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# Smart Mobile Cities: Opportunities for Mobile Operators to Deliver Intelligent Cities



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## Executive Summary

The twin challenges of rapid urbanisation and climate change are contributing to the scarcity of resources in cities in both developed and developing markets. Cities around the world are suffering resources constraints in energy supply, road capacity, water reserves and even clean air for their citizens to breathe. New solutions are urgently required to cope with these resource challenges to ensure that the city of the future is a safe, healthy and desirable place for its citizens to live, work and play.

Smart cities employ innovative digital services layers, that use sensing & control, analytics and ubiquitous communications, to optimise scarce resources. Empowered to make better decisions about how to travel or transport goods more efficiently and to understand the real time cost of using electrical appliances, the city's citizens and businesses will make better use of these resources. As a result, cities will allocate resources more efficiently; in parallel saving costs and transitioning to a low carbon economy.

Mobile operators have a fundamental role to play in this emerging multibillion dollar value chain.<sup>1</sup> Operators collectively own the network infrastructure best placed to deliver digital urban services to future citizens. Operators are also well positioned to provide the technology platform from which these future services can be delivered, and in some markets, to deliver end-to-end services direct to consumers. Beyond the technology challenge, there is also a significant need to orchestrate the disparate ecosystems, which is something that operators are well placed to achieve. However, they need to act soon to seize this opportunity, as competition is intense in all layers of smart city services provision.

A large volume of literature on 'Smart' or 'Intelligent' cities has been produced, but little analysis has been done on the business propositions for specific smart city value chain participants, such as mobile operators. This report focuses on the communications technology value proposition within new build, developing market and developed market smart cities. The purpose of the report is to encourage telecom operators to focus investment and resources on the smart city market opportunity. It is also designed to equip operators with compelling arguments for persuading mayors and city governance bodies to develop a smart city vision and roadmap for the next decade (with telecom operators as valuable partners to help with the delivery of this vision).

This report identifies mobile payments and ticketing, intelligent energy management and analytics and commercial insight as the initial opportunities that operators should look to pursue in cities around the world. These services combine the largest benefit with the greatest ease of implementation, and are therefore most applicable opportunities for near-term, large-scale pilots.



## The Challenges of Sustainable Urbanisation and Climate Change

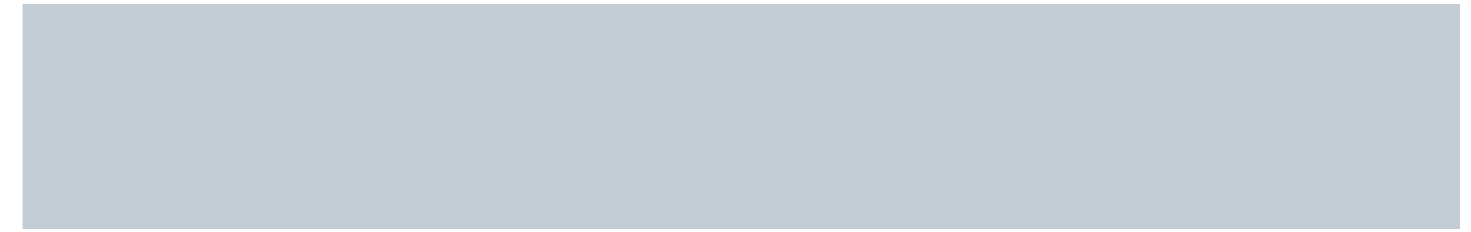
The UN estimates that at some point between 2008 and 2009 the world's urban and rural populations became equal in size for the first time in human history. Urbanisation is set to continue as the rural population seek the wealth and social opportunity that cities offer. In the period from 2007 to 2050, the UN estimates the urban population will grow from 3.1bn to 6.4bn.<sup>ii</sup> In China alone, it is estimated that 18 million people per year move to urban environments and, that by 2025, China will have 221 cities with over 1 million people (Europe has 35 today).<sup>iii</sup> Population shifts on this scale have never been seen before and will create tremendous infrastructure challenges.

