# The 4th Industrial Revolution and the Municipal CEO

## ETSI City Digital Profile

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# Foreword

"Now is the time for city leaders and structural investors around the world to embrace a new wave of infrastructure – the municipal 4$^{th}$ Industrial Revolution – and deliver smarter, cheaper, citizen-focused, services with a solid return on investment.

If we get the horizontal thinking right, we can avoid next generation silos and pull through fully interoperable, standards-based, replicable, scalable solutions.

Please will you join us in partnership to deliver cities fit for the future?"

PAUL COPPING, CHIEF INNOVATION OFFICER, DIGITAL GREENWICH AND CHAIR OF ETSI ISG CITY DIGITAL PROFILE

# City Context

Our cities, predicted to be home to two-thirds of the global population by 2050, are hotbeds for technological and societal transformation. However, they face a perfect storm of urban challenges.

Demographic changes are putting pressure on available urban space and housing supply, overloading public services which are already tuned for economic austerity. Environmental and food production issues are threatening citizen health. Our energy supply is struggling to comply with environmental and resource constraints.

Technological innovation continues to drive the Fourth Industrial Revolution, which "is blurring the lines between the physical, digital, and biological spheres"[1] and is triggering extraordinary changes in our societies.

Today, we can access goods and services immediately via connected devices, raising every citizen's expectations of the services available. Yet as technology becomes more deeply embedded in everyday life, we risk a digital divide – influenced by age, geography and levels of education – developing into discontent and even hostility.

City authorities seek to meet every citizen's needs, economically and socially, while at the same time competing to present themselves as the most attractive places for businesses to invest, locate a business, and recruit their workforce.

Smart city thinking offers ways to leverage the opportunities of the fourth industrial revolution for the betterment of urban living. Key technologies will underpin this, from the ubiquitous connectivity of our built environment and everyday objects, forming an Internet of Things enabled by 5G, to the automation of repeatable tasks, artificial intelligence and the growing potential for security and assurance in distributed ledger technologies (DLT).

But many city administrations are not readily equipped to take advantage of these technologies. A smart city approach requires truly horizontal thinking, looking beyond sectoral silos to reimagine existing systems, create new processes and interactions, and migrate towards new forms of service delivery. With an integrated plan, the same layers of infrastructure can be shared by many services which were previously managed (expensively) in separate vertical systems. This is one of the main sources of improved integration and reduced costs in a horizontal design for smart cities.

Transforming such thoughts and ideas into action requires visionary leadership with buy-in starting at the CEO and then mainstreamed throughout the city's management. Whereas today each smart city is a bespoke project, our mission is to enable the smart city to become a replicable standards-based implementation of a whole stack of technologies. This transformation will enable large numbers of cities to benefit from economies of scope and scale, including through collaborative procurement to engage in collective bargaining with their strategic suppliers. Over time, this will enable cities to develop a stronger voice in directing their own business models and deriving direct benefit from the intellectual property

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[1] Klaus Schwab, World Economic Forum https://www.weforum.org/agenda/2016/01/the-fourth-industrial-revolution-what-it-means-and-how-to-respond

embedded in their operations. The supplier community also benefits from reduced entry risk and more rapid deployment at scale of emerging technology.

# Politics, Progress and Votes

Politics is the art of the possible[2]. Drastic changes to how citizens in a democracy live, work, communicate, think and hope, require not only leadership, but transparency, long-term planning with funding and reliable follow-through, beyond re-election timescales. Political leaders need to be sure that projects are on track and will deliver the promised services. They need to deliver voter satisfaction - which may be expressed by measures such as health, safety, productivity, clean air, liveability and happiness.

