Huawei Smart City
White Paper

Contents

Executive Summary

2019 marks the 500th anniversary of the death of Leonardo da Vinci, perhaps Italy's most famous citizen. Da Vinci was a painter, a sculptor, a mathematician, a geographer, an anatomist, an engineer and an inventor. Da Vinci was also an architect, and he spent much time defining what he thought would be the ideal city, at least according to that time. He had already foreseen what a smart city should be: **a fusion of architecture and engineering in order to provide an efficient transport infrastructure, a water and navigation system, urban safety, and most importantly a pleasing environment for citizens.**

Ancient Rome not only built the Romanesque flat road, but also located under the roads the essential city infrastructure for water pipes, waterways and sanitation. This infrastructure and services are important for building large theatres and venues, and for allowing large groups of residents to live together harmoniously and sustainably. Huawei sees the same requirement today for the digital infrastructure, the ubiquitous connectivity that will

Thomas Miao
CEO, Huawei Italy

allow Italian cities, citizens and enterprises thrive together, harmoniously and sustainably, in the modern city. We are focusing on key concepts such as driving local innovation to create jobs, providing safe and high quality of life for residents, and attracting talents, tourists, and visitors, all together in a spirit of open co-habitation and collaboration.

To celebrate this 500th anniversary Huawei has organized a Smart City Tour in Italy to stimulate and revitalize the focus on Da Vinci's goals of **using technological inventions to help modern cities become more efficient and sustainable**. This whitepaper captures our thinking, and the experiences we have had with our customers around the world.

We know that cities are about people. And as Jane Jacobs says, "Cities have the capability of providing something for everybody, only because, and only when, they are created by everybody." Ensuring that there is a place for citizens to live, breathe, work, play, and rest, and also to speak up and share their opinions, was a goal of Da Vinci and is a goal for Huawei as well.

The population is expected to grow in the Urban Area: according to United Nation, 68% of the world population projected to live in urban areas by 2050 and 2.4 billion people will move to cities;

to accommodate them it will be necessary to enlarge and adapt urban areas or build new ones with a use of natural resources that could increase by 125% to 90 billion tons. To tackle this problem it is therefore necessary to rethink in a sustainable way to transform, design and build our cities.

To have an engaged and open population in a digital and prosperous Italy requires secure and trustworthy digital environment that meets the challenges of today and tomorrow. To lay the foundation for a trustworthy digital environment, both now and in the future, connectivity alone is not sufficient – there must also be transparency, integrity, and accountability.

Smart City Concepts

Cities are places where people live. No matter what their architectural style nor their physical environment, it is the inhabitants and their culture that define and differentiate cities from each other. The Smart City must be **citizen-centric**, providing the space for citizens to live, breathe, work, play, and rest, and also to speak up and share their opinions. Huawei is focusing on the key concepts of **building a fully connected, intelligent world.** We believe that every city should have a relevant, useful and meaningful definition. Working with
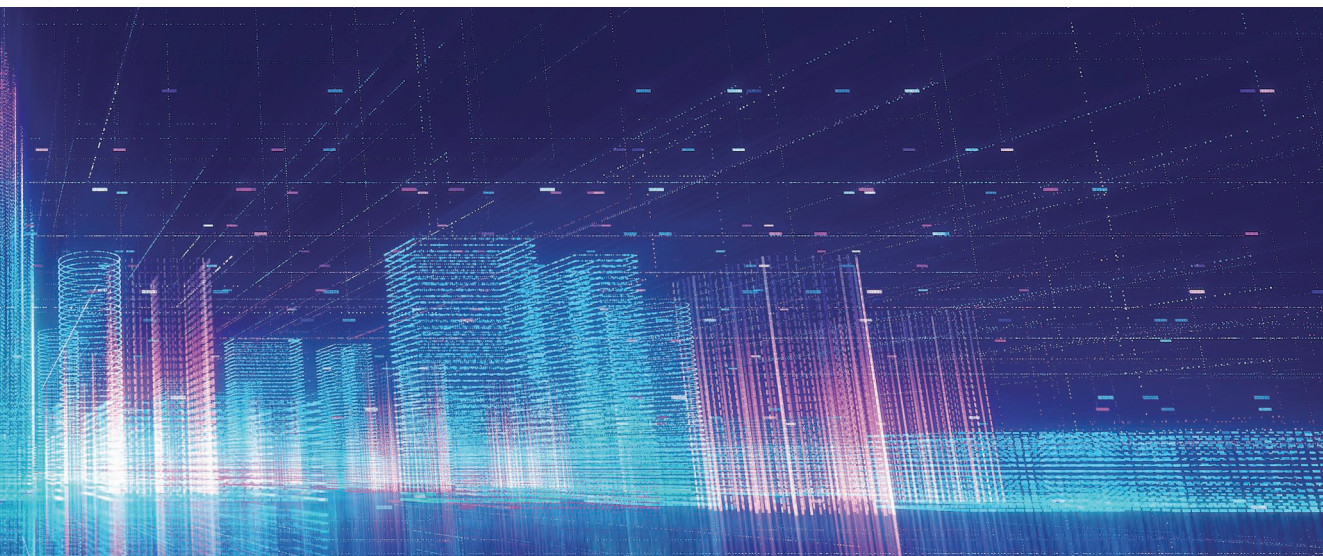
our clients over the past years we have proposed a description of our own, based on the history of Italian cities, leveraging the thinking of Italian innovators, empowering the Italian ecosystem of Smart City service providers and partners, with these key characteristics: **We want to help build a Citizen-Centric, Smart, Equilibrium and Trusted nation of Smart City.** Together with our Smart City Alliance, we strive to support the digitalization of Italy and stimulate local innovation to create jobs, provide safe and high quality of life for residents, and attract talents, tourists, and visitors, all in a spirit of open co-habitation and collaboration. Smart City projects promote growth in **administration, use cases, and business**.

Huawei's mission and vision for Italy

Huawei has been working in Italy for 15 years, demonstrating this commitment to **transparency, integrity and accountability**, and we are committed to helping Italian cities, and most importantly, Italian citizens, to drive successfully into the future. Starting from this year, Huawei is willing to issue one white paper each year and building the Smart City Alliance with our ecosystem partners. Our vision and mission is, to be **a Smart City enabler, partner and incubator that will assist Italy once again pioneering the new smart world, this time**

in the digital economy, empowering Italian cities and citizens. We want to contribute to Italy's success not only with **our experience with global partners**, but also with **our knowledge of the product, solutions, technologies, and programs**, an Italy where cities are **All Things Sensing, All Things Connected, All Things Intelligent, All Things Green, All Things Secure, All Things Esthetic!**

Key Concepts & Technical Enablers

| All Things **Sensing**	All Things **Connected**	All Things **Intelligent**	All Things **Green**	All Things **Secure**	All Things **Esthetic**
5G	Blockchain	Cloud Computing	Big Data	IoT	Artificial Intelligence

ICT infrastructure will be the foundation of the intelligent world

Smart City Requires Seamless Collaboration Across All Domains

All governments in Italy have launched projects in order to foster digitalization and close the gap with the rest of Europe. Many policies (from Industry 4.0 to the Three-Year Plan for ICT in PA) have been put in place, and many initiatives have been launched, with the flagship projects of SPID and PagoPA getting to a rapid diffusion. However, lacking a comprehensive and full approach, Smart City plan at national level, each city is defining its own path towards the Smart City. In the early stages of Smart City planning, city planners and administrators need to cooperate intensely with "stakeholder" enterprises to ensure that development is both technically and financially feasible, and sustainable. Of equal importance, enterprises that provide smart solutions need to understand the issues municipal authorities face and view challenges from a city management standpoint. From this perspective, enterprises will be able to better develop smart products and solutions tailored to Smart City requirements and help municipalities maximize investment returns from scarce resources.

