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connected’. It gives you the latest insights on digital transformation.

Also available:

EXECUTIVE SUMMARY

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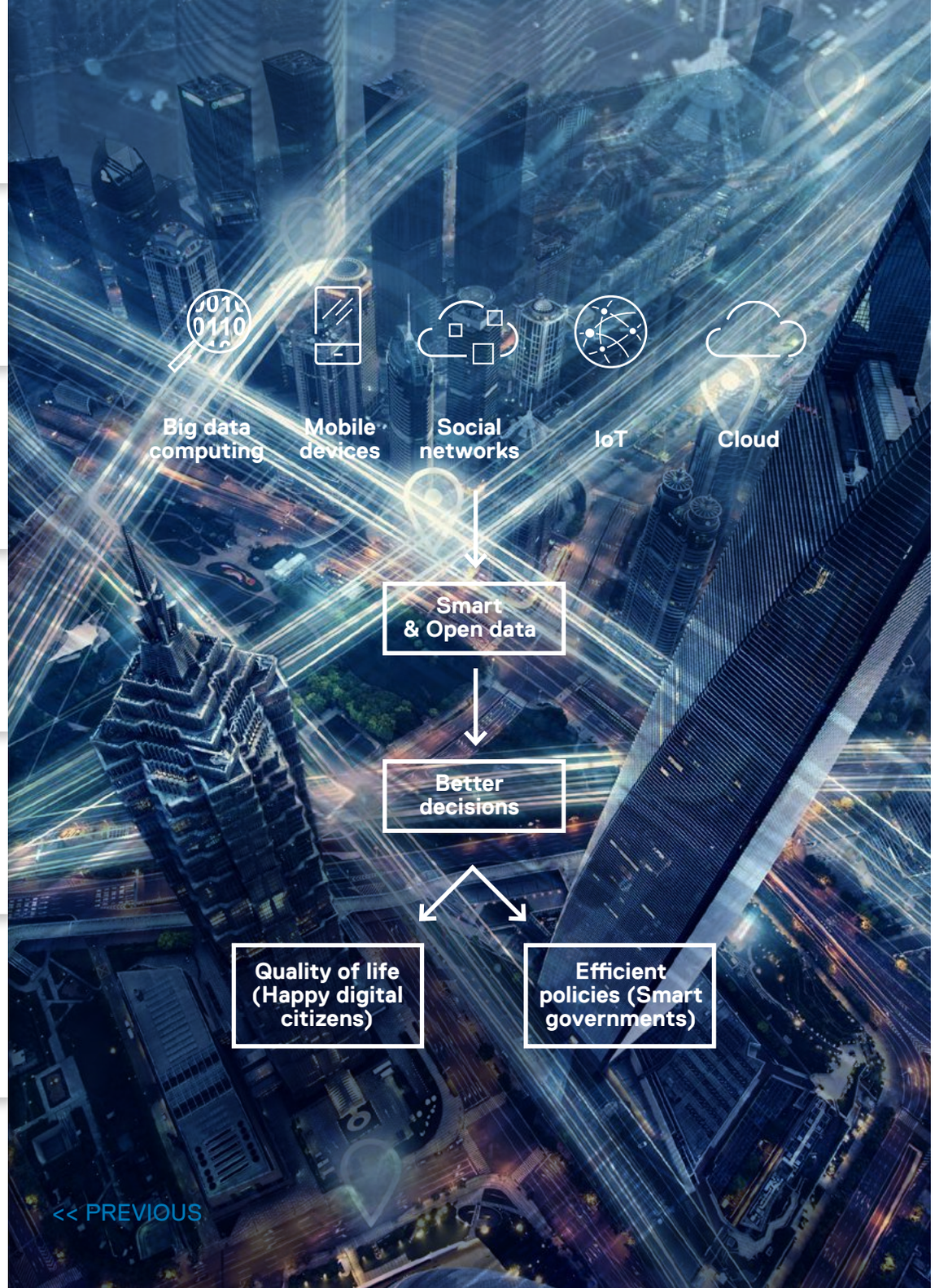

EXECUTIVE SUMMARY

Connected cities or 'smart cities' mix technology and human capital to solve problems resulting from the growth of the urban population.

In our increasingly urbanized world, citizens, companies, public services and machines (IoT) generate **mountains of data** that can be used and **shared** by public authorities to make their city smarter. City officials should work as a **catalyst** as well as an **orchestrator** to streamline all **innovations** – public and private, from citizens as well as companies – that can solve **modern-day challenges**. The scope of action is broad – public health, mobility, housing, security, schooling, waste management, culture, tourism and more – but the final goal is pretty simple: to improve **the quality of life** for everyone in the city.

In the smart city, every cent of **public money is spent efficiently** and **digital citizens** have all the information they need at their fingertips.

The challenge for the Connected City of the future is to keep in mind that technology is **a means and not an end.**

In the 'smart city', every citizen feels connected to progress.

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"A Smart City is a finite entity (district, town, city, county, municipality and/or metropolis) with its own governing authority that is more local than national. This entity is built on an ICT foundation layer that allows for efficient city management, economic development, sustainability, innovation and citizen engagement."

Source: IDC, 2015

CHAPTER 1

The City of 2050

By 2050, the world population will reach 10 billion people, compared to 7.3 billion today. Most of that increase will happen in cities. Experts forecast the urban population will have doubled by then.

This demographic boom, already very visible today in many parts of the world, comes with big challenges that could lead to chaos. Unless local governments, together with their communities, step up to the plate and work on innovative solutions.

How can we let cities grow while preserving, or even improving, quality of life for all citizens? Moreover, where can we combine urban development with sustainable working and living conditions?

Even where the population increase stays under control – like in most historic cities in the Western world – how can we keep the cities attractive, green and prosperous, **both economically and culturally,** while ensuring that urban areas are accessible and inhabited by a variety of income earners?

The Connected City can **improve quality of life** and **preserve social cohesion** thanks to a smart combination of new (mobile) technologies with human and economic factors.

75%

OF THE WORLD POPULATION, WILL BE LIVING IN CITIES BY 2030
FROM METROPOLIS TO MEGALOPOLIS

Source: United Nations

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Four paths to the Connected City

1 Smart Environment

Reducing air and water pollution, improving energy efficiency in buildings, deploying more energy-efficient street lighting and investing in circular waste management systems. These are some of the key challenges faced by a growing number of cities under **relentless environmental pressure.**

On the solution side, we see cities innovating with **better traffic management**, sidewalks that generate solar energy and pollution **absorbing billboards** or green walls. More generally, we see public buildings being made more **energy efficient** and **waste sorting** schemes that enhance recycling rates.