Cities are currently responsible for around 80% of global carbon emissions.<sup>iv</sup> Despite occupying only 2% of global land area, cities consume around 75% of the world's resources.<sup>v</sup> Much of the growth in resource consumption is coming from non-OECD emerging economies, where energy demand is expected to increase by 73% between 2006 and 2030.<sup>vi</sup> As cities around the world grow in size, we are beginning to see that strained resources, infrastructure and services are causing natural limits to urban growth, which in turn limits the economic growth opportunity. In parallel with the growth, many existing cities need to start upgrading their obsolete infrastructures, which have been deployed over the past 10-40 years.

The challenge of managing sustainable urban growth is one of the defining challenges of the 21st century. City leaders, mayors and other politicians are already wrestling with these challenges and are looking to make changes that will position their cities for growth, as attractive centres for investment and innovation and as fulfilling places to live.

These set of challenges represent a significant opportunity for investments in "smart" urban infrastructure. Cisco estimates that \$1.2 trillion<sup>vii</sup> will need to be invested in ICT and "smart" urban infrastructure worldwide over the next decade.

However, in this era of tight governmental budget constraints, capital-efficient solutions delivered by highly competitive public private partnerships are likely to be the business model that wins favour with municipal buyers. Additionally, ICT has an important role to play to improve and ensure efficient resource allocation. Cities need to deploy



common platforms across multiple service layers to drive economies of scope and scale, and to generate a unified and coherent 'customer experience' for their citizens. However, this will increase the complexity of the urban ecosystem of digital services, driving a greater-than-ever need for effective partnerships and clear-sighted orchestration to align the large number of stakeholders. Telecom operators are well placed to play a strategic role in creating and orchestrating these ecosystems.



### Oulu, Finland, population 150,000.

Oulu City is leading and orchestrating a smart city programme. It uses a Public Private Partnership (PPP) based on a living lab concept, in which no incubation is required because the whole city becomes the lab for new services. Living labs have now spread throughout Europe and further afield. (see <http://www.openlivinglabs.eu/>)

- The PPP has public funding of €180 million and private funding of €130 million:
- The municipality advocates, endorses and funds advertising and communications for new urban services to the citizens, and incubates the service development by testing it directly on the population, as per the living lab concept. It also provides city furniture and infrastructure to be used in the pilot.
- The city uses the living lab to win inward investment into the city. The concept encouraged, for example, Ericsson to move a major R&D lab to the city.
- Oulu now has 1,200 WiFi hot spots covering the majority of the populated area in the Oulu region. This Oulu network is used by over 20,000 people every month.

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## Intelligent Cities as the Solution

### Defining the Intelligent City

There is no agreed definition of an Intelligent City. Based on our research and experience we suggest that an Intelligent City should exhibit the following common principles:

- A city in which **citizens and services providers have access to enhanced information flow**. Such city maximises the utilisation of its key resources by leveraging data gathered through widespread embedded sensors and controls, real time data analytics and ubiquitous communications.
- A city which **combines disparate data sets to offer productivity insights** and enhancement to its citizens and service providers.
- A city which **maximises the economies of scope and scale across its multiple infrastructure layers** through a common service delivery platform, or Urban Operating System ("Urban OS").
- A city which **uses innovative technology and innovation** to strive to go beyond economic targets, to deliver sustainable, quality of life improvements for its citizens, its industry and the local environment.



Enhanced information will lead to significant urban services innovation, with increasing GDP growth, a reduction in government costs, the creation of a sustainable environment and the enhanced wellbeing of the citizens.

The services that will deliver these benefits may include:

- **Smart grid technology** to empower end users to be more efficient with their energy uses, and to allow utility companies to proactively identify and repair energy or water leakage.
- **Smart traffic control** through sensors in roadside furniture to proactively reroute traffic to avoid congestion and maximise road utilisation.
- **Smart CTV/surveillance cameras** to measure real-time footfall mashed up with weather and events data, to alert transport networks, police, and retailers in real time to spikes in footfall.
- **mHealth remote monitoring solutions** to help chronically ill patients remain longer at home, with data that is integrated with care-provider scheduling tools to optimise home visits around medical need.
- **In-vehicle telematics** to improve the attractiveness of eVehicle adoption by directing drivers to charging stations, taking into account queue times and availability.
- **Data records of urban activity** will lead to more efficient long-term planning tools for urban planners, city services, policy and transport systems, and also private sector infrastructure investors.