Smart City Requires Seamless Collaboration Across All Domains
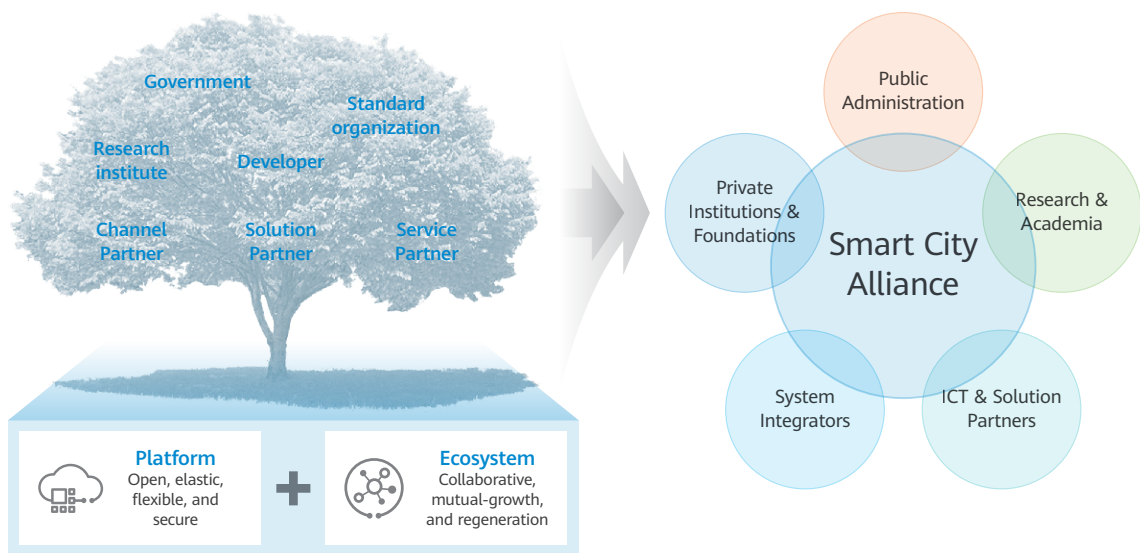
Smart City Use Cases: Smarter, More Sustainable

Modernization of urban infrastructures is crucial for Italian cities. The local transportation, energy and gas, water supply networks, etc. undergo a digitalization process, mainly through the deployment of sensors to improve control, maintenance and quality of service. Fragmentation of competencies is another major problem in Italian cities. Smart City plans often fail or slow down because of the difficulty of coordinating all actors involved, both within the municipality and among the different stakeholders that should intervene for the success of Smart City projects. A wide variety of Smart City use case have been described in this white paper to address the issues and priorities facing each city:

1. **Smart Transportation:** analyzes traffic data collected by sensors and adjust traffic signals in real-time to mitigate traffic congestion.

2. **Smart Utility:** monitors city activities in real time in coordination with police, fire, and transportation agencies.
3. **Smart Healthcare:** the Artificial Intelligence will play an important role to support the diagnosis of doctors. Monitors patients at home and relieves the pressure on hospitals with limited resources.
4. **Smart Education:** provides virtual classrooms and innovative study environments that are more productive and safer for students otherwise exposed to city hazards.

5. **Smart Tourism:** Augmented Reality (AR) and Virtual Reality (VR) as enabler of Smart Tourism. It will require an ICT infrastructure and the development of applications to enrich the quality of tourism.
6. **Smart Port:** Autonomous Guided Vehicle AGV is already a reality in some ports; the next challenge is automation of containers.
7. **Smart Building:** build the enterprise level system for buildings, allowing real-time data availability, integrity, security, stability and scalability at every moment.

Smart City Makes Our Lives Better

| All Things Sensing | All Things Connected | All Things Intelligent | All Things Green | All Things Secure | All Things Esthetic |

Business Consulting

Urban Planning & Design	**Smart Applications**	Public Utilities	Smart Building	Smart Transport	Smart Tourism	Smart Education	Smart Healthcare	Smart Port	**Cybersecurity & Privacy Protection**
	Digital Platform	IoT, IOC, Big Data, other AEPs							
	ICT Infrastructure	5G, NB-IoT, Wi-Fi, Router, Storage							
	Smart Devices	Smart Pole, Sensor, Camera, Connected Car							
	Green Facility	Solar Inverter, Network Energy							

Digital Economy

Digital Economy

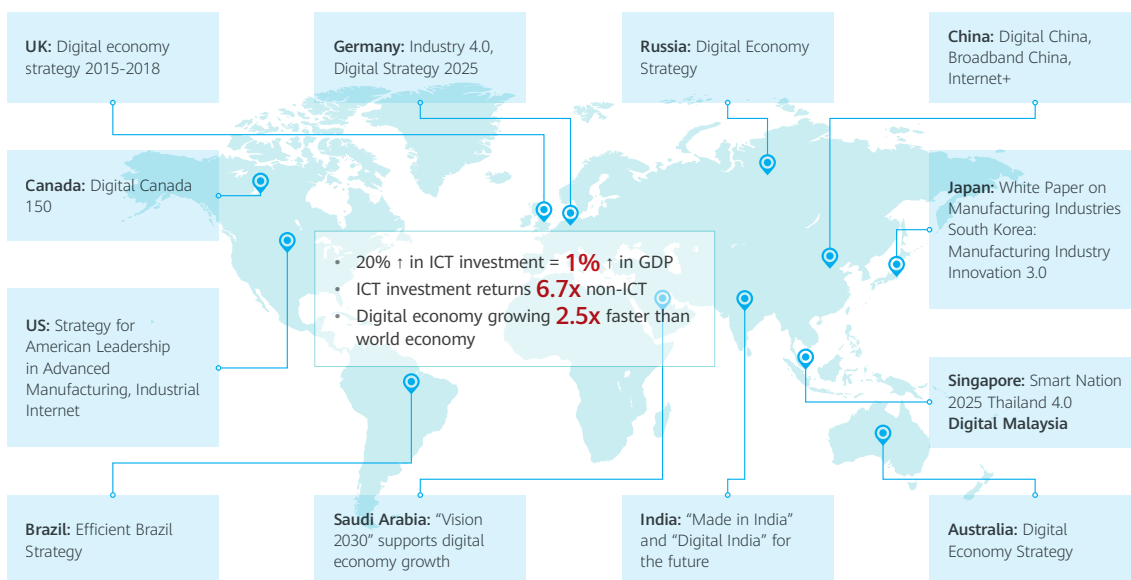## Digital Economy and Governance

With the convergence of information technology and human production and life, information technology has exerted great influence on economic development, social governance, national management, and people's life.

All countries in the world have promoted economic digitalization as an important function to realize innovation and development. Take China as an example. In 2016, China's digital economy accounted for 30.1% of GDP, 22.4 trillion RMB of the scale, it's 2.4 times, 3 times, and 3.1 times of the US, Japan, and UK, respectively.

Despite the headlines that ICT gets and its ubiquity in our daily lives, from the perspective of traditional development, the ICT sector accounts for a small proportion of the economy. However, in recent years, with the emergence of technologies such as cloud computing, big data, and Internet of Things (IoT), information technology increases the Total Factor Productivity (TFP) of every other industry and has an enormous indirect contribution to economic growth.

It is evident that the digital economy is becoming the highlight of a country's overall economy, and the growth rate of the digital economy is higher than that of the national economy. The

Over 170 countries worldwide have published a national digital strategy (ITU)

UK: Digital economy strategy 2015-2018

Germany: Industry 4.0, Digital Strategy 2025

Russia: Digital Economy Strategy

China: Digital China, Broadband China, Internet+

Canada: Digital Canada 150

Japan: White Paper on Manufacturing Industries South Korea: Manufacturing Industry Innovation 3.0

US: Strategy for American Leadership in Advanced Manufacturing, Industrial Internet

- 20% ↑ in ICT investment = **1%** ↑ in GDP
- ICT investment returns **6.7x** non-ICT
- Digital economy growing **2.5x** faster than world economy

Singapore: Smart Nation 2025 Thailand 4.0 **Digital Malaysia**

Brazil: Efficient Brazil Strategy

Saudi Arabia: "Vision 2030" supports digital economy growth

India: "Made in India" and "Digital India" for the future

Australia: Digital Economy Strategy

digital economy is becoming a new kinetic energy of economic development, driving the rapid development of society.

The digital economy generates value for a nation and its cities in five ways: restructuring traditional business models, increasing labor productivity, promoting industry maturity, promoting mass entrepreneurship, and increasing employment.