2 Smart Government

What used to be called e-government opened the way to new forms of online services for citizens. Smart Government goes deeper by improving the dialogue between the city's government and the city 'users'. In a smart city, City Hall should be just a few clicks away. **Mobile apps** can be used to consult the population on public matters. Anyone can provide feedback and participate more in public life improvements. **Big Data technologies** are being used by city officials to gain insights into priority issues and to make better decisions with greater transparency. Because **collective intelligence** is needed to solve complicated issues and create engagement, the city CIO should promote open data strategies to foster innovation all around.

3 Smart Living

For most urban populations, the first prerequisite for quality of life is to feel safe and secure. In a smart city, technology is used to **enhance security** and combat crime - while **preserving privacy.** Deriving actionable intelligence from data can also improve access to information about **health and emergency services.**

Given the current housing crises, insights can promote new and more inclusive housing facilities.

In addition to the above, the **touristic and cultural offerings** can be made even more dynamic and open to anyone.

4 Smart Mobility

Mobility, or rather immobility, is a nightmare for most of those living and working in big cities. And it is a real headache for decision-makers and city planners. Some of the ingredients of the solution are well known, like more efficient, comfortable and **greener public transport systems.** However, there needs to be a long term, coherent vision and strategy. In the meantime, **smart parking systems**, greener logistics, **traffic information in real time** or incentives for using bikes can all contribute to helping people move (again).

2billion

THE NUMBER OF CARS ON THE PLANET BY 2035

Source: Navigant Research

75%

CITIES CONSUME 75% OF GLOBAL ENERGY PRODUCTION

Source: United Nations UN-HABITAT program

10%

THE EUROPEAN VIDEO SECURITY SURVEILLANCE MARKET HAS GROWN AT A CAGR OF 8-10% OVER THE PAST FEW YEARS

Source: Homeland Security Research

35%

CURRENTLY, ABOUT 35% OF THE EU'S BUILDINGS ARE OVER 50 YEARS OLD. BY IMPROVING THE ENERGY EFFICIENCY OF BUILDINGS, WE COULD REDUCE TOTAL EU ENERGY CONSUMPTION BY 5-6% AND LOWER CO2 EMISSIONS BY ABOUT 5%

Source: Navigant Research

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WHAT A CONNECTED CITY SHOULD NOT BE ...

- **A short term, tactical digitization of public services:** a Connected City goes broader than just booting or shifting public services online. Of course, administrative simplification for citizens and companies alike is part of the 'smart city' equation, as is easing existing relationships between the city and all its stakeholders. A Connected City, however, should go one step further. It should create **new interactions** and find **new solutions** to live better together.

- **A technology stronghold:** we should keep in mind that technology is an enabler and not a destination in itself. From this perspective, the city's CIO and the people in charge of the city's IT infrastructure and services will play a vital role in empowering Chief Digital Officers (CDO) and urban planners. The Connected City can rise above itself when technological leaders work **hand in hand** with public service visionaries.

- **A 'one size fits all' approach:** every city has its own specifics and will give its own definition of what the ideal smart city should be. In other words, there is no 'one size fits all' approach to building a Connected City. **Each city has its own DNA**, based on its history, its topology, its political system. There is no 'magic' Smart City ERP system. Also, there will be no Big Bang migration from a modern to a smart city. In this step-by-step approach, the key part is to keep the momentum going and accept the learning curve. Rome was not built in a day.

- **A top-down approach:** in city-planning timelines, 2050 is just the day after tomorrow. As previously mentioned, much of the process will be incremental. Of even greater importance is how the city's transformation engine is run. Rather than build a Connected City from the top down, visionaries should build it from the bottom up. This does not mean dispensing with an overarching 'Smart City' vision and strategy. Rather, once the strategy is set, visionaries should look for ways to drive early **incremental value**. For example, start with a single building or street and make digital technology choices for infrastructure upgrades. Quick wins will lead to larger implementations and adoptions.

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A CLOSER LOOK – DELL EMC CUSTOMER CASE
DUTCH EERLE WANTS TO BE A MODEL 'DIGITAL CITY' BY 2050

1 **The city**: situated in the south of the Netherlands, Eerle has 18,500 inhabitants. It embarked on an ambitious 'Living tomorrow' project to improve the health and well-being of all its residents, visitors and businesses. It wants to be a model 'Digital City' by 2050, showing that being future-proof is not the privilege of mega-stars like San Francisco, London or Singapore.

2 **The vision**: 'Eerle - Living Tomorrow' wants to use technology to enhance working and living conditions, as well as leisure possibilities. Its approach to the Connected City is holistic. Projects vary from water and waste management, clean air at school, safe streets, CO_2 reductions and healthcare everywhere.

3 **The solution**: the municipality collects data from various sensors and devices (IoT), according to each specific need – from safe swimming in public parks to air quality control in classrooms. This data is sent through a communication (mobile) network to feed Big Data storage systems. Mobile apps are built on top of these to deliver real-time information to citizens and visitors in a user-friendly manner.

4 **The partnership**: such a broad and innovative project is only possible when different parties work closely together and share knowledge. The municipality can count on a dozen or more technology and engineering partners. Energy company SPIE and Dell EMC are in the driver's seat of this trendsetting project. Dell EMC provides several IT building blocks, both on the storage infrastructure, the virtualization (VMware) side and on the application (RSA, Pivotal) side.

1992

A SMART CITY SHOULD BE CONSIDERED AS AN OPPORTUNITY TO TRANSFORM A CITY, LIKE WHAT HAPPENED IN BARCELONA WITH THE 1992 OLYMPIC GAMES.

Source : Josep-Ramon Ferrer, director of Barcelona's Smart City Program

THE KEY TAKEAWAYS FOR THIS CHAPTER

A potential win-win-win

If it succeeds in having a broad impact on all aspects of city life, thanks to a bottom-up technology-enabled approach that engages all stakeholders, the Connected City will be a major improvement for...

- **Citizens**, who need higher quality of life
- **Businesses**, which attract talent as a result of increased productivity, easier commuting and better living conditions
- **Cities**, which attract new investments, IQ and lifeblood, while increasing operational efficiency and future-proofing with smart lighting, buildings and safety

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CHAPTER 2

The open data challenge

To create a win-win-win for citizens, businesses and local governments, the Connected City needs to turn mountains of data into insights that will be beneficial for all.

