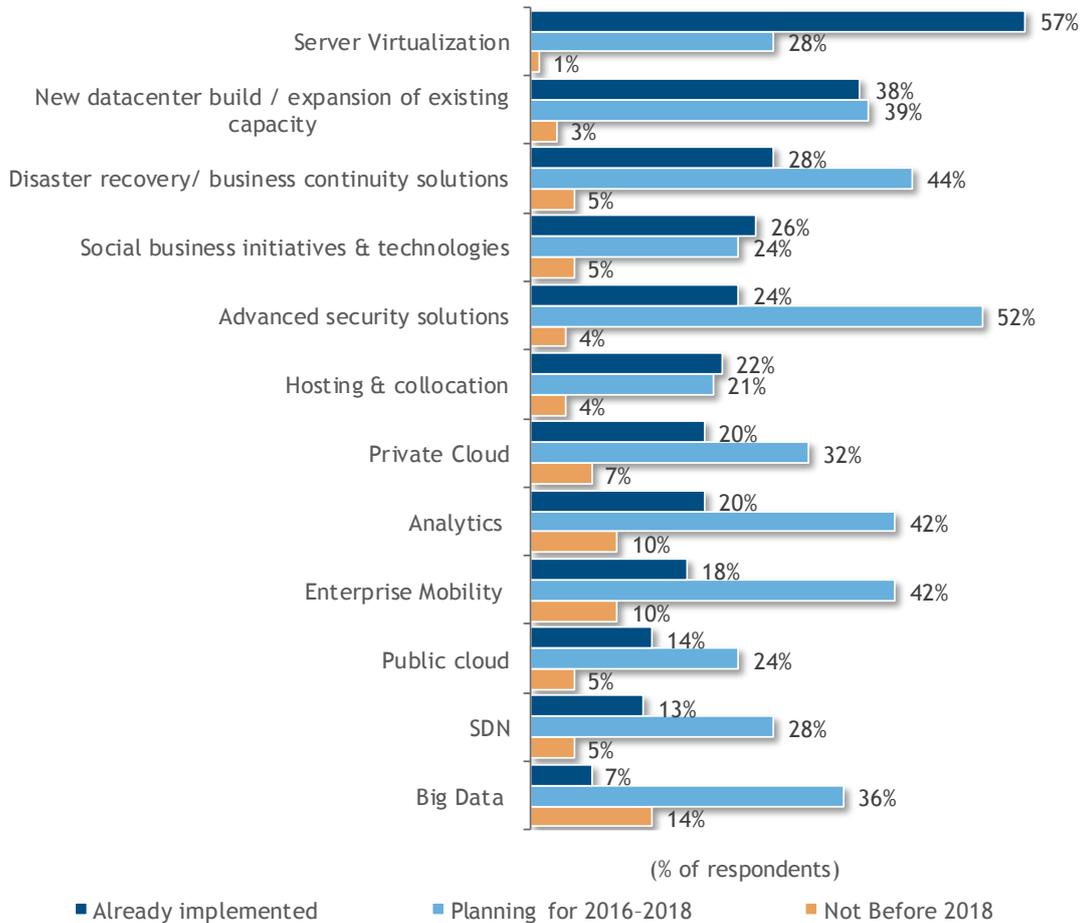
GCC Governments' Digital Transformation Drive for Future City Development

Digital transformation initiatives in public sector organizations are enabling and accelerating Future City development. According to IDC's 'CIO Survey 2016', while 40% of governments across the Middle East, Africa, and Turkey (META) have already undergone some form of digital transformation, 20% are about to begin their digital transformation journeys. Another 16% of the government organizations responded that they are currently planning their digital transformation projects.

When asked about their specific investment plans for different digital technologies, government organizations in the META region responded as follows:

FIGURE 5

Government Digital Technology Investments



Source: IDC CIO Survey 2016

Current implementations of digital technologies in the government sector remain relatively low, except for server virtualization, new datacenter buildouts or expansions of existing datacenter capacity, and disaster recovery and business continuity solutions. However, in the next two years, a significant number of respondents are planning to invest in advanced security solutions, especially as the Middle East is facing the threat of increased cyberattacks. Investments are also expected to be made in disaster recovery and business continuity solutions, analytics (including business intelligence tools), enterprise mobility, datacenter-related initiatives, and Big Data. These digital investments are directly related to the ongoing digital transformation initiatives undertaken by the government that will enable and accelerate Future City projects.