An Intelligent City can also use enhanced information flow to stimulate behaviour change amongst citizens and service providers. For example:

- Public service or private sector pricing models can be made dependent on real-time demand – whether that is for energy supply, or access to a bike for hire. Envisage a situation where transport is priced in real time to reflect the demand for that service – for example, bike hire from tourist centres is priced at a premium to reflect its value.
- Micropayments can be used to incentivise community-wide behaviour change. For example, small micropayment remuneration (via mobile phones) was used in Jakarta to incentivise individuals to increase rates of waste recycling.<sup>viii</sup>
- Social exclusion can be addressed as mobile devices become more affordable and reach previously-isolated parts of society - a large number of people in emerging markets lack access to traditional payment methods or banking services, which reduces their likelihood to pay for basic services that would greatly aid development.



### The City Archetype

At first glance, smart city infrastructure may appear to mainly be a developed world opportunity. However, upon further analysis it becomes clear that the opportunities are perhaps even more compelling in developing world cities, where user behaviour is overtaking developed markets and urban conurbations are transitioning from no services directly to digital services. A good example is Kenya, which had very little consumer banking infrastructure 5 years ago, before Kenyan mobile operator Safaricom launched its mobile payment service. By the end of 2008, just 2 years after the launch, 5 million customers were using M-Pesa mobile wallets and mobile payments for securing their savings and, in many cases, to pay for urban services such as gas and electricity supply.<sup>k</sup>

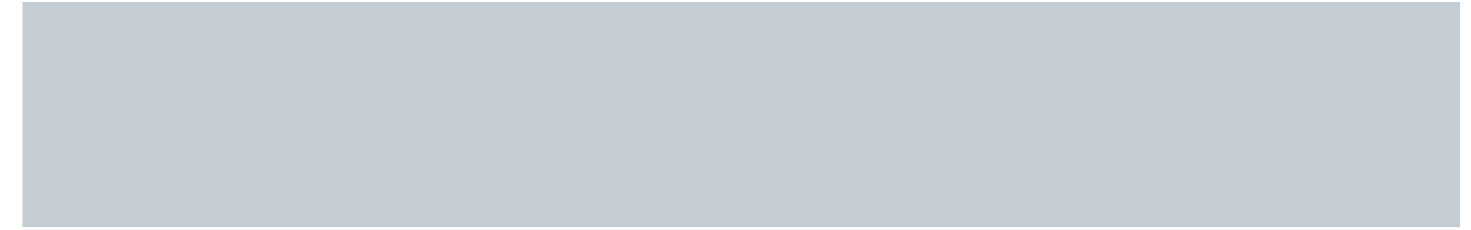
Over the past two years we have seen the concept of Intelligent or Smart Cities transfer from the conference circuit to the strategic agenda of national governments, multinational infrastructure providers and system integrators.

We even see examples, particular in East Asia, where governments are backing Smart City pilots and positioning their industrial champions at the heart of the Intelligent Urbanisation agenda, with the intention of generating a 'smart infrastructure' export market. For example, in Japan, METI has a program underway with companies, such as Panasonic, Hitachi, Toshiba and others, to develop smart city services that can be tested in four domestic pilot cities, and eventually sold internationally. Similar strategies are being followed in Korea and China as well.

There are 3 significant city archetypes that need to be considered somewhat differently:

- New build cities
- Developed market cities
- Developing market cities

**New Build Cities** - In Asia and the Middle East we have seen the emergence of the 'new build' Intelligent City. The highest profile of these cities is Masdar in Abu Dhabi and Songdo in Korea. These showcase cities help to build momentum and accelerate the move to a broader intelligent infrastructure, by demonstrating successful service offerings case studies that can be transferred to other urban environments.