Data sharing and intelligence are central to managing population growth, along with many challenges related to safety, pollution, mobility, commerce or culture.

Consequently, the future-proofed Connected City must be built on a strong ICT (information & communications technology) foundation that is **open, agile and data driven.** This will allow efficient city management, speed to market (STM) services, sustainability, innovation and transparent citizen engagement.

Adding to the challenge is the fact that, quite often, the bulk of municipal budgets is already committed to ongoing programs, notably for the modernization of legacy applications. As IDC points out in its white paper 'Building Agile, Data-Driven Smart Cities', city administrators have to balance these new requirements while trying to optimize budgets and resource allocation, and still meet citizen needs and requirements.

2,549

THE HOURS THE AVERAGE MOTORIST LOSES DURING THEIR LIFE, LOOKING FOR A PARKING SPACE

Source: The European Union

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How to start with open data governance?

1 Create trust

The complexity and volume of data is ever increasing. Cities can extract data from their own operations, as well as from data that citizens generate throughout their everyday activities.

To cope with this complexity, it is critical for the builders of the Connected City to create a **smart city data governance** plan. This plan will be the base reference to build trust with citizens. It will tell them which data is being used, when and what for, through transparent communication.

*Example: **Dubai** is enacting an Open Data Law that will provide citizens and private organizations with access to data that can be leveraged to develop innovative solutions.*

2 Take care of the packaging

In the digital world, information and services can be increasingly tailored to the user and deliver value in real time. But the way, more specifically the format, in which it is made available is as important as the content itself. For IT leaders and urban planners, this means creating an open environment that translates data and makes it **accessible to everyone**, and not just to data scientists.

We said already that a true Connected City should engage all of its citizens, also those who are less tech savvy. To reap the benefits of smarter tools and apps, citizens need **dashboards** and **interactive statistics** that are easy to understand. They need user-centric interfaces tailored to their needs.

*Example: One of the first European cities that started an Open Data initiative is London. In January 2010, Mayor Boris Johnson launched the **London Data Store**, which now gathers more than 700 datasets, about crime rates, planning decisions, traffic accidents or house prices.*

3 Engage citizens and businesses on a forum

One major challenge when building a Connected City is to gather, in a structured and interactive way, all new ideas coming from collaboration initiatives like hackathons.

To support citizen entrepreneurship and startups, smart city builders should consider building an **open innovation and developer forum** (or open portal) adapted to their specific city's requirements. Data scientists and application developers can then use data from this forum to gain new insights and create new services. Ideas can then turn into projects and projects into real applications.

*Example: In **Brussels**, following the terrorist attacks in 2016, a hackathon dedicated to first aid and emergency services was organized by a startup incubator in Molenbeek. This initiative was supported by the local authority under the Brussels Smart City program. Collaboration was put in place between IT developers and the 'business' represented, in this case, by the fire and emergency services of Brussels and the local Red Cross. Less than a year later, a first mobile application 'CitizenMap' was launched, based on open data about the location of defibrillators in the city. It is now being tested in the field.*

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What is a data-driven city?

The data-driven city leverages Big Data technologies, analytics and cloud computing scalability across various data feeds in order to:

- extract quality, and predictable and actionable insights
- ensure strategic decision-making
- deliver improved performance management

A typical example of how a city can improve security is by using quality data feeds from building sensors and CCTV cameras.

The data-driven city is bound to find these four challenges along the way:

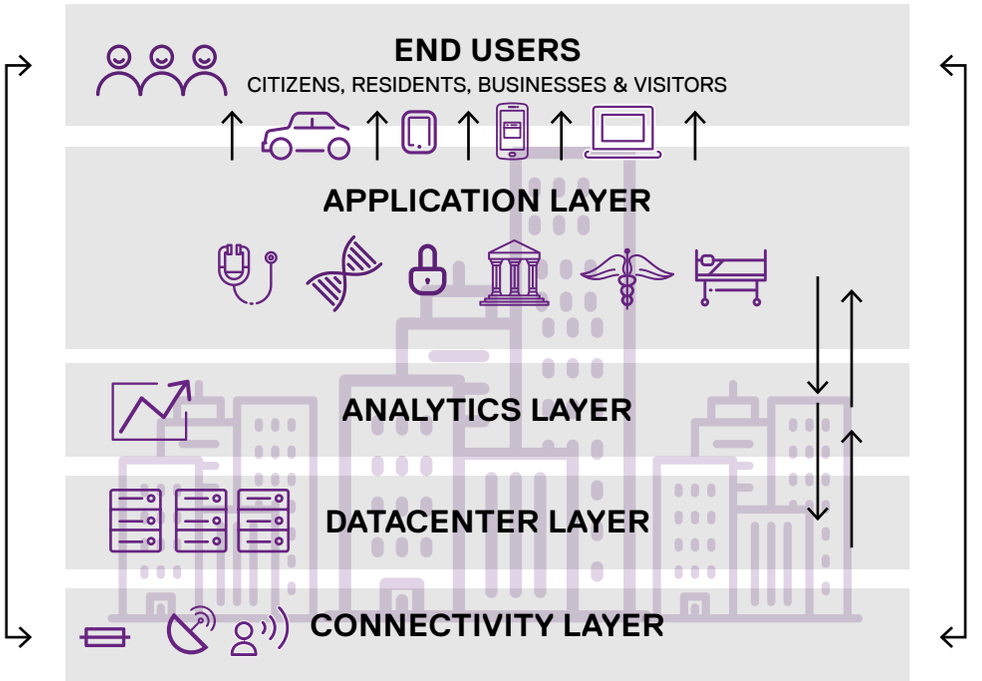
1 **Classify and store the data.** Capturing the data from various sources is just the beginning. The Connected City needs to define **data access privileges** for various public and private entities. This sorting job comes with issues around data interoperability, data quality and data formats.

2 **Let old and new coexist.** New initiatives will not start from a totally empty page. Many of them will involve the **modernization of existing ecosystems** that already store data that can't be thrown away just like that. The Connected City will have to combine old and new ecosystems.

3 **Strike the right balance.** Local governments will need to strike the right balance between data security, accessibility and privacy. It will be key for citizen data not to be shared by third parties without due consent.

4 **Build a stronger infrastructure.** With its open architecture, cloud computing is a unique opportunity to interconnect various departments and stakeholders around Connected City projects. **Cloud technologies** can be leveraged by cities to consolidate data from various applications and sensors while providing enhanced compute and storage capabilities. To take advantage of this cloud-enabled common platform, cities first need to enhance their infrastructure. This means making new investments in existing datacenters or building out new and more powerful ones. On the application side, a cloud-empowered city will be able to create new services based on data from **third-party applications** and **sensors (IoT)**. However, even in the cloud, the challenges around data security and data portability will not disappear.