In the wave of digital economy development, the government has the following dual roles: use technology to transform internally, and exert a far-reaching influence by catalyzing the digital transformation of other enterprises and societal sectors. According to McKinsey, under the existing ICT technologies, governments can generate more than US$ 1 trillion each year through digital economy strategy and digital transformation of its own and various industries.

More and more countries have developed corresponding national strategies. They have evolved into digital countries, such as Germany's industry 4.0, Singapore's smart country, Kenya's national ICT development plan, EU's Horizon 2020 and Digital Agenda, America's Smart Earth, and

Japan's rejuvenation strategy.

Huawei released a study a few years ago that examined the impact of investment on GDP. The results showed that an investment of US $20 million in industrial equipment, real estate construction, and traditional secondary production will increase the GDP value by a corresponding US $50 million. However, if the same US $20 million is invested in the information industry, through capabilities like data centers and broadband connectivity, the GDP increases by US $180 million and at the same time, 387 new jobs are added. Why? Because digital economy is a catalyst, a force-multiplier. It can help push other industries to develop rapidly.

Therefore, we say that in the digital economy era, dividends of digital economy are three to five times that of the traditional economy. This is a strong driving force. Infrastructure in the digital economy era is the broadband network, mobile network, IoT, and data center. This is the most fundamental part of smart city construction. We believe that smart city construction can be the core of a city's digital transformation and can be a foundation for digital transformation of cities.

The Digitalization Process in Italy

The digitalization process in Italy is slow and confirmed at the European level by the DESI (Digital Economy and Society Index (DESI), the composite index that summarizes relevant indicators on Europe's digital performance and tracks the evolution of EU member states in digital competitiveness. What does the DESI say?
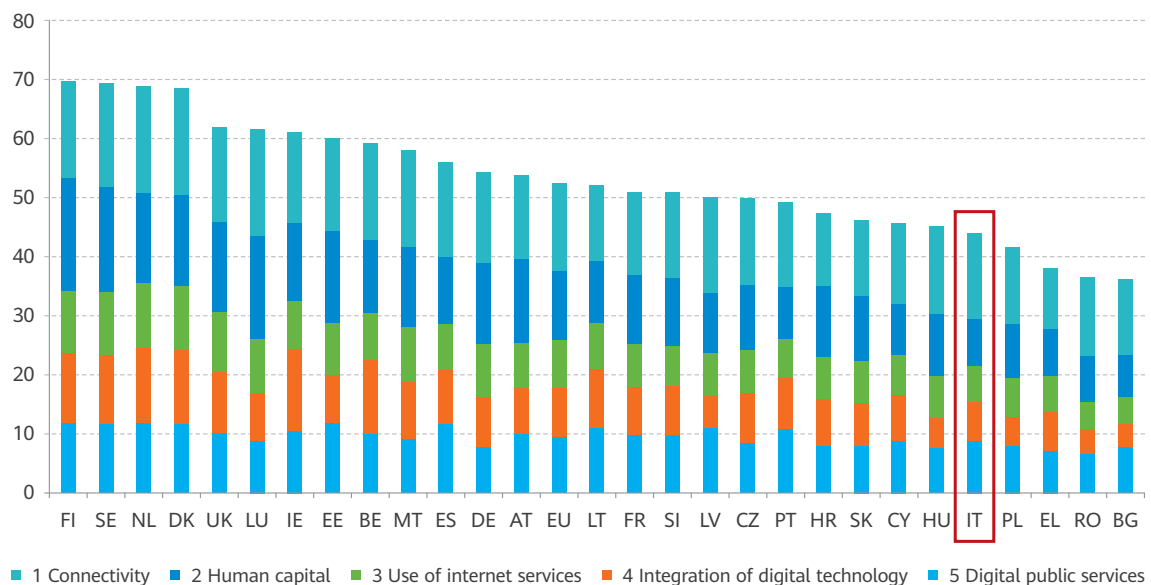
Separate from what is indicated by the DESI, Italy is relatively strong in mobile network, services and diffusion, use of social networks (both from citizens and enterprises), and the availability of online public services (albeit in a very fragmented way).

The use of Internet as a regular practice and for accessing interactive services is on the contrary the most relevant gap. Reasons for the relatively low adoption rates are the aging population (less accustomed to exploit innovation and more resistant to changing their habits), the structure of the economic sector, with a very high prevalence of micro and small enterprises, and the already cited fragmentation of the public sector.

All governments in Italy have launched projects in order to foster digitalization and close the gap to the rest of Europe. Many policies (from Industry 4.0 to the Three-Year Plan in the PA) have been put in place, and many initiatives have been launched, with the flagship projects of SPID and PagoPA getting to a rapid diffusion.

The new government has created an ad hoc ministry to be responsible for stimulating digital innovation when improving governance, giving impetus and implementing the necessary coordination of all objectives. A more vigorous governance is the best condition for the acceleration of our country, in the spirit of a Smart nation, as it has been stated in the new Government's program. The new ministry needs to focus on the role of the digital economy.

Legend: ■ 1 Connectivity ■ 2 Human capital ■ 3 Use of internet services ■ 4 Integration of digital technology ■ 5 Digital public services

Smart City Foundations

Smart City Foundations

Evolution of Smart City

With the emergence of the internet and e-business in the late 1990s, many governments began to look at putting their own services "online" in a trend known as 'e-government.' The typical approach consisted of taking simple processes, such as requesting an appointment or applying for a driver's license, and moving them onto simple forms that were published on government websites. Often the back-end fulfillment of the request remained manual, and online forms were printed off and distributed in hard copies, but at least the citizen had the impression that things were advancing.

Over time, more and more services were moved online, often lumped together in the form of life events, enabling citizens to enter information once and then having that information sent around to all of the relevant ministries or agencies. An example of this is the "lost wallet". This service allowed an unfortunate citizen to enter all of their personal details once, and then multiple requests would be sent to each agency that needed to provide a response, for example a new birth certificate, a new driver's license, request of a police report for insurance purposes, generation of a new tax identification number, etc.

Most e-government services started as individual citizen-facing services, gradually combined into life events, and then extended into government-to-government and government-to-business transactions. These also tended to occur at the regional and national levels of government, due to the complexity and the cost of technology required supporting online service delivery.

Over time, the technology has become simpler and cheaper, governments have become more sophisticated in their use of ICT, and citizens have become more demanding, with expectations of service delivery shaped by Facebook, Amazon, Google and Instagram. Therefore, we arrived at the Smart City.

Smart City is a new model for urban information construction, integrating technologies such as 5G, cloud computing, big data, Internet of Things, mobile Internet, and artificial intelligence with urban scenes. A growing number of governments worldwide are building Smart City via an impressive array of leading-edge ICT technologies that aggregate, share and converge citywide resources to provide real-time, efficient, and intelligent information services.

Definition of Smart City

The most commonly asked question on this topic is, of course, what is a Smart City? There are many definitions, and we believe that every city must have a definition that is relevant, useful and meaningful to itself. However, working with our clients over the past years we have proposed a description of our own, based on these key characteristics:

Citizen-Centric
(esthetic and green)

Advanced integrated technologies allows for a simple and clean esthetic approach where the cities are uncluttered from the unnecessary. 2019 marks the 500th anniversary of Leonardo da Vinci; perhaps Italy most famous citizen. Da Vinci was a painter, a sculptor, a mathematician, a geographer, an anatomist, an engineer and an inventor. Using technological inventions to help modern cities become more esthetic and sustainable is the key for urban planning and designing.

The smart city embraces environmental protection and quality of life by creating a beautiful connection with nature. Huawei is committed to promoting green ICT solutions. We aim to drive industries to conserve energy, reduce emissions and build an environmentally friendly low-carbon society that saves resources. We use innovative energy solutions and green facility to help our customers and users reduce their power consumption and carbon emissions.

Smart
(all things sensing, all things connected, all things intelligent)

Huawei's vision is to bring digital to every person, home and organization for a fully connected, intelligent world. All things sensing: our smart device will deliver a personalized experience to all, respecting the unique character of everyone. All things connected: our ICT infrastructure solution will provide ubiquitous connectivity to give everyone equal access. All things intelligent: build digital platforms and work with our smart city alliance partners to develop smart applications so that to help all industries and organizations become more agile, efficient, and vibrant, and enabling the full potential of every person to be realized.