Challenges Faced by Future City Development Authorities

Some of the potential challenges facing city authorities in relation to Future City projects are outlined below:

- **Lack of Vision:** Setting a vision, in itself, is the first and foremost step in commissioning any Future City project. Without having the right vision in place or properly defining the desired outcomes, the project may be carried out in an ad hoc fashion, seriously risking the effectiveness of the outcomes and negating the purpose of the investment.

- **Lack of Coordination Among Partners:** Future City development is a complex project that involves participation from various government departments, the private sector, regulators, and citizen groups, as well as from technology providers such as systems integrators, infrastructure and software vendors, IT service providers, and telecom operators. In the absence of the right leadership and coordinated efforts, there is a risk of the project being derailed, resulting in budget overruns or unwanted outcomes.
- **Lack of Open Data Policy and Innovation:** The objectives and the expected outcomes of Future Cities are often quite varied from each other. Governments need to foster a culture of innovation and develop relevant skills within the community to support the development of innovative Future City solutions. However, without an open data policy, the right skills, or an application development community in place, the city will be unable to leverage local talent and develop innovative local services at pace.
- **Lack of Citizen Engagement:** Future City authorities often fail to communicate the key objectives of a city, its ongoing developments, or the availability of eservices to their citizens. They then compound this by failing to take valuable feedback. Without having the right citizen engagement mechanism or citizen-centric approach in place, Future Cities may find it difficult to achieve the desired objectives.

Some of the potential technical challenges involved in the development of Future City projects are as follows:

- **Revenue Model:** Cities have many areas of potential use cases, like remote monitoring or surveillance in public safety, or in transportation, environmental monitoring, or energy monitoring. The challenge is less about the potential uses of applications and more about finding the revenue model that can pay back the initial investment and support the application system maintenance.
- **Inability to Manage Data and Leverage Analytics:** A Future City ICT infrastructure is tasked with managing ever-growing volumes of data, much of which is unstructured data such as video, text, and social media interactions, and may prove a big challenge in itself. The city authorities are also tasked with securing and analyzing large volumes of data generated by citizens, devices, networks, and social media to help streamline administrative processes. In the process, the city authorities are also tasked with ensuring the privacy of its citizen-generated data.
- **Integrating Complex Systems:** A city is also a complex ecosystem of many verticals, from transportation to healthcare to utilities, all of which require their own industry-specific ICT and domain expertise. Future Cities face a particularly complex challenge in making these overlapping systems interoperable due to the lack of common standards.
- **Security:** A Future City ICT infrastructure is often an intertwine of a variety of elements such as communication networks, datacenters, platforms, and devices, all of which are connected to the internet. This complex configuration makes the Future City infrastructure vulnerable to security threats at different levels and in different forms. As Future City ICT infrastructure also includes storage systems containing high volumes of citizen data, their data privacy may also be at risk. Without having a complex and multi-layered security solution in place, this fundamental threat is difficult to address.

FUTURE OUTLOOK

Inspired by innovation-driven Future City developments in the Middle East such as Smart Dubai, other major city authorities in the region are also expected to accelerate their initiatives to develop technologically advanced, economically sustainable, and citizen-centric cities. Some of the ongoing projects in the region are still taking place in siloes. The region's city authorities will look to apply their strengths in innovative thinking, leveraging the skills and world-class consulting capabilities available in the region, and willingness to engage with citizens for collective positive outcomes for the cities.

They are also expected to actively implement advanced technologies such as IoT, cloud, Big Data analytics, and future-proofed connectivity infrastructure. According to the recent CIO survey carried out by IDC (refer to 'Digital Technology: Adoption Trends in META'), a significant number of government organizations are already in the process of – or are planning to undergo – digital transformation with the potential to lead in to Future City developments.

From a supply point of view, IDC expects the ongoing advancements and the availability of the 3rd Platform technologies, and a number of related technologies to influence Future City investments. Availability of connectivity enablement platforms, advanced security, edge computing, Big Data/analytics solutions, and IoT sensors, devices, and applications that form a part of the 3rd Platform, together with the available professional and consulting service skills to foster a conducive environment for the Future City ecosystem development in the Middle East region.

Essential Guidance to Future City Development Authorities

Successful deployment of Future City initiatives and the use of related technologies depend on a multifaceted approach guided by a strategy that accounts for not just technology but also human and capital resources, organization culture of administration departments, business and IT processes, and the data.