**Developed Market Cities** - In the developed world, the primary driver for adopting an Intelligent City vision is typically to ensure that energy demand does not over-run supply by adopting 'green' energy practices, which should in turn lead to lower carbon emissions. Amsterdam, for example, is striving for a 40% reduction in carbon emissions by 2025.<sup>x</sup> Additionally, many developed market cities have decaying infrastructure that is reaching end-of-life, heralding a new infrastructure investment cycle. Many utility companies and service providers are beginning to use 'smart' functionality as a criteria in the tender process to distinguish vendors' value propositions, as infrastructure contracts come up for renewal.

A major challenge for achieving economies of scope and scale across multiple digital service layers is that developed market infrastructure supply tends to be highly-liberalised, which means the mayor and the municipal governance body has little direct influence on the roadmaps of the urban service providers.

**Developing Market Cities** - In the developing world context, the primary challenge for cities is typically over-congestion (both urban density and traffic volume) caused by the unprecedented rapidity of urbanisation in the past 10-20 years. A further challenge is to develop the educational, transport and communication infrastructure to incubate talent and to attract industry and commerce. While developing market cities are often burdened by bureaucracy, they typically have the advantage of having relatively centralised and top-down municipal governance structures, which mean that a city mayor has the influence to sponsor and promote large scale infrastructure projects, such as the implementation of a smart grid or eVehicle programme. This means that it is easier to find 'a single buyer' in a developing market city and it increases the potential for multiple digital infrastructure layers to be contained on a single platform.

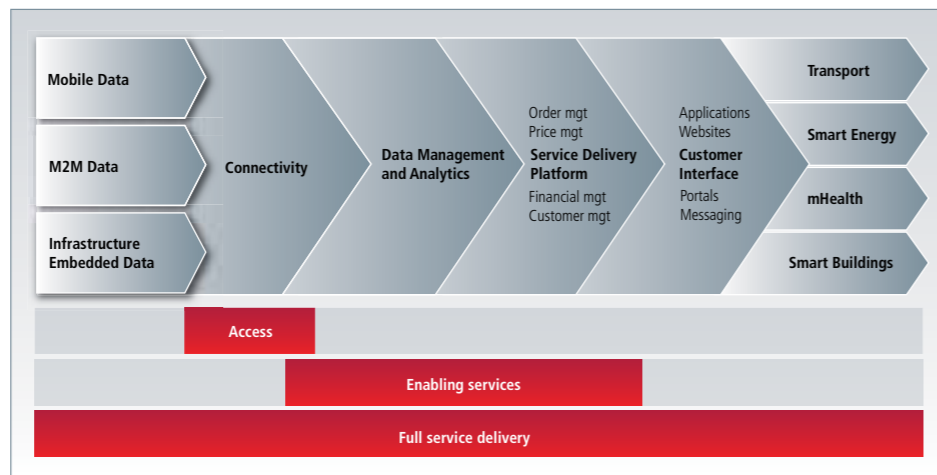




**The Intelligent City Value Chain**

The Intelligent City value chain starts at the point where data about the citizens and the urban environment is generated. That data is then analysed, combined with other services and delivered through useful and targeted applications and interfaces to end customers. Providers have the opportunity to assume different roles across different parts of the value chain from a pure access play to full service delivery.

**Exhibit 1: Intelligent City value chain**



**The five steps to the Intelligent City Value Chain:**

- **Data is collected** from a wide range of devices including mobile phones, traditional computing devices and embedded sensors and actuators within new devices, such as home appliances and vehicles, as well as from fixed infrastructure, such as roadside furniture, buildings, water systems or weather stations.
- **Data backhauled by communications networks** via a combination of fixed and wireless infrastructure depending on the mobility of the application and bandwidth and latency requirements. In many residential emerging market settings, mobile networks may be the only option.
- **Data is analysed and warehoused** in a central data management platform which stores, tags and processes large data sets in the cloud.
- **The data feeds a Service Delivery Platform (“SDP”)** that sits on top of the data warehouse and runs the ‘order to payment’ process for city services. It contains several discrete modules, for example price management, booking, fulfilment, billing, relationship management and analytics around a vast range of citizen services. The SDP should have open APIs to encourage a developer community to generate fresh insights and innovative new services.
- **The user interface**, accessed by citizens, businesses and service providers, would be freely available via web services on mobile or desktop platforms. Innovation and competition should lead to a rich set of applications based on open data sets, hosted on the SDP.