Equilibrium
(environment, economy, community)

The Smart City seeks to establish a balance between the environment, the economy, and the community. We know that this is necessary – a vibrant community in a beautiful environment will not last long without a strong economy. The Smart City therefore looks to ensure that each of those three domains is sustainably interlinked to the other two.

Moreover, when we talk about the community, we mean 4 users groups: city residents; tourists who move into, though, and out of the city; businesses who operate in the city; and the government employees who deliver city services.

Equilibrium also suggests an inclusive city, where all members of the community are considered. It is

a fact that most Smart City services developed so far focused on the upper socio-economic segments of society; Smart Parking solutions, for example, only benefit those people who afford to buy a car, insure a car, drive a car and then pay for parking. A Smart City should ensure that services are targeting all citizens.

It is perhaps interesting to note that our description of a Smart City does not include any mention of technology; although we believe that technology is both a vital enabler and a driver of «smartness», we also believe that we should not limit the definition to only those characteristics that are technical in nature.

Trusted
(data protection for individual, enterprise and government)

The world is experiencing an evolution of Smart City. These emerge from innovations in information technology that, while creating new economic and social opportunities, pose challenges to our security and privacy expectations. In the digital world, data is the new petrol, data processing is more complex and the risk of data leaks is increasing. Over the past 30 years, Huawei served more than 3 billion people worldwide, supporting the stable operation of more than 1,500 carrier networks in over 170 countries and regions. We have maintained good cyber security records worldwide, and customers have recognized our practices in cyber security.

Huawei has established a comprehensive privacy protection framework and governance system, and complies with all applicable privacy protection laws and regulations, especially the GDPR, that has taken effect in the EU.

Benefits & Return of Smart City

What are the short, medium and long-term benefits of Smart City? Building a Smart City does not mean waiting for years before seeing results. Some use cases can give benefits in a shorter time. For example public lighting, where new light sources such as LEDs can generate significant savings in energy bills. Significant savings can also be achieved in the management of public buildings in energy bills, through sensors that measure environmental conditions and can automatically adjust temperature and brightness, adapting the systems climate and light conditions, allowing for a reduction in waste.

Launching Smart City projects can lead to image benefits to the city, which presents itself as an innovative, dynamic city, in step with the times, and able to innovate by making innovations available to citizens. In other cases, the benefits are long-term ones, for example where a cultural change or mobility styles in citizens is needed to achieve results, all of which take longer for citizens to assimilate change.

Today, several studies and many experiences that demonstrate the return from investing in Smart City projects. What is important to consider is that the benefits are of a different nature (economic, social, image, etc.) and are expressed in different timeframes. In fact: there are short-term benefits, and they typically involve some infrastructure interventions that lower maintenance costs and thus result in savings

Smart Lighting:
For example, in Bergamo, the municipal agency a2a intervened on 15,000 light points in the city with new LED light fixtures, leading to substantial savings:

- Reducing electricity consumption by 39%
- Reducing the cost of replacing lamps (10,000 fewer lamps replaced each year), with also a strong impact due to the reduction of waste produced
- Increased safety for citizens due to increased lighting and fewer faults, which reduce the periods when areas where lamps fail remain in the dark
- Reducing light pollution of the atmosphere, as there is no upward light emission

With an investment of approx.1.5mln €, the saving is held in more than 3mln € in 9 years.

This type of intervention is also suitable for smaller cities (where public lighting infrastructures are often older). For example, the Municipality of Torraca (SA), a small medieval village, has already for many years replaced all its plants (over 700 light points) with LED technology, achieving in a short time savings of 70% in both energy consumption and the costs of 90% of light pollution to the atmosphere.

Another benefit of smart lighting is the positive impact on other Smart City applications that can be accommodated on new plants. In fact, the so-called "smart pole" can accommodate Wi-Fi hot spots for connectivity to citizens, security video surveillance cameras, parking sensors, antennas for collecting data from nearby sensors (from the smart metering of new gas meters generating up to smart bins), photovoltaic panels to power these plants, and many other "smart" applications.

Other interventions give results in the medium-term: for example, the modernization of water

Type of benefits	Short-term benefits	Medium-term benefits	Long-term benefits
Use cases	Smart Lighting Smart Building Smart Parking	Smart Metering (water, gas, electricity) Smart Waste disposal Smart Tourism	Waste production reduction Smart Mobility

networks, with sensors that detect leaks and allow for more targeted and efficient maintenance, lead to savings in the medium-term, when failures are and produce water consumption savings. For example, Barcelona has invested in the water network, and today it delivers savings estimated at 42.5 million euros.

Finally, long-term returns should not be underestimated, which occur when interventions, in order to be effective, require a cultural change or behavior in the citizen. These include, for example, those on waste collection, known not to be fully implemented overnight, but requiring users to adapt to new collection and disposal behaviors, changing their consumption and domestic habits.

Smart Transportation, which takes several years to be appreciated, should be considered because people have to wait for mobility styles to change. For example Milan, which has intervened on mobility with a mix of initiatives (from limiting private traffic – with Area C and road pricing -, to strengthening public transport, from sharing mobility that has covered more vehicles – car sharing, bike sharing and scooters sharing- up to the apps that integrate public transport and bike sharing to push integration). They achieved a reduction in the car fleet of as many as 47,000 units in 7 years, as well as a variation in the sales mix with non-polluting cars (electric, hybrid, etc.) which doubled in just 3 years, and finally a decrease in air pollution, gaining, depending on the pollutants, 2 to 3 extra days of clean air each year.

Smart Building: Another application that can be used in a very short time is the energy efficiency of buildings. It is estimated that in general their consumption accounts for 15 % of energy resources, so that they can be a source of potential savings. The realization of operative control rooms which integrate data from sensors measuring temperature, humidity, brightness, and so on, helping the internal regulation of heating/conditioning on the basis of the conditions. In the most sophisticated applications, renewable energy

production facilities (e.g. the subsidiary networks) can be integrated, with a perceptible consumption saving and, in spite of self-produced consumption energy. In general, Payback time for the return of this type of investment involved around 4-5 years, according to implemented technologies of different areas (temperature, light, energy, etc.).

Smart Parking: Increasing the use of technology support for parking can lead to significant returns. Two types of intervention: from technologies which facilitate the user to find a parking lot, pay it (possibly later based on the actual parking time), and immediately understand the availability of convenience. Many people are looking for the liberties and the chances of intervening in this field. In addition, the technology, which supports the control of the actual payment (cameras, sensitivity, instrumentation of controllers, etc.), is subject to the possibility of contraventions. With a combination of these technologies, Barcelona has realized 36.5mln € per year of supplementary revenues to the city.

Smart City Trends & Directions in Italy

The Smart City in Italy is mainly concerned with the urban environment. It is in the cities that the problem of livability and quality of life has always been raised, and it is at the local level that services are provided to citizens and businesses, that the urban structure of the cities is defined, it is therefore natural that the construction of the Smart City is born primarily in the cities.

Lacking a comprehensive and full approach Smart City plan at national level, each city is defining its own path towards the Smart City. European funds are helping Italian Administrations to become smarter. At national level, the PON Metro is funding nearly 1 billion € of projects in Smart City and Social Inclusion projects, improving infrastructures and services in the metropolitan areas, especially in the South of Italy, which is on the way to reduce the gap with the Center and Northern cities. This shows that cities can be

helped by central government not only through funding, but also through the definition of common standards that enable economies of scale and interoperability between the solutions adopted. This role is very important in order to have a Smart Nation and not only a variety of individual Smart City with limited interoperability between them.

Furthermore, most Regions have adopted, in the framework of EU funds, an «Urban Agenda», financing interventions in the main urban medium-sized areas of their territory, from alternative mobility to energy efficiency, building renovation, and to digital service delivery for citizens and tourists. These regional agendas are pushing cities to a converging path and to the adoption of digital platforms and services at regional level. It is very important that users of a territory (think of commuters who travel daily from one city to another or tourists visiting a region) find similar services, homogeneous interfaces, and integrated information. A regional approach to Smart City projects can facilitate the reuse of solutions, as well as the adoption of infrastructure platforms and wider-scale services, which allow smaller cities to benefit from innovation, with a view to a Smart Nation.