As per IDC's Smart City MaturityScope, a propriety framework from IDC on the state of Smart City developments (see the report '*IDC MaturityScope: Smart City*' – Doc # US40814315), the following elements should be taken into account by authorities when developing a roadmap:

- **Vision:** Includes attributes such as strategy, leadership, and sponsorship.
- **Culture:** Includes attributes such as the culture of innovation, the process of innovation within the organization, and the way in which citizens and community groups are engaged.
- **Process:** Includes attributes such as governance, performance management, and the partnership ecosystem.
- **Technology:** Includes attributes such as the adoption of IoT, cloud, Big Data, mobility, connectivity platforms, edge computing, security applications, analytics, and architecture for the 3rd Platform.
- **Data:** Includes attributes such as how citizen data is protected, the analytical tools used for processing data, open data initiatives, and the process for data sharing within a city.

City authorities that are looking to progress along the maturity curve are advised to pursue the following strategies:

- **Develop a Core Team with Representatives from Key Departments:** Beyond key executive sponsors, such as mayors, a core team must be developed that represents key departments across the city for decision-making and strategy. Further, best practice models should be followed to break down siloes and enable internal coordination.

- **Prioritize Projects with Directly Measurable Outcomes:** Identify or continue projects that are high profile and have measurable, public results.
- **Employ an Agile Innovation Approach Rather than a Rigid Strategic Planning Method:** This is easier said than done for local governments, and a good starting place is to move strategic planning for Future Cities to the level of a 'coordination framework'. Future City leaders, whether in the IT department or part of another office, should consider creating guidelines and frameworks for all departments that may be considering a department-level investment. This will help in future coordination of efforts.
- **Educate Key Stakeholders:** Educate a broad ecosystem of stakeholders to accelerate implementations and investment.
- **Raise Citizen Awareness and Seek Their Engagement:** City authorities must take on the responsibility of raising citizen awareness around Future City initiatives and developments. The authorities must also raise the digital literacy on potential functionalities and usage of the available eservices and apps. Additionally, authorities must drive citizen engagement and participation and seek feedback on streamlining their administrative processes.
- **Open Up Data and Foster Innovation:** City authorities must also classify the data and share all the relevant data which will help citizens in understanding the status quo and influence them to participate in decision making process. Additionally, city authorities should also foster innovation among citizens and the service development communities by imparting the right technical skillset necessary for the development of innovative applications and solutions. Authorities must also provide the right platform for the developers to present their solutions, get the necessary regulatory approvals, to contribute to the collective growth of the city.
- **Experiment with Convergence Across Domains and Technologies to Move Toward a Platform Model:** While investing in a citywide platform is not usually realistic for most cities, investments should be made with an eye toward convergence. Future Cities need to actively work against the duplication of technology and assets and toward using resources that enable data to be shared as a strategic asset that can be accessed by many via a platform model.
- **Look for Expertise:** Bring in people with consulting and professional service expertise to help with training and skillset requirements. Adopt ROI or other methods for justifying the investments.
- **Consider Alternative Business Models:** Future City initiatives will not be structured as traditional buyer-supplier relationships, in which one government department can determine all business/budget requirements and one supplier can provide all the necessary technology. Future Cities are instead ecosystem plays, which require experimentation with alternative delivery and governance models, such as shared services that enable buyers to develop reusable platforms that can be integrated across multiple domains; public-private partnerships (PPP) to combine competencies from suppliers and academia in applications, analytics, platform connectivity, intelligent systems, and systems integration services; or non-profits to better leverage the contribution of communities of citizens.
- **Seek Federal Government Support:** Lobby the federal government for support with funding, for policy and process support in projects, and to bring cities up to speed with other regions of the world.

Additionally, city authorities should also consider the following to remove any anticipated technical stumbling blocks:

- **Establish Common Technical Standards:** Any city comprises a complex sub-system of departments and functions, and this requires an interconnected flow of smoother and faster communication among them to create a working ecosystem. As such, common technological standards and communication protocols need to be put in place to make the ecosystem functional and interoperable within itself. City authorities must work closely with their technological partners to achieve common technical standards.
- **Work on Establishing a Security Framework:** Future City ICT infrastructure deals with a variety of devices, networks, and applications that contain structured and unstructured data, all of which is vulnerable to a variety of security threats at different levels and in different forms. To address this, the relevant Future City authority must put a policy and framework in place to manage security and deal with the potential threats. It should also work on formulating policies for undertaking regular audits and training/educating all the stakeholders involved.