In a Connected City, devices used by citizens, residents and visitors are both the source AND the destination of data.



"On-line services are available in most cities, but often only through select and limited channels. Ordinary citizens, however, are more and more connected and use parallel channels to communicate, and they expect (even demand) that cities to be open to this."

Source: From Smart City Economics, position paper by Atos

"Tapping into the Internet of Things will help police departments turn Smart Cities into Safe Cities."

Bill Searcy,
Vice President for Global Justice, Law Enforcement, and Border Security Solutions, Unisys

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IOT AND BEES TO MONITOR URBAN AIR QUALITY

The Internet of Things (IoT) is already real in numerous Smart City projects around the world. Sensors help measure traffic congestion and pollution and take necessary actions.
Based on its industry leading IoT infrastructure portfolio, Dell is going a step further by experimenting the combined used of IoT and bees to monitor environmental parameters.
A bee hive has been installed on the roof of the IoT lab in Limerick, Ireland. Sensors in the hive collect data about humidity, heat, CO2, etc., which are in turn aggregated and analyzed. With this Internet of Bees project, Dell gains insights that can benefit different industries.

30 billion

CONNECTED DEVICES TO THE INTERNET OF THINGS BY 2020

Source : Gartner

AND

50 %

OF CITIZENS OF BIG CITIES WILL BENEFIT FROM SMART CITY APPS AFTER VOLUNTARILY SHARING PERSONAL DATA, BY 2019

Source : Gartner

VS.

400 billion

THE TOTAL COSTS OF CYBERATTACKS TO THE GLOBAL ECONOMY EACH YEAR, ACCORDING TO ESTIMATES. THE PUBLIC SECTOR IS A RECURRENT PRIMARY TARGET.

Source: Lloyd's

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SECURITY ON TOP OF PUBLIC CIOs PRIORITIES

It comes as no surprise that data security is the number one policy and technology priority of CIOs of public bodies.
According to a survey made by NACSIO, the organization representing CIOs from the US States, data security rose from position 7 in 2011 to being the top priority in 2015.

Open data is essential to building **accountable** and **effective** institutions, and to ensuring public access to information — both goals of the United Nations' 16 Sustainable Development goals.

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A CLOSER LOOK
HOW BOOMING DUBAI IS TRANSITIONING TO A SMART CITY

1 **The challenge:** Like most countries in the Persian Gulf, the UAE is expected to have one of the highest urbanization rates in the world. The flourishing city of Dubai works as a magnet. But space and resources are limited.

2 **The vision:** The government of Dubai launched a series of 'smart' initiatives and strategies to ensure the 'happiness' of its citizens. Technology innovation is seen as the key enabler to give citizens access to various services on their mobile phones, while allowing the city to make efficient use of its resources. The World Expo 2020, with 25 million visitors expected, should be a showcase for this Dubai Smart Government.

3 **The strategy:** Dubai defined six sectors that have to become 'smart' first, namely infrastructure, transportation, communications, financial services, urban planning and electricity. 100 initiatives have been launched across these sectors, along three key tracks: connectivity, mobility and data. Nearly 1,000 services are expected to go 'smart' in the coming months. To solve the open data challenge, Dubai intends to set up a command center where city officials will get a unified view of all Smart City operations.

4 **The first results:** In 2015, Dubai's Roads and Transport Authority (RTA) said that close on 100% of its services are now available online and are mobile to road users, public transport users and businesses.
IoT is also very concrete. The Dubai Electricity and Water Authority has already deployed 200,000 smart meters, thus allowing citizens to monitor their consumption on their mobile phones.
Security is another priority. Dubai Police has introduced smart services that allow citizens to locate traffic jams, report accidents, etc. It has also installed more than a thousand CCTV and mobile cameras to monitor crowds and traffic.

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"Smart cities demand a technology-driven solution that is open, agile and software-defined in order to bring fast response to citizens' needs while optimizing the utilization of available resources."

Patricia Florissi,
Dell EMC VP and Global CTO for Sales

KEY TAKEAWAYS ON THIS CHAPTER

- **Smart citizens** require on-time and accurate services and information.
- **Transparent & Secure**: more transparency means providing open data to diverse stakeholders while dealing with legislative mandates, compliance regulations, privacy laws all while combatting cyber invasions of citizen information.
- **A matter of trust**: securing citizen data, protecting against breaches and solutions such as data encryption and identity and access management, as well as security monitoring and analysis.