Modernization of urban infrastructures is a crucial topic in Italian cities. The local transportation, energy and gas, and water supply networks, etc. are under a digitalization process, mainly through the deployment of sensors to improve control, maintenance and quality of service.

Fragmentation of competencies is another major problem in Italian cities. Smart City plans often fail or slow down because of the difficulty of coordinating all actors involved, both within the municipality and among the different stakeholders that should intervene for the success of Smart City projects.

Smart City has adopted projects and governance so to foster integration between pillars, trying to design their interventions with a crosscutting approach that makes all stakeholders work together. This is one of the most important

success factors for Smart City projects, and could be achieved through the adoption of horizontal infrastructures, like for example data platforms, which push all involved actors towards the same objective and to act in a coordinated way.

Which is the starting point for the Italian Smart City? According to EY's Smart City Index 2018, Italian cities are more and more evolving towards the «smart city paradigm», even though some best practices at international level remains at distance for many of them. The best in class in Italy are rapidly improving their «smart performances». Milan accelerated its smart plans so to become one of the European benchmarks, thanks to top positions in fiber optics coverage, mobility sharing infrastructures and digital services.

Top 10 Smart City in Italy:

	Torino	Milano	Bologna
	⬆ +1	⬆ +1	⬇ -2
	2	1	3

Modena	4	⬆ +7
Trento	5	⬆ +1
Bergamo	6	⬆ +8
Roma	7	⬆ +2
Firenze	8	⬆ +2
Parma	9	⬇ -4
Genova	10*	⬆ +2
Brescia		⬇ -3

Metropolitan municipalities are once again at the top of the ranking; Bologna, first in the last edition, drops to third place, overtaken by Milan and Turin. Some improvements are observed for Rome and Florence, while Southern Metropolitan cities are catching up (Bari is now the first one), leaving the last positions of the ranking.

Medium-sized cities continue their path of growth: 5 of them (all in Northern Italy) are in the first 10

positions, with Modena (4th) at the top of this class.

Small City generally increases its performance, but at a less rapid rate, so resulting in losing position in the ranking. To build a Smart City and its layers it is necessary to reach a critical mass (composed of resources, actors and markets) that is currently available only in cities with more than 80.000 inhabitants (according to whom?)

What are the latest trends in Smart City in Italy? The smartest Italian cities show some common traits:

- A rapid deployment of sensors, regarding all the urban infrastructures (transportation, energy, etc.), which is capable to produce billions of data on the functioning of the city; this process is faster in bigger cities, mainly those in which multi-utilities operate, thus deploying standardized sensors and interoperable data;
- A growing attention (and some initial experiences) to the building of data platforms, collecting all big data coming from sensors and hosting open data from the public database.
- The fast deployment of SPID (Italian National Digital Identity) and Pago PA (the National
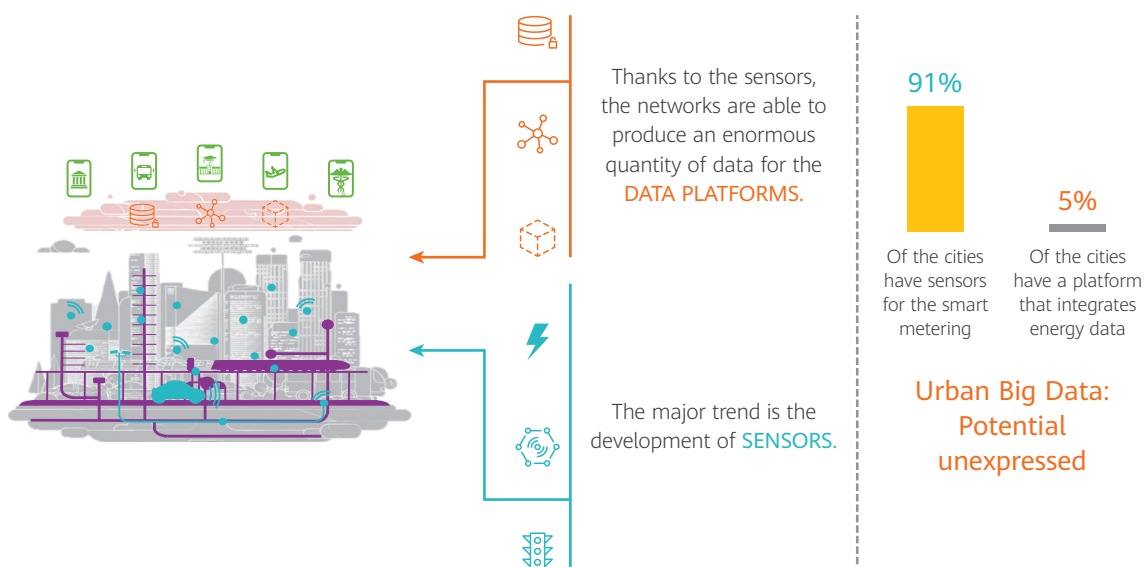
Electronic Payment system) is creating interoperability conditions and integration of services among different actors, thus fostering even more advanced solutions like one-stop-shop registers (Fascicolo Unico del Cittadino), which could provide easier access to on-line public services.

Rapid deployment of sensors in the cities, but few data platforms

The process of building data platform is slower than the deployment of sensors, which is a gap that cities should fill.

Fragmentation of competencies is another major problem in Italian cities. Smart City plans often fail or slow down because of the difficulty of coordinating all actors involved, both within the municipality and among the different stakeholders that should intervene for the success of Smart City projects.

Smarter cities have adopted projects and governance so to foster integration between pillars, trying to design their interventions with a crosscutting approach that makes all stakeholders work together.

Thanks to the sensors, the networks are able to produce an enormous quantity of data for the DATA PLATFORMS.

The major trend is the development of SENSORS.

91%
Of the cities have sensors for the smart metering

5%
Of the cities have a platform that integrates energy data

Urban Big Data: Potential unexpressed

Huawei and Smart City in Italy

Huawei and Smart City in Italy

Huawei's goal in the Italian market is to support the development of a uniquely Italian approach to Smart City, an approach that honors the history of Italian cities, leverages the thinking of Italian innovators, empowers the Italian partner ecosystem of Smart City services providers, and positions Italy to assume a leadership role on the global stage.

To achieve our ambition for Italian Smart City, Huawei can contribute to our understanding of Smart City needs, our strong strategy and vision in supporting the cities in becoming smart or smarter, and our experiences from over 160 Smart City projects around the world. With this background, Italian cities can benefit from specific capabilities such as:

- **Business models and reference architectures** that encapsulate best-practice approaches to Smart City programs;
- **A global ecosystem of solution partners** who can complement local start-ups in developing local solutions for local problems;
- **Modern and high-performing intelligent operating centers – IOC**, as well as external portals – to give to the cities' managers and operators and to the external customers (citizens, tourists and business companies) the tools for monitoring, governing the city and interacting with the city itself;
- **Smart City use cases with world-leading communication technologies** to facilitate the interconnectivity of people, devices, data and events;
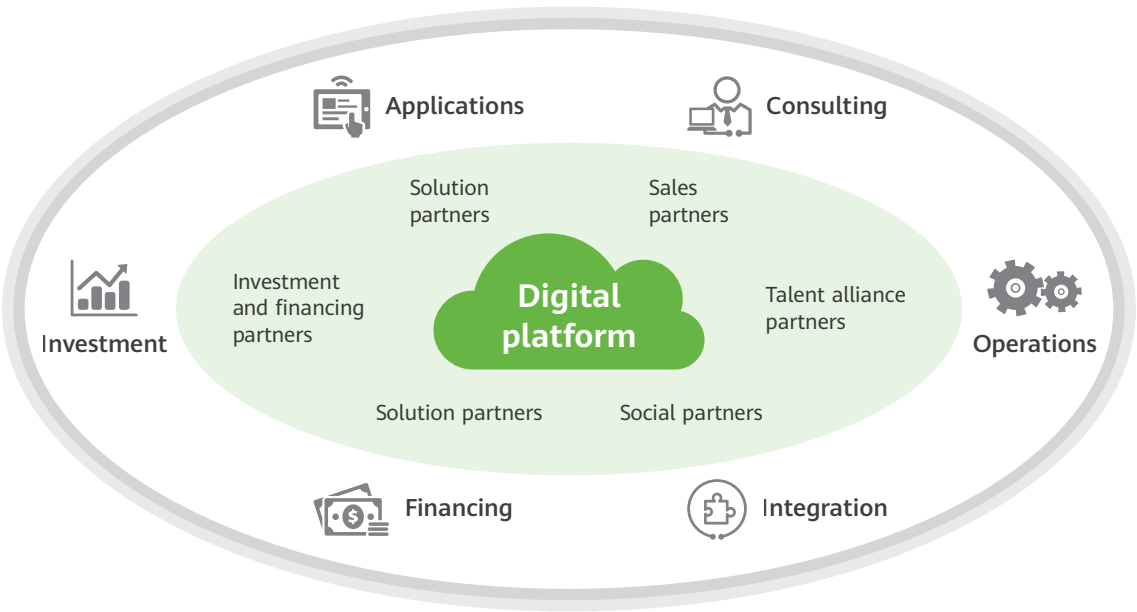
Business Models and Reference Architectures