HEWLETT PACKARD ENTERPRISE'S APPROACH

Spun-off from the erstwhile Hewlett-Packard company in November 2015, Hewlett Packard Enterprise (HPE) directed its focus back to the enterprise segments, paying particular attention to the servers and storage that the company was already known for, as well as cloud, security, Big Data, mobility, infrastructure (datacenter solutions), and IoT. These solutions are in direct alignment with the technologies that constitute what IDC refers to as the 3rd Platform, which plays a vital role in the digital transformation journey and in Future City transformation projects undertaken all over the world. In addition to these solutions, HPE is strengthening its professional and services capabilities and forging partnerships with independent software vendors (ISVs), system integrators, and telcos in order to position itself strongly as an end-to-end technology partner for Future City developments.

Connectivity Infrastructure Equipment

HPE's core offerings include a broad mix of hardware, software, and services. The hardware categories can further be divided into connectivity, primarily networking equipment (acquired through Aruba Networks in 2015), servers, and storage equipment. The connectivity network equipment includes switches, routers, access points and controllers. It also includes wireless LAN equipment, campus and branch networking, datacenter networking, WAN networks, software defined networks (SDN), and network function virtualization (NFV).

Edge Computing Technology

The company's offerings also include edge computing equipment under its Edgeline gateway portfolio. The portfolio currently includes edge computing platforms as well as edge compute gateways. The edge computing platforms include HPE Edgeline EL1000 and HPE Edgeline EL4000. These two platforms are converged IoT systems with the ability to move computational functions from datacenters to the edge, through integration, data acquisition, real-time analytics, and control. The HPE Vertica algorithms that are programmed into these platforms are capable of delivering a broad range of IoT data analytics use cases. The equipment is capable of withstanding operating temperatures in the range of 0–55°C and humidity of up to 95%.

There are two types of edge gateways currently available from HPE Edgeline - EL10 Intelligent Gateway and HPE Edgeline EL20 Intelligent Gateway. These ruggedized devices are designed to operate in an open environment. The gateways are fitted with CPU, memory, and WiFi connectivity to address a variety of IoT use cases and Future City solutions. True to what edge computing

stands for, HPE's Edgeline products process designated data streams in real time before the data is stored for further analysis. As such, these solutions can help Future City authorities to compute the data closer to the edge of the network and analyze the data being generated in real time, thereby enabling them to act faster.

Software and Cloud Solutions

The vendor's software offerings can primarily be split into enterprise software, infrastructure software, and other software solutions. Enterprise software includes Big Data analytics, security, IT service management and operations management, software-defined data center (SDDC), and cloud-related software such as software as a service (SaaS). Infrastructure software includes hybrid and private cloud software, server management, and storage management software. Software applications also include information governance and management software. The portfolio also includes an IoT connectivity platform, which can be deployed on-premise or via cloud.

The platform helps communication service providers and enterprises to onboard new IoT use cases. Some of the key attributes of the platform are outlined below.

- Data-centric platform that is helpful for managing and analyzing collected data
- Includes application enablement platform
- Capable of managing heterogeneous set of IoT gateways, devices, and sensors
- Sensor and device agnostic and is capable of managing millions of devices
- 'OneM2M' standard compliance and is capable of abstracting the underlining network
- Scalable and suitable for large-scale IoT deployments
- Use cases supported include: Connected Car, Future City, Smart Lighting, and Smart Metering
- Application programming interface (API) support

HPE offerings also include the 'Meridian' mobile app platform, which is as an API for the development of various location-based services capable of targeting citizen needs in the Future City context. Another offering from HPE is 'ClearPass', which is a security policy management platform for controlling network access on mobile and IoT devices. The solution addresses digital workplace security challenges across multivendor networks by replacing legacy policies with context-aware policies. It enables guest access, bring your own device (BYOD), and IoT onboarding.

Future City ICT infrastructure needs a number elements including IoT applications, e-governance apps, and service delivery platforms to be running simultaneously and be accessible to both authorities and citizens alike. These need to be deployed centrally on a cloud in order to serve the growing needs of Future Cities. HPE is capable of addressing these needs. The company's cloud solutions, under its Helion portfolio, include managed cloud and professional services, managed cloud applications (including SAP, Microsoft, Oracle, and its own SaaS model), managed cloud brokerage services, enterprise mobility solutions, cloud-enablement services for service providers, Helion mobility for public sector, managed virtual public cloud for public sector, managed private cloud for public sector, and cloud-related professional services. The company had also developed its OpenStack strategy through a partnership with Microsoft on AZURE.