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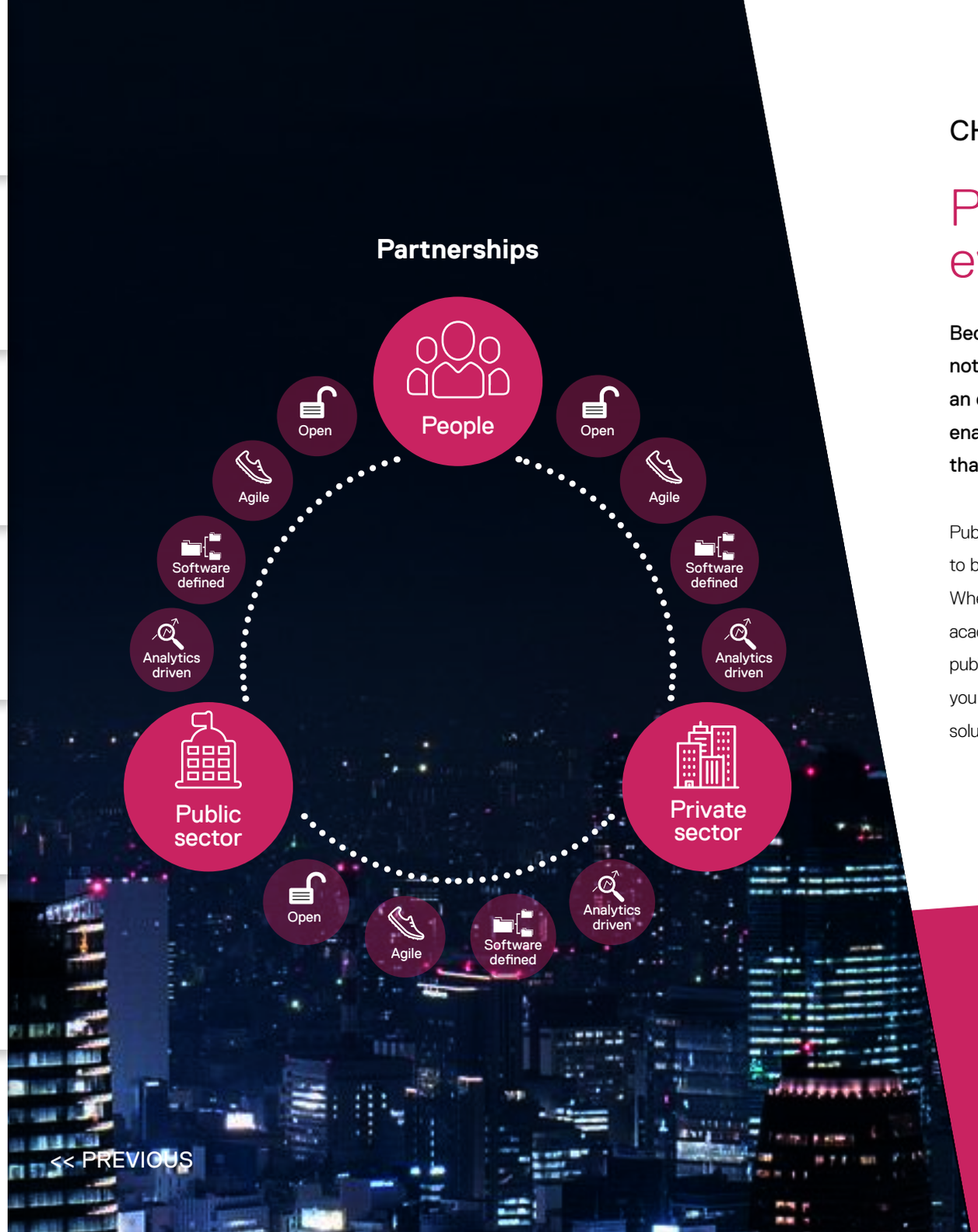

CHAPTER 3

Partnerships to engage every citizen

Because of limited resources, both financially and technically, governments will not be able to build a Connected City alone. Their job, both as a catalyst and as an orchestrator, is to build core capabilities and to set the governance rules that enable other players in the ecosystem to come forth with new apps and services that bring added value.

Public and private sector partnerships are key to building the Connected City ecosystem. When you bring disparate groups like citizens, academics, startups, technology vendors, public utilities and city administrators together, you multiply the chances of developing robust solutions for real needs.

To sum up, Connected City visionaries should gather all energy available so that disparate digital or technological tools converge into a real citizen engagement platform. For that, they first need to put a framework in place.

"We can't develop enough apps fast enough to satisfy the growing demand"

Lea Deesing
Chief Innovation Officer for Riverside, California.

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Who does what in a Connected City Framework?

Technology is a means and not an end for the Connected City journey and success will depend on the ability of widely different groups of people to innovate together. No single stakeholder can have a deep and lasting impact alone.

1 **Citizens** are the source of most data needed to drive Connected City services. They are also the barometer in the sense that the effectiveness of any initiative depends on their satisfaction level as the main consumers of new apps and services. 'Citizens' should be understood in a broad sense, including visitors and businesses that wish to engage with the city.

2 **Governments** are the major enablers of the Connected City ecosystem. They drive the agendas and have to leverage IT investments so that they benefit as many departments as possible. Other stakeholders expect them to objectively measure the benefits of the various 'smart' initiatives.

3 **Technology vendors** play a vital role in ensuring the security, openness and user-friendliness of all new digital services and apps, as well as the integration with legacy systems.

4 **Planners and developers** define the big picture of the city of the future. They have to integrate the Connected City roadmap into their planning of the big construction works that lie ahead.

5 **Utility providers** of water, gas or electricity are key elements of the value chain of the Connected City. They can ease the daily life of citizens, while ensuring continuous and cost-effective services.

"Connected Cities are implementing technological infrastructures that embrace and facilitate a continuously innovative environment which not only caters to residents' needs, but is also able to predict their future requirements and demands. Ultimately a smart connected city allows better allocation of its resources which results in a more economically efficient and happier way of life as it opens up opportunities for citizens to interact with and contribute to its growing portfolio of services. This in turn attracts the top tier of global talent leading to a more competitive and intuitive city for happier residents."

Mohammed Amin,
Senior Vice President, META Region, Dell EMC.

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A Data Lake where everybody can swim

To facilitate collaboration inside a large entrepreneurial community, Connected Cities need to rely on an open, secure and scalable IT platform that breaks down silos. This platform should favor open-source technologies that are easy to use and encourage development across a broad ecosystem.
Dell EMC recommends the implementation of a 'Smart City Cloud'. This platform in the cloud is made up of 3 layers:

- **An Infrastructure Foundation Layer** enables the abstraction, aggregation and pooling of storage, network and computing capacities for diverse stakeholders. This allows cities to accelerate innovation and to scale infrastructure resources depending on new citizen services and apps.
- **A Data Lake Layer** provides an open systems architecture (OSA) for the ingestion, protection, management and sharing of data. Cities fish in the Data Lake to transform mountains of data into actionable insights that can be made available to the Connected City Ecosystem.
- **An Application Layer** enables the consumption of all the data aggregated and analyzed in the Data Lake. It allows cities to test, deploy and manage applications in an agile manner, whether these are developed internally or come from third parties.

Leveraged in a Smart City Cloud, cloud technologies are a unique opportunity to consolidate data across different industry-specific systems and applications.

It allows technology vendors to scale digital services from different partners while preserving existing service levels.
Initiatives in the energy efficiency field, for instance, require interconnectivity between different stakeholders: utilities, municipalities and building owners. Each use their own sensors and smart devices. Cloud technologies help build a common platform.

"Local governments need to work on the part of the iceberg that's below the water line, building core capabilities that enable the development of high-value civic apps by other players in the ecosystem."

Extract from 'Local Government in the Digital World" by Digital Communities (e.Republic)

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OPEN SOURCE TECHNOLOGIES BEST FOR OPEN INNOVATION

The ideal Connected City platform should favor open source technologies in order to capture innovation from a wide network of developers. A significant proportion of Dell EMC's building blocks for the Smart City is based on open source components. This includes Dell EMC Cloud Storage, Pivotal Big Suite (entirely open sourced) or Pivotal Cloud Foundry, which is a leading edge Open Source PaaS.