In the early stages of Smart City planning, city planners and administrators need to cooperate intensely with "stakeholder" enterprises to ensure that development is both technically and financially feasible, and sustainable. Of equal importance, enterprises that provide smart solutions need to understand the issues municipal authorities face and view challenges from a city management standpoint. From this perspective, enterprises will be able to better develop smart products and solutions tailored to Smart City requirements and help municipalities maximize investment returns from scarce resources.
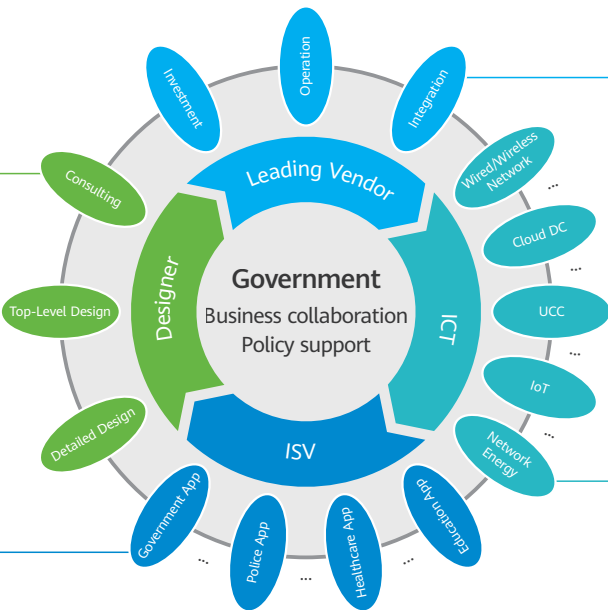
Smart City Ecosystem and Partners

A Smart City requires top-level design, integration, operations, service applications, and new ICT infrastructure — much more than what a single vendor can supply. Building Smart City requires seamless collaboration of players across all domains.

Applications

Consulting

Solution partners

Sales partners

Investment and financing partners

Digital platform

Talent alliance partners

Investment

Operations

Solution partners

Social partners

Financing

Integration

Business Consultation, Top-level Design, Feasibility Study, Preliminary Design, and Detailed Planning

Project Investment, Integration, and Operation

Investment

Operation

Integration

Wired/Wireless Network

...

Consulting

Leading Vendor

Cloud DC

...

Designer

Government
Business collaboration
Policy support

ICT

UCC

Top-Level Design

...

IoT

...

Detailed Design

ISV

Network Energy

Technical Support, After-sales Service ICT Device and Solution Provider

Industry-specific and Localized Content, Service Customization

Government App

...

Police App

...

Healthcare App

...

Education App

Combining a deep understanding of cities' needs, leading technologies with best practices, Huawei is committed to promoting the development of open Smart City platforms and vendor ecosystems, globally and locally. Through the open platforms and ecosystems, Huawei jointly develops end-to-end holistic Smart City solutions with more than 400 industry-leading solution partners across the globe. With the support of more than 2,300 channel service partners, Huawei offers access to mature project operation processes, implementation expertise, and delivery systems.

400+
Solution Partners
Open Lab

2,300+
Channel Service Partners
eSDK

Intelligent Operations Centre (IOC)

An Intelligent Operation Center (IOC) works as a city 'Smart Brain'. Deployed based on business systems (a neural network) of bureaus, this system supports comprehensive perception, analysis, display, and visualized command. The IOC integrates the government, Internet, IoT, and video data and integrates information coming from cloud computing, big data, and AI to implement comprehensive sensing, prediction, warnings, decision-making, command and dispatch.

The Intelligent Operation Center Provides the Personalized Views at All government Management Levels.

Management perspective

| Decision-making level |
| City Managers |

| Management level |
| Gov. office Leaders |

| Execution level |
| Operation command Personnel |

Management Level View

Macro
Panoramic view, macro data, trend prediction, and warning

Meso
Partial view, meso data, trend prediction, warning, and event monitoring

Micro
Personal view, micro data, problem handling, trend prediction, event distribution

Service Perspective

Public Safety
Economic Operations
Transportation
Government Affairs
Industry Development
Living Environment
Civil Services
Population & Poverty Alleviation
...

The City situation awareness capability helps to monitor and visualize Major Operation Indicators in Real Time. The IOC displays the Gross Domestic Product, Industrial benefit, Import & Exports, Assets & Investment, Budget and more.

However, the IOC solution can also help the Smart City operators to handle incidents, events and anticipate possible future situations by adding commanding capabilities to it.

For instance, in case of an emergency the IOC can serve as advanced command and control center following the Standard Operating Procedures, where Intelligent Association with the event Location for the identification of risks, locating nearby public forces, the possible Emergency and Rescue Plans, evacuation routes, Disaster Impact Deduction and Derivative Disasters Analysis, are possibilities open to the IOC operator.

Public Utilities

Smart City is one of the most advanced areas when talking about digitalization. They develop initiatives based upon their own risk-appetite, budget, clarity of potential benefits and stakeholder development.

Utilities are one of the most active areas in the city, basing their implementation strategy in the incremental approach, by focusing first in quick wins with proven technologies that leverage their capabilities while providing economic benefits to the cities. As opportunities and technologies are evolving continuously, from there they can leverage their capabilities and effectiveness in the future.
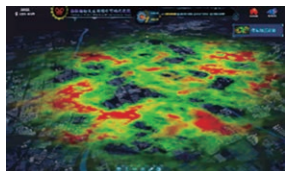
Traffic heat map	Urban parking space planning	Flood control	Sensor monitoring

Smart Tourism

Smart tourism solutions aim is to achieve information on touristic resources, economy, activities, etc. before, during and after tourism through the Internet, mobile Internet, with portable Internet terminals and using cloud computing, Internet of Things and other new technologies. It can enhance the benefit of tourists in the various tourism links of food, housing, travel, tourism, safety, shopping and entertainment.

Pre-Travel	During-Travel		Post-Travel
• Online Booking • Scenery Preview	• Mobile Navigation • e-Ticket • e-Payment • Wifi • Safety	• Service Hotline • Incident Dispatching • Transportation Management • Hotel Management	• Online Sharing • Big Data Analysis

Huawei's Smart Tourism concept orbits around these four functionalities:

- **Smart Tourism Service** provide more official tourism information for travelers before tour. During tour smarter services such as Wi-Fi, information and navigation
- **Smart Tourism Operation** a unified platform including tourism products, tickets management, and other related items. It is convenient to run resorts and get operating data.
- **Smart Tourism Management** in charge of regulatory policies, tourism monitoring assistance, qualification issued and tour guide management
- **Smart Tourism Marketing** a resort can integrate tour, shopping, accommodation, eating and transportation. Business shops such as hotels or shops push ads into the platform

In the future, we will see more and more Augmented Reality (AR) and Virtual Reality (VR) as enablers of Smart Tourism. As an example, imagine to be able to visit the Arena of Verona or the Coliseum in Rome and thanks to the AR enjoy your favorite opera (Aida for example) and be immersed and present on stage close to the singer, or to be present during the battle of Gladiators or see "Temples' Valley" in Agrigento.