## The Political Context for Successful Smart City Initiatives



**Secure a Political Mandate** → **Ringfence Financing** → **Execute on Smart City Initiatives** → **Achieve Smart City Benefits**

**Demonstrate RoI**
- Economic benefits
- Social benefits

**Execution Dependencies**
- Leadership
- Process discipline
- Open standards

**Key Performance Indicators**
- Measure
- Report
- Engage Citizens & Local Businesses

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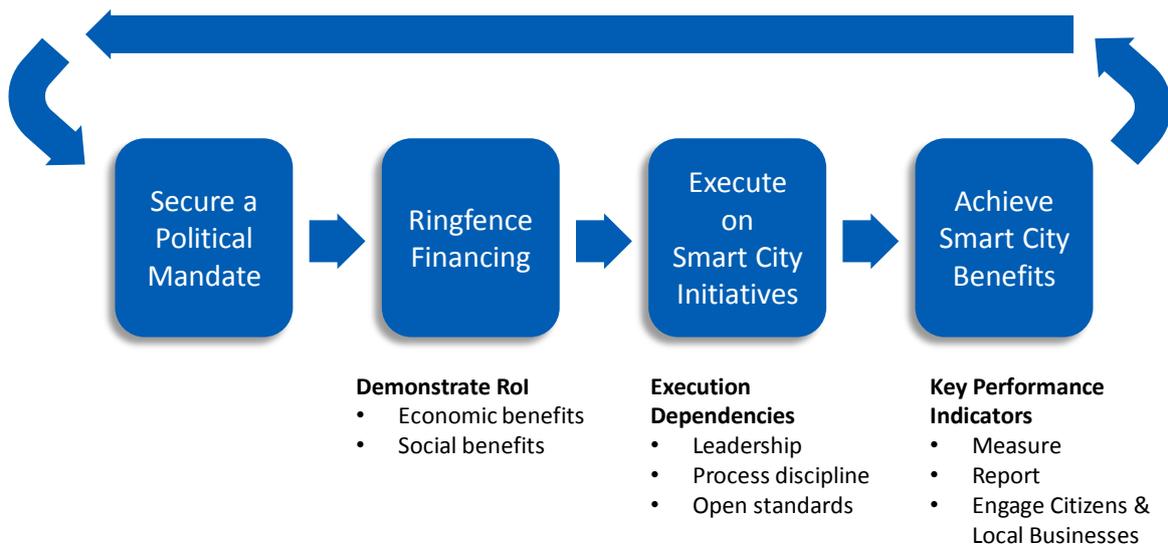
[2] Otto von Bismarck, 11. August 1867 "Die Politik ist die Lehre vom Möglichen."

# Complications

City CEOs, politicians and engaged citizens are well aware of the above needs and constraints. But nothing is simple. The potential for emerging technologies to make cities smart is attracting considerable attention from innovative administrations. The promise of having access to reliable, timely data about anything happening within a city is very appealing for "transparency" and for near real-time problem solving, from transport overload to garbage collection to emergency services. New data sources can lead to improved and more efficient service delivery. Data also supports better informed planning decisions.

However, moving from a general intuition of opportunity to actionable plans is challenging. It requires "change management" on a massive scale across multiple bureaucracies and diverse stakeholder organisations. It is also challenging because the breadth of options and range of risks is huge.

Part of the complexity stems from an increasingly crowded market for smart city solutions, with both established vendors and new entrants claiming to have killer applications. These are often bespoke systems with limited interoperability, replicability and scalability across the market.

Effective use of standards can reduce this risk. However, the standards environment is itself complex with overlapping regimes and domains of application in the many activities that a city covers. This is the case both in formal standards bodies and in market competition between proprietary systems.

Some of the more attractive and innovative opportunities identified in many smart city pilot projects involve working across different organisations within a city - energy and transport, environment and healthcare for example. Quantifying the benefits and return on investment in these cases may not be straightforward. Procurement processes can also complicate realisation of business cases that are shared between different organisations within the city, e.g. when part of the calculations relies on the Net Present Value of very real reductions in health care needs in the future.

The market is developing quickly with a technology life cycle of maybe three or four years, working with a built environment of assets that may be designed to last fifty to a hundred years.  For example, the spatial decisions city planners take - such as the layout of road networks - need to take account of ongoing transitions: from carbon fuel to EV or hydrogen; from driven to autonomous vehicles; and from private ownership to the sharing economy.

# Think Horizontal

It is a big challenge to engage with smart cities across all the application areas at once, linking areas which have historically been independent silos. This is what we call thinking horizontally.