"Technology is becoming the leading contributor to redefining the city and its potential as it strives to maximize its efficiency and the happiness of its residents. While the day-to-day life of residents becomes ever-more digital, the demand for the Connected City to provide the same frictionless convenience and on-demand services is now a growing expectation."

Mohammed Amin,
Senior Vice President, META Region, Dell EMC.

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Who's in charge?

The building of a Connected City is a journey, a **'living lab'** that will learn from its errors. To keep the dynamic going, the City needs an **enthusiastic and dedicated person.** Job titles may vary: Smart City Manager, Smart City Ambassador, Chief Urban Planner, Chief Innovation Officer etc.

But one thing matters: in close relation with the Mayor's Office, this Smart City Manager will have the key responsibility to:

- **Facilitate collaboration** inside the city's administration itself. We know that city public services tend to work in silos, with very few interactions between, for instance, the population department, housing services and roadworks. Most of the time, the IT department is also on an island.
- Fulfil the **innovation enablement** role of the Connected City towards external stakeholders and coordinate these energies.
- **Communicate** to the world the results that are being achieved and be the contact person for the press.
- **Negotiate** a clear mandate and a **budget** with the policymakers.

Without this, the Connected City is just wishful thinking.

By using strong interpersonal skills, the Smart City Manager can be the perfect **bridge-builder** between the **technological, human** and **institutional** worlds so that the Connected City can combine short-term results and a long-term vision.

PARTNERSHIPS BETWEEN CITIES

Given the limited budgets and resources, cities in the region or country have a vested interest in sharing best practices around 'smart' services. Open-source and cloud technologies can help mutualize investments in IT infrastructure. Players with a horizontal approach like regional institutions and universities can play a role in facilitating inter-city collaboration and providing benchmarks. The same goes for technology vendors.

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A CLOSER LOOK – DELL EMC CUSTOMER CASE
LEADING DIGITAL CITY TURNS TO THE CLOUD
TO ENSURE PUBLIC SERVICE CONTINUITY

1 **The city:** Avondale (United States, Arizona) has won several national awards for utility management, public engagement and innovation as a Digital City.

2 **The challenge:** already a pioneer in internal hybrid cloud computing for storage and networking, the city wanted to take a major leap with its backup and disaster recovery strategy by moving it completely to the cloud. The new virtual computing environment had to ensure that critical public health, safety, utility and financial services would always be available for its 80,000 inhabitants, even in case of a catastrophic event.

3 **The solution:** Avondale chose VMware vCloud Air Disaster Recovery. Ease of use was a key consideration, as well as tight integration with the existing vSphere environment.

4 **The benefits:** a reliable and cost-effective cloud-based disaster recovery solution, reaching the highest standards in terms of data recovery speed.

VMware, part of Dell Technologies, is a strategically aligned business partner for Dell EMC.

KEY TAKEAWAYS FOR THIS CHAPTER

- The success of the Connected City will depend on its ability to develop an ecosystem that leverages both public and private partners.
- The city council should not try to reinvent the wheel but should work as an innovation enabler for all stakeholders.
- The city needs an open, intelligent and people-centric technology platform, that interconnects people and data in (near) real time.
- It also needs a dedicated manager with a strong personality and who is at ease in technological, human and institutional matters.

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"Smart cities should have a very strong ICT foundation that allows better management, better allocation of resources, sustainable innovation and definitely, citizen engagement."

Mohammed Amin,
Dell EMC Senior Vice President and Regional Manager

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CHAPTER 4

The mayor's point of view

The Connected City holds the promise to:

- Convert Petabytes of raw data into **valuable information** for citizens, visitors and businesses.
- Turn this knowledge **into action,** by taking efficient measures that improve standards of living in the City.
- Build **trust** between people and policymakers.
- Revitalize (local) **democracy** thanks to collaborative technologies.

The challenge for inspirational City leaders will be to extend the city transformation from some isolated 'nice-to-have' initiatives to a holistic customer engagement platform that improves all aspects of daily life.

Connected City visionaries have to decide on budgets that turn visions into sustainable actions.

One of the biggest challenges will be to ensure that no one is left behind. Public-private partnerships will be key in bringing solutions to life while also closing the digital divide.

Digitalization can be a contributor to more equality.
The role of the mayor in particular is to support and safeguard a coherent vision that makes the city more attractive to all, striking the right balance between economic, environmental, security or cultural priorities.

The mayor's contribution to success will be to designate or at least cooperate with people on an ongoing improvement process, over a longer timescale than that of the electoral calendar.

240

THE NUMBER OF EUROPEAN CITIES WITH POPULATIONS OVER 100,000 THAT HAVE SOME "SMART CITY" FEATURES. IT MEANS THEY USE TECHNOLOGY TO IMPROVE THEIR ENERGY USE, TRANSPORT SYSTEMS OR OTHER INFRASTRUCTURE.

Source: European Parliament

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Different paths to a same goal

Though the destination is clear, the first steps on the journey can be very different, according to the history of the city, economic challenges or policymakers' priorities. A city that is enjoying an economic boom will tend to focus on meeting demographic changes or enriching its cultural offering. A city that has gone through an economic downturn will pivot to innovation in order to create new jobs and social cohesion. Health, mobility and air quality are common denominators here.

The first Smart City initiatives generally originate from different City departments, deputy mayors or sometimes the mayor themselves with little cross-fertilization. Here, the task of the Smart City manager will be to bring all the pieces of the puzzle together, with the sponsorship of the Mayor.

How to kick-start the Connected City journey?

Here are some of the most common first steps to realize 'quick wins' on the road to a smarter city:

Smart lighting

Public lighting is a common entry point for new smart services. IoT technologies enable planners to deploy energy-efficient street lights that detect human presence and consume energy only when needed. Combined with low-energy LED bulbs, these adaptive technologies can significantly reduce streetlights' electricity consumption that now accounts for between 20% and 50% of local government energy bills. Smart lighting technologies, combined with real-time mobility data coming from vehicles, can also help fine-tune traffic lights to limit congestion. Made smart, public lighting can also be dimmed up in specific areas in case of danger.

Examples: the French city of Nice is leading a trial project focused on smart lampposts in public spaces. The lighting can be adjusted for a range of situations via remote operation or sensors, helping to improve security. The project also considers real-time weather conditions like fog and rain to reduce electricity bills substantially.