All these new ways to deliver smart tourism will require an ICT infrastructure and the development of applications to enrich the quality of tourism.

Another important topic would be how to guarantee security in specific touristic area, prevent the aggregation of too many people in a specific area, and use new technologies like face recognition to detect wanted people

Digital Platform	Tourism basic management · Tourism big data analysis · Tourism unified control
Smart Application (Ecosystem)	**Smart Tourism Service**: One-stop Smart Tourism service platform · Real-time Information release system — **Smart Tourism Operation**: Tourism e-ticket system · Tourism resource system — **Smart Tourism Marketing**: Tourism e-business platform · Regional marketing system — **Smart Tourism Management**: Tourism industry regulation · Travel agency and tour guide management
Infrastructure	Data Center · NBN · Wi-Fi · Agile Network
Smart Device	iBeacon

Smart Healthcare

New technologies have influenced many parts of our daily life. Today's healthcare system has also recognized the advantages of using Information and Communication Technology (ICT) to improve the quality of healthcare, turning traditional into smart healthcare. Smart healthcare is defined by the technology that leads to better diagnostic tools, better treatment for patients, and devices that improve the quality of life for anyone and everyone. The key concept of smart health includes eHealth and mHealth services, electronic record management, smart home services and intelligent and connected medical devices.

Main advantages that the integrated solution approach provides are:

- **eHealth** is the use of ICT infrastructure for health including treating patients, conducting research, educating the health workforce, tracking diseases and monitoring public health

- **mHealth** is public health practice supported by mobile devices, such as mobile phones.
- **Smart Healthcare Network** provide dedicated connection for health include core network and access network, switch for hospital and smarter services such as Wi-Fi, POL technology
- **Smart Healthcare Cloud** is responsible for coordinating public health systems and hospital systems, sharing patient information between the two parties while ensuring privacy.
- **Smart Clinic Collaboration** facilitates the diagnosis of a seriously ill patient by several doctors, or to provide a demonstration of real-time teaching cases for medical schools.

In the Smart Health domain in the future, Artificial Intelligence will play an important role to support the diagnosis of doctors. As an example doctors can be supported by AI to formulate the diagnosis of a melanoma from devices that can learn from hundreds of thousands of images classified in the world thanks to machine learning algorithm and support doctors in the diagnosis. The machine will
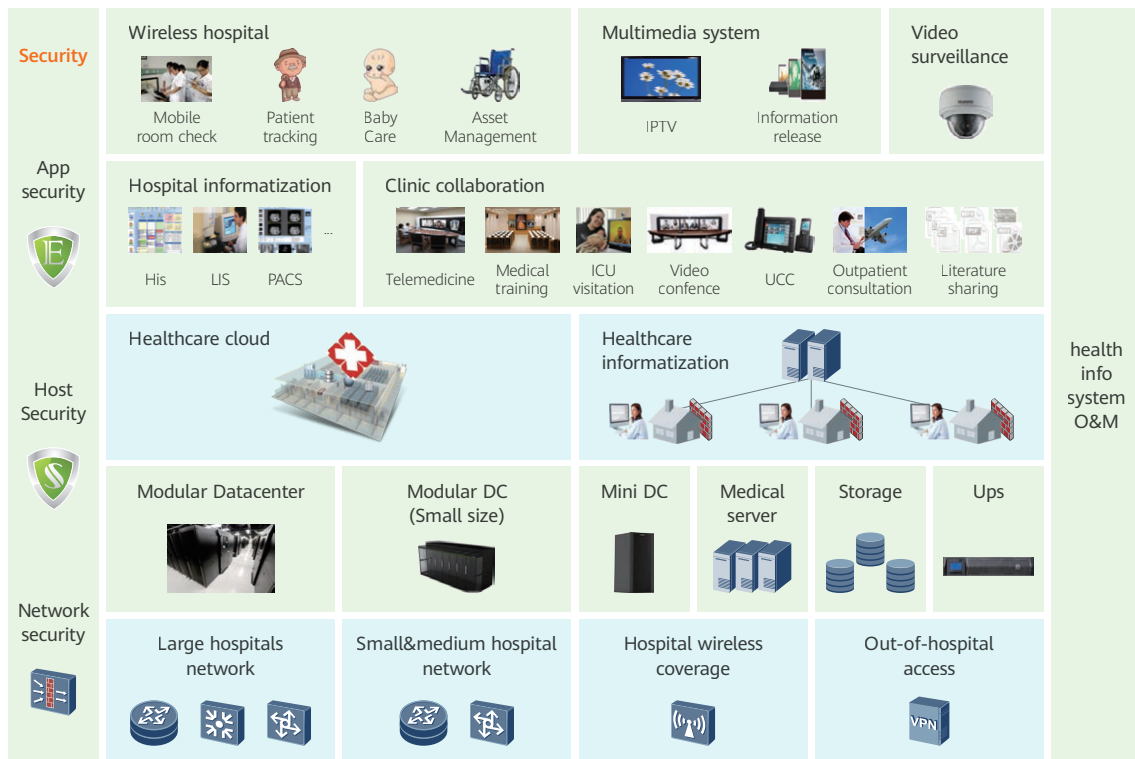
never replace a human being in the decision but it will help to reduce possible mistakes.

This new era of AI support in Smart Healthcare will require a transformation of ICT infrastructure to support the intensive algorithm of machine learning that would allow the convergence of results in short time with a good accuracy.

Home Hospitalization would be another important area, to reduce the costs in case of chronic diseases. IoT, devices, connectivity, will help doctors monitor their patients and be promptly informed in case of any issues.

Other applications like Remote Surgery is already a reality in some country for particular and specific surgery. This would allow saving time and reducing costs in case of emergencies, but requires a reliable infrastructure able to guarantee continuity during the whole period of surgery.

Smart Transport

Smart transport, driven by emerging ICT technologies are evolving into 3 main topics,

closely following the development trend of "cloud computing, big data, internet of things, mobile internet", striving to achieve safe, orderly, smooth and efficient urban traffic, and make a convenient experience for people to travel:

- **Operational Automation**, such as unmanned driving, self-service check-in, smart unattended container terminals that are fully automated.
- **Work and Service Mobility**, involving mobile ticket booking, mobile inspection, and mobile office.
- **Service Visualization**, for example, using IoT technologies to manage network-wide rail resources and to track the vehicle location and running status in a timely manner.

The following drawing shows our reference architecture for this service:

In this field, we will experience big changes in the future becoming more intelligent and green. The road will communicate with the vehicles and the vehicles will communicate among them. As an example, when crossing a street, intelligent camera will detect a person crossing the street and the

Travel Services, Mobile Access	Multi-Modal Transportation, E2E	Smart Production, Emergency Mgmt	Infrastructure, Real-Time Detection	Mobility Sharing	**Application and Service**

AI platform			**Digital Platform**
IoT platform	Big Data platform	Video surveillance platform	

bus station	Airport	Rail/bus station	**Hub**	**Data Center** — Data Center
Railway, subway	Map, road network	Highway	**Line**	**Network** — Backbone network — IoT — 5G/4G/3G/WIFI
People	Goodes	Car/Bus	**Object**	**Device** — Sensor — Mobile Deive — Camera