Most cities with any track record in this field will have started their smart city journey via a single application, often motivated by a technology-driven means to reduce operating costs. Smart parking, dynamic street lighting and intelligent waste collection are three such examples.

The next phase of the smart city journey is typically to build additional applications that leverage early-stage investments. Smart lighting installations, for example, can support environmental monitoring, public safety and traffic management applications through the addition of sensors and the application of pattern recognition techniques.

Problems may arise when these early commitments begin to limit the ability of a city to improve, innovate and expand its portfolio. This is the dilemma of vertical, single-purpose, fast-to-market strategies that function as silos. With the passing of time, they demand significant new investment in redesign and system integration efforts. Because they are not sharing common infrastructure across multiple use cases, they are less likely to maximise cost reduction.

When city authorities launch vertical initiatives to address local issues, they should plan for some future where individual applications must scale vertically (e.g. adding more districts to a smart, street lighting system) and evolve horizontally. Consider the example of traffic monitoring sensors for a congestion management application. In time, the traffic-related infrastructure could accommodate environmental and other sensors, implying a high potential for re-use at the hardware and communications layers. Furthermore, integration into city planning tools (for housing, green areas, siting of hospitals and aged-care centres) can improve citizen health and safeguard wellness in the future.

## Phased Evolution of Smart City Initiatives
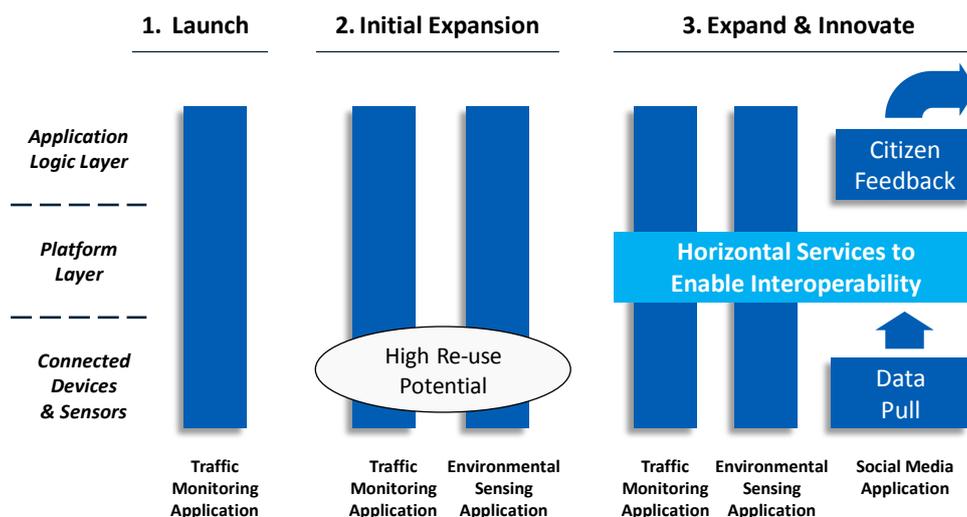
In a future evolution, the city might import social media data to improve its sensing capabilities and as an information feedback mechanism to alert car drivers, cyclists and pedestrians. This progression is illustrated above and highlights the evolutionary and expansive nature of a seed application through two stages of expansion.

The integration of smart city services increases the potential to re-use technology and data higher up the application stack through a horizontal layer. This layer comprises a set of services that allows applications to source data from multiple sources and for applications to interact with one another in a general form, rather than through custom-built integrations.

Since they begin with many legacy systems, cities will support a system of several service delivery infrastructures. City leaders and their operational staff should be concerned not only by how they will individually evolve but also about the way they interact. Consider, for example, the interdependencies between: traffic lights and energy; waste and transport; and, communications and energy. For the city to satisfy the needs of the citizens living in it, the correct, simultaneous functioning of all systems is required. A "horizontal" management approach is pretty much essential to achieve this effectively.

As they build vertical solutions, but plan for horizontal capabilities, city managers and technical architects can also position their investments to integrate emerging, general purpose technologies. Examples include artificial intelligence capabilities, policy controllers to enforce privacy and security, and tokenization capabilities to enable data monetization in a coherent and system-wide manner.