Smart waste collection

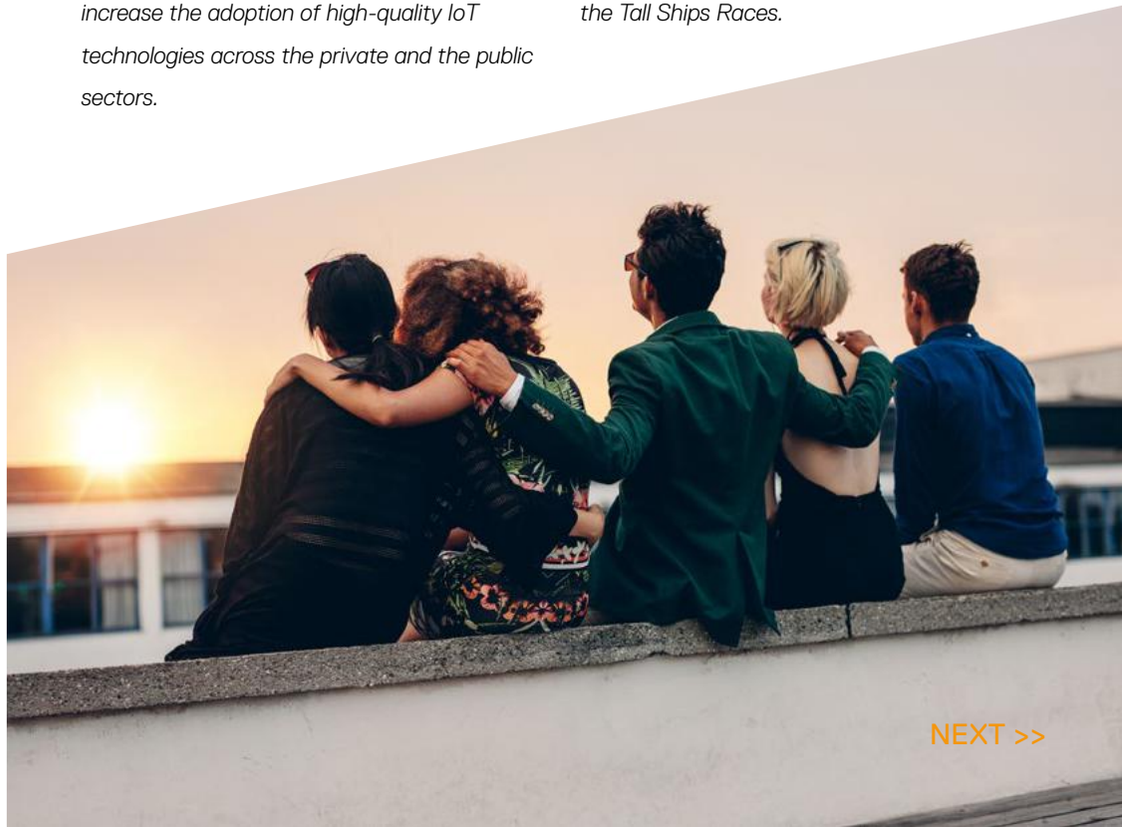
Efficient and greener waste management is a priority for many cities. Some of them are promoting smart garbage containers, equipped with sensors that alert collecting services when a container is full. There is nothing less attractive for a city than waste being spread on the street. And it saves money for the City services as garbage collection rounds can be optimized.

Example: Smart Waste is an essential part of the IoT-UK program, backed by a £40m investment from the British government to increase the adoption of high-quality IoT technologies across the private and the public sectors.

Crowd monitoring

Anonymized localization data from smartphones helps cities better manage big public events like concerts or marathons. This is good for security and mobility as police forces and public traffic managers have a better view of the different flows and can take appropriate measures.

Example: The Belgian City of Antwerp uses cellphone-based crowd monitoring techniques to secure popular events like the Marathon or the Tall Ships Races.



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WHERE DO YOU GET THE MONEY?

The good news for the Mayor is that the City does not have to jeopardize its own budget in order to get smarter. The following financial alternatives can be investigated:

- **Public-Private Partnerships:** the most popular funding model. PPP projects involve private investment from multinationals and local companies that include some form of a government guarantee of revenue streams.
- **Collaboration between cities:** Connected Cities have a vested interest in fostering partnerships among them to mutualize costs.
- **Green bonds:** debt financing used by the city.
- **Energy-saving performance contracts:** includes carbon emission and other environmental contracts.
- **Tax increment financing**
- **Crowdfunding:** emerging as a new means to fund Connected City initiatives, notably in the culture field.
- **Private investment and philanthropy**

Besides these alternatives to taxpayers' money, some cities are exploring new business models to fund their Connected City projects, for example by

- offering **pay-as-you go applications** to third parties;
- allowing **advertising** and **private sponsorship** of (some parts) of the Connected City platform;
- generating **revenues from data.**

Of course, these funding models should be explored in complete transparency in order to maintain the necessary trust between citizens and the city administrators.

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DELL EMC

A CLOSER LOOK – DELL EMC CUSTOMER CASE
HOW PUNE USES VIDEO SURVEILLANCE TO TAKE UP PUBLIC SAFETY CHALLENGES

1 **The city:** with over 3 million inhabitants, Pune is the ninth-most populated city in India, near Mumbai. Like other fast-growing Indian cities, Pune has had to face policing challenges in recent years. A bombing in 2010, killing 17 people, created a sense of urgency for the local authority to take public safety measures against terrorism.

2 **The challenge:** the state government initiated the Safe City, an advanced electronic and Physical Security Information Management (PSIM) project. More than 1,200 IP cameras were installed across the city and a state-of-the-art command and control center was deployed.

3 **The approach:** The Pune police needed a robust and scalable technological solution to store and manage the large volumes of camera data. Petabytes of data are stored in a centralized architecture using Dell EMC's Isilon NAS storage platform. It integrates video analytics and an automatic license plate recognition system with a criminal database. The use of VMware servers, optimizing hardware efficiency and minimizing rack space requirements, was critical to the project goals.

4 **The result:** Pune now operates more than 20 applications related to video surveillance. Consequently, more than 200 significant crimes, including murder cases, have been investigated.

KEY TAKEAWAYS FOR THIS CHAPTER

- Mayors have a leading role to play, setting the vision and striking a balance between economic, environmental, security and cultural priorities
- Together with other City officials, they decide on budgets and the people in charge
- Financial alternatives to taxpayer money need to be explored
- Cities are making some first quick-wins with smart lighting, smart waste or crowd monitoring

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CHAPTER 5

Before and after digital transformation

Smart cities are a very concrete development of the 4th industrial revolution that is now under way. 3D printing, artificial intelligence or the Internet of Things (IoT) are reinventing the interaction between man and machine.