infrastructure present on the road will broadcast a warning message to the cars present in the area to slow down. Cars will talk to each other to prevent an accident in specific situations where sensors today cannot help like on turns or crossings. This is far from being autonomous yet, but it will assist drivers to get a warning well in advance and reduce the number of accidents.
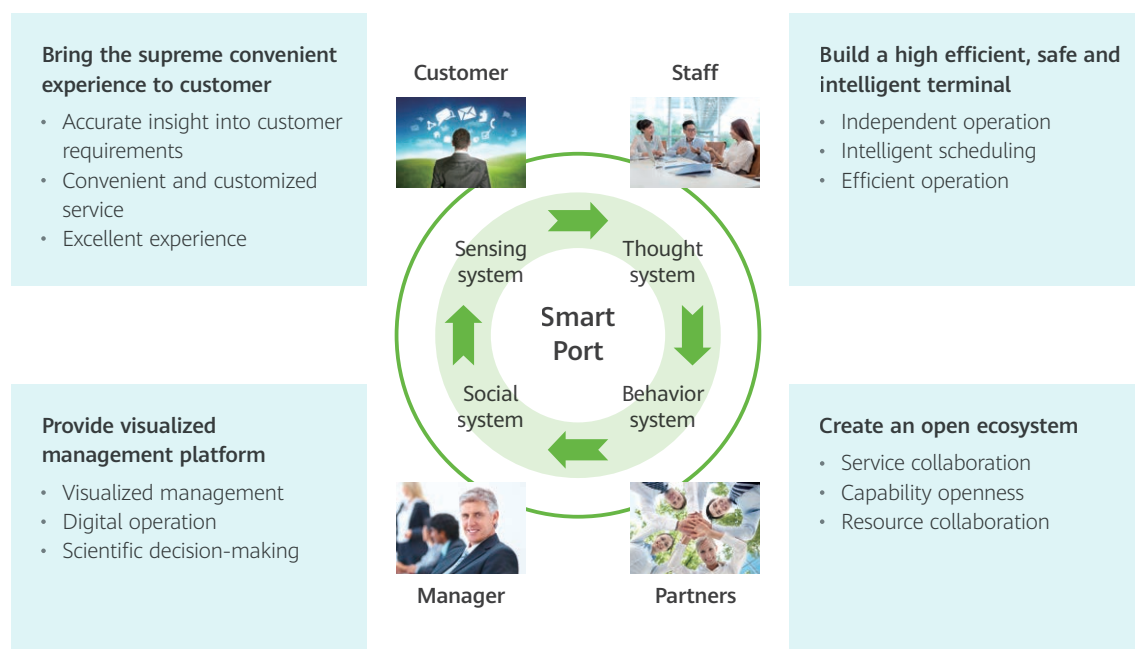
Electrification will be another trend in Italy. Electric Cars will be present in our country and this will allow saving costs (transport fuel in each Gas Station, refinery of fuel etc.) and will likely make our cities greener and less noisy. However, it will change completely on the way to recharge cars. e will see more electrical charging stations all over the cities and even in our houses and garages, we will schedule a trip considering the time needed to recharge the battery, we will need to be more digital to book the resource and the way to organize the recharging based on the delay that might be experienced during a trip. Sensors, Energy stations and brain to schedule the queue that would adapt dynamically based on delays will be essential. among citizen might burn to recharge electric cars when not used for its own one.?

Smart Port

The Smart port is essentially a deep change and reconstruction of a port production operation, management and business model driven by a new generation of information technology. The vision of Smart Port is, convenient, efficient, safe, intelligent and open.

Based on the vision of smart port, it is not only the intelligence of operations in the port, but also the organization of the port and the intelligence of the people in the organization; not only the wisdom of a single port, but also the wisdom of the port ecosystem.

The logistic of containers would be the challenge a Smart Port will need to phase to increase the efficiency and reduce the overall cost. The transformation to small-scale logistics is already happening in the warehouse of the e-commerce giants like Amazon, Alibaba etc. In large scale, this will happen in the future also to Smart Port for the big containers considering that in a port the environment is more complex and security is necessary. Autonomous Guided Vehicle AGV is already a reality in some ports the next challenge would be the automation of containers.

Bring the supreme convenient experience to customer

- Accurate insight into customer requirements
- Convenient and customized service
- Excellent experience

Build a high efficient, safe and intelligent terminal

- Independent operation
- Intelligent scheduling
- Efficient operation

Customer   Staff

Sensing system   Thought system

Smart Port

Social system   Behavior system

Manager   Partners

Provide visualized management platform

- Visualized management
- Digital operation
- Scientific decision-making

Create an open ecosystem

- Service collaboration
- Capability openness
- Resource collaboration

Smart Building

Along with the development of ICT technologies, the necessity of building management capabilities has emerged. Nowadays different subsystems live together in buildings but, most of the times, working independently without sharing information.

Our approach builds this enterprise level system for buildings, allowing real time data availability, integrity, security, stability and scalability at every moment. The following drawing shows our reference architecture for this solution:

| Applications | Energy Efficiency | Security Management | Distribution Management | ...... | Access Control |

IoT Platform — Big Data Analytics, API, Data Collection, Authentication

IoT Gateway — Data Collection, Edge Computing, Protocol Conversion, Interface Conversion

Sensors & Controllers — Lighting, Cameras, Electricity Meters, ..., Access Control, Elevators
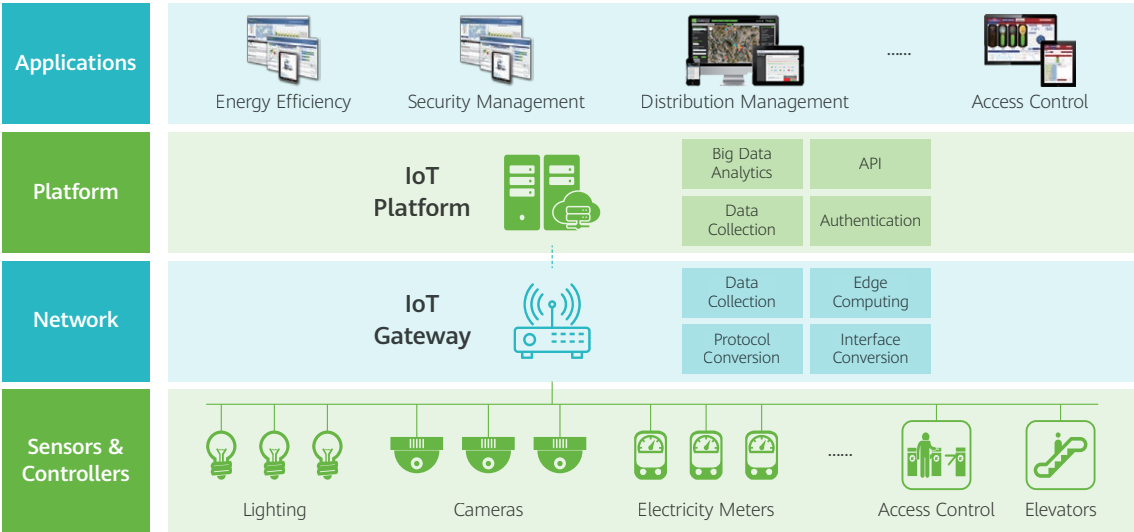
Smart Education

In a world overrun by technologies schools and universities cannot just stand by and watch.
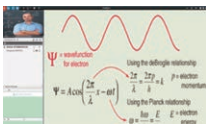
The Internet has dispersed contents, which are no longer to be found merely in the classroom or library, smartphones and tablets have become a central means of expressing oneself and accessing knowledge. Nevertheless, this is just the beginning, nowadays there are collaborative educational platforms, QR codes to share and access content, platforms using video capabilities to enhance the classes' performance and to provide remote video lessons...

Furthermore, today's centers must remain competitive and be able to compete with online e-learning formulas. Indeed, in the USA, the National Center for Academic Transformation is encouraging universities to experiment innovative teaching methods, based on the use of new technologies. As a result, average costs have decreased by 38%, the percentage of exams passed increased, along with the students' satisfaction.

Huawei Smart Education Solution aims to facilitate lifelong education for all, with flexible approaches and transform from a teacher centered to a student centered model. By leveraging the power of ICT the solution implements digitalized administration, educational resources sharing diversified learning methods, bridging the gap between the rural and urban areas, thus boosting educational equity.

Scenarios	Online learning	Interactive teaching	Educational administration	Convergent Communications
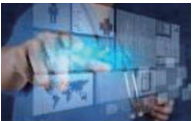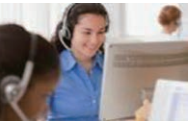
Smart Education Platform

| Products	Live eClassroom	Branch classroom	Multimedia classroom	Convergence & collaboration	eRoom
	Live Virtual Classroom (LVC)	eLearning	eSchoolbag	eManagement	eLibrary

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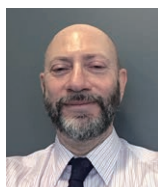
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