Security

In addition to its standard suite of enterprise IT security solutions, the company also offers IoT-specific solutions such as Fortify, which is a software security testing tool and management

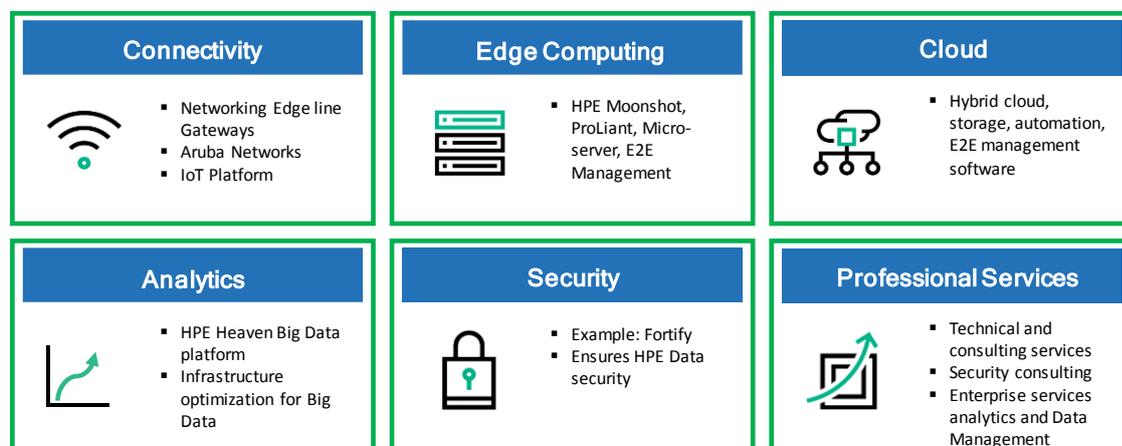
platform helping businesses to create, supplement, and expand their Software Security Assurance programs. HPE also offers security solutions for IoT devices.

Analytics

In the advanced analytics arena, the vendor offers its own Big Data solutions that comprise Big Data software (IDOL enterprise search and data analytics platform, Haven on-demand machine learning APIs), Big Data hardware (HPE Vertica Servers, HPE Moonshot, HPE ConvergedSystem, HPE Apollo, HPE 3PAR StoreServ), and Big Data services and support that include analytics and data management services, Big Data customer support, Big Data professional services, and business intelligence modernization services, as well as IT consulting services.

FIGURE 6

HPE's Future City Solutions



Source: IDC, 2016

Professional Services

HP has traditionally been a strong player in the enterprise IT infrastructure space. However, with the spin off HPE and its merger with the newly acquired Aruba Networks, HPE has been able to expand its portfolio into the communication infrastructure equipment market. Going forward, HPE is looking to gain a stronger foothold in the enterprise services segment as well. HPE's services portfolio includes advisory and consulting, IT support services, network management services, and education and training services. The company offers a variety of IT consulting and transformation services and support to architect, deploy, and optimize IoT technology. Its IT consulting team includes specialized departments in the areas of hybrid infrastructure, data science, information security, and hyperconnected architectures.

Partnerships

HPE's focus on the services segment has become even more important in view of its growing ambitions for emerging opportunities such as Future Cities. In order to tap into the opportunity, the company is constantly expanding its partnership network with a variety of players such as ISVs (i.e., Microsoft and SAP), systems integrators (to target the vertical opportunity in healthcare, security, energy and lighting, hospitality solutions etc.), and telecom service providers (such as Telecom Italia).

About IDC

International Data Corporation (IDC) is the premier global provider of market intelligence, advisory services, and events for the information technology, telecommunications and consumer technology markets. IDC helps IT professionals, business executives, and the investment community make fact-based decisions on technology purchases and business strategy. More than 1,100 IDC analysts provide global, regional, and local expertise on technology and industry opportunities and trends in over 110 countries worldwide. For 50 years, IDC has provided strategic insights to help our clients achieve their key business objectives. IDC is a subsidiary of IDG, the world's leading technology media, research, and events company.

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