The 1st and 2nd industrial revolutions: The introduction of the steam engine. A century later, the invention of electricity and the rise of the steel industry. These developments all deeply transformed the way cities were organized from the mid-18th century to the mid-20th century. To take one example, the whole transport system in big cities was totally redesigned.

Hundreds of thousands of horses (up to 200,000 horses in New York City in the 19th century) were replaced in a few decades by streetcars. This had a huge impact on how not only transport but also whole processes of city life were organized. Instead of managing tons of waste (manure in this case), city services had to deal with railways, power distribution and, lastly, ticketing systems in order to cope with overcrowded public transport systems.

Very traditional jobs, from stable boy to horse-smith, gradually disappeared, to make way for new ones.
Then came the Ford-T, which became man's new best companion. Roads had to be built, traffic management systems put in place.

The whole city was redesigned for the individual car.

The 3rd industrial revolution started with the invention of computers and culminated with the Internet, helped build modern cities. Some of them became pioneers in what used to be called e-government at the beginning of the 21st century, offering efficient online services to citizens.

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Now with the 4th industrial revolution well under way, Connected Cities can use open, agile and data-driven technologies to become Smart Cities.

They will have no choice if they want to solve the many urbanization challenges that tomorrow will bring. The change will not happen overnight but, in the end, the (digital) transformation will be so profound that historians will probably confirm that the term 'revolution' was used properly. Moreover, in a century where everything tends to move at 'Internet speed', the revolution will not need two centuries but only a few decades. All cities – big and small and all over the world – will evolve from modern to smart. Here is how:

MODERN CITY	CONNECTED CITY
Required a strong urban and civil infrastructure (roads, bridges, stations etc.)	Requires a strong digital infrastructure
Was built by urban architects and planners	Is built by digital architects, based on an open Smart City platform
Designed 'top-down'	Is developed 'bottom-up', with citizen engagement
Organized per proven, closed process	Promotes trust, transparency and collaboration
Was focused, mainly, on economic development	Focuses on citizens' well-being and sustainability
City services were working in silos, each with its own measurement system	Empowers data sharing between city departments as well as crowdsourcing
The mayor or one of their deputies claims an individual contribution to the modern City	A Smart City manager is accountable for the collective progress
Tried to realize a maximum of investments on its own, raising more taxes if needed	Relies on external partners as much as possible, focused on resource optimization
Local government used online tools, from time to time, to consult citizens on certain topics	Communication between authorities and citizens becomes a two-way street
The Town Hall had longer opening hours and you could fill in some forms online	Citizens have access to municipal services whenever they want, regardless of location or device
Liked to compete with other modern cities in order to attract industry	Realizes the added value of exchanging best practices and data with other Connected Cities

A CLOSER LOOK

AMSTERDAM SMART CITY CONNECTS INNOVATORS

1 **The city:** Amsterdam Smart City (ASC) is an ambitious innovation platform that aims at improving the livability of the Amsterdam Metropolitan Area while promoting sustainable economic growth in a future-proof city.

2 **The approach:** ASC is an ecosystem that constantly challenges businesses, residents and governmental institutions to test innovative ideas and solutions for urban issues. Dell is proud to be part of a large community of organizations, companies and startups which help Amsterdam becoming one of the smartest city in the world.

3 **The results:** Projects range from smart street lighting to citizens' smart energy grids. One of the most original projects, ready for replication, is a beer made out of rainfall. In all, more than 40 projects have been launched along 6 themes: Infrastructure & Technology; Energy, Water & Waste; Mobility; Circular City; Governance & Education; Citizens & Living.

1.6 trillion

THE TOTAL INVESTMENT BY SMART CITIES GLOBALLY IN 2020, ACCORDING TO A REPORT BY BANK OF AMERICA.

Source: Merrill Lynch (BAML), 2017

3.48 trillion

THE SIZE OF THE GLOBAL SMART CITIES MARKET IN 2026,

Source: an early 2017 report by Persistence Market Research

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Where will the investments go?

1. Smart IT Infrastructure: $712bn by 2020 (Technavio)
2. Smart Housing: $405bn by 2030 (AT Kearney)
3. Smart Safety and Security: $222bn by 2021 (Homeland Security Research Corporation)
4. Smart Energy Infrastructure: $137bn by 2024 (Navigant Research)
5. Smart Mobility: $45bn by 2014 (Navigant Research)

Final takeaways in order to join the smart city revolution

Technology is there to create an evolutionary Connected City platform. To make the revolution concrete, the Connected City visionaries have to keep three necessary "I" characteristics of the Connected City in mind.

1. **Instrumented:** as many aspects as possible of the city and its people need to be measured, thanks to easy-to-understand dashboards.
2. **Interconnected:** the Smart City IT platform enables the rapid movement and fusion of data in real time, thus ensuring the 24/7 availability of data, when and where needed.
3. **Intelligent:** a Connected City is not static. It can observe and adapt to its surroundings and to life-events as they occur, thus providing resources on demand when its citizens need them. This is the real smart city making life easier by allowing anyone to adapt to changes.

"We will neglect our cities to our peril, for in neglecting them we neglect the nation."

John F. Kennedy

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DELL EMC AND THE CONNECTED CITY

Dell EMC is a global technology leader that enables governments - from national to international - to redefine their operations and deliver IT as a service (ITaaS) on all levels. Through innovative products and services, Dell EMC accelerates the journey to cloud computing, helping IT departments store, manage, protect, and analyze their most valuable asset – information – in a more agile, trusted, and cost-efficient way.

The Smart City needs a smart digital foundation. Dell EMC offers all the expertise required to meet these needs. On top of a software-defined Infrastructure foundation, Dell EMC provides the building blocks to deploy a Data Lake and an application layer. Dell EMC's technologies are open, standardized based and modular.

Dell EMC services its customers – which include 98% of the Fortune 500 – with the industry's broadest and most innovative infrastructure portfolio, from edge to core to cloud.

This portfolio enables Smart City visionaries to build a futureproof connected city platform that is

- Instrumented
- Interconnected
- Intelligent

ABOUT DELL EMC

Dell EMC is part of Dell Technologies, a unique family of businesses that provides the essential infrastructure for organizations to build their digital future, transform IT, and protect their most important asset, information. The company services customers of all sizes—ranging from 98% of the Fortune 500 to individual consumers—with the industry's broadest and most innovative portfolio from edge to core to cloud. Dell Technologies family consists of the following brands: Dell, Dell EMC, Pivotal, RSA, SecureWorks, Virtustream, and VMware.

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