## Adding Common Services via a Horizontal Platform
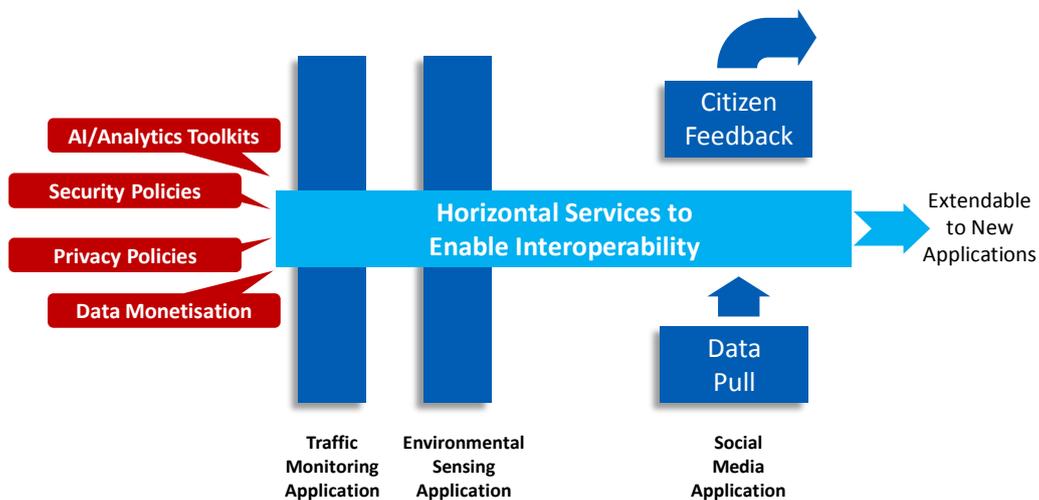


The benefit of a 'think horizontal' strategy is to encourage implementers to deploy applications, in their priority areas, in the context of a long-term convergence roadmap. Systems designers can plan on the basis of shared capabilities and infrastructure. These are advantageous in terms of "building once and reusing many times", an approach that drives economies of scale.

"Think horizontal to minimize orphan investments"

So, in conclusion, city leaders should 'think horizontally' and apply the simple rule of building common systems for many use cases, while refusing to authorise next-generation silos.

# Join ETSI City Digital Profile and Think Horizontally

ETSI's new initiative called "City Digital Profile" - an Industry Specification Group - is a community of common interest where cities can determine the agenda. Our current focus is to look at the use and benefits of emergent and leading-edge technology streams. We are working on a standards-based road map and technology stack which can be useful to city leaders in judging options and motivating their teams.

**"Here is a forum for cities to act collectively and influence procurement strategies"**

We seek to inform the cities themselves about the rapid developments in city wide infrastructure and technology platforms, so that they are aware of the innovations and the benefits they can derive.

We invite all aspiring smart cities to join us in this journey. Our group will offer open workshops alongside our member meetings, so please register your interest at ISGsupport@etsi.org to receive further information and on how to become a member of ETSI CDP, the City Digital Profile group.

As a first step - and a quick call to action - we invite you to share either an account of how you delivered some horizontal thinking in your city, or how you might structure things differently if you were starting afresh. And if you are completely new to the design and development of smart cities, but wish to work in our team, please start by sharing with us your top three priorities for this year.

There are dozens of interesting Smart City events this year (we maintain a list: https://goo.gl/5GfmzV) and below you see a number where you can meet various members of the ETSI CDP group for informal discussions: just contact us in advance via ISGsupport@etsi.org.

| Event | Dates | Location |
|---|---|---|
| Smart to Future Cities | 25 - 26 April 2018 | London, UK |
| FIWARE Global Summit | 8 - 9 May 2018 | Porto, Portugal |
| IoT Week | 4 - 7 June 2018 | Bilbao, Spain |
| Intelligent Community Forum Global Summit | 4 - 6 June 2018 | London, UK |
| ETSI IoT Week | 22 – 26 October 2018 | Sophia Antipolis, FR |
| Smart City Expo World Congress | 13 - 15 November 2018 | Barcelona, Spain |

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