Global Case Study 1  
**Harnessing the Power of Analytics in Singapore**  
 Project: **LIVE Singapore!**  
 LIVE Singapore! is a five year research project lead by MIT’s SENSEable City Lab and focused on the development of an unprecedented platform for the collection, combination and distribution of the growing number of real-time data sets originating from urban systems and networks, such as vehicle fleets (taxi, bus, subway), telecommunication networks (mobile phone, landline, WiFi), seaport and airport operations, environmental sensor networks, and user-generated data.  
 It is becoming increasingly evident how the combination of different kinds of urban data can give radical new insights into how a city works, how people make use of the physical space and how they access services. The ethos of the project is one of ‘open innovation’, inspired by the recent data.gov initiatives. It provides a platform and toolset to enable

developer communities to join in to explore intriguing new combinations of data and develop applications that employ the platform’s real-time streams. In this sense, public institutions and companies, as well as individuals, are all invited to participate in contributing data streams that they are interested in sharing with the public through a common framework. All data-sharing partners benefit from being able to see beyond their own networks and tap into the vast creative potential of developer communities to find ways of extracting new value from existing data, leading to innovative insights, as well as new service opportunities.  
 One of the project’s key characteristics is that it is not only one specific application, but a flexible and scalable platform. In many ways the platform is capable of becoming the ecosystem for the new domain of city programming, allowing new ideas and functionality to be incorporated as they mature.  
 LIVE Singapore! is in its early stages, but already has partnered with some of the city’s key actors including

SingTel (a telecoms company), Singapore Power, Changi Airport, PSA (Singapore’s seaport operator) and the National Energy and Environmental Agencies, as well as the major public and private transportation providers. The ability to bring together these and other new data streams opens up several exciting propositions, such as:  
 ■ **Meeting Taxi Demand**  
 In Singapore, taxis are in very short supply when it rains. The level of precipitation is very high, but also very localized (often to within a few km<sup>2</sup>), therefore the city is exploring combinations of short-term (10 mins in advance) weather forecasts with GPS taxi location data to help direct taxis to the upcoming high demand areas.  
 ■ **Mapping Carbon Emissions**  
 Singapore has a target of cutting roughly 12 million tonnes of CO<sub>2</sub> emissions by 2020.<sup>1</sup> Cars generate a high proportion of their emissions whilst accelerating. By using GPS, speed and accelerometer data on vehicle fleets, new insights

can be gained in real-time regarding where traffic flows generate high CO<sub>2</sub> emissions. This enables joggers, bikers and others to avoid high pollution areas and is a valuable input to transportation route planning to help reduce emissions.  
 ■ **Supporting Energy Efficiency**  
 In 2009, Singapore’s Energy Market Authority launched a smart meter pilot project. By allowing homeowners to access their personal energy consumption information, pilot trials reveal that they can derive at least a 2% reduction in overall energy consumption and a 10% reduction in peak consumption.<sup>2</sup> By overlaying energy data, various incentives, and consumer attitudes and preferences, the project can better understand people’s usage and help to tailor the specific messages to drive greater savings.  
 The value of coalescing these different data sets will grow over time as the platform matures. As the pool of available data grows, the project will enable the city to solve a range of issues, such as congestion, emissions management, energy efficiency and more.

<sup>1</sup> <http://www.lowcarbonsg.com/tag/carbon-emissions/>  
<sup>2</sup> <http://www.smartmeters.com/the-news/689-smart-grid-pilot-launched-in-singapore.html>



## Role of the Telecoms Operator

Telecoms operators are well placed to take a leading role in Smart Cities but need to act purposefully and quickly to optimise their role in the value chain.

As highlighted in exhibit 1, there are three layers of opportunity for telecoms operators in Intelligent Cities – Communications infrastructure, enabling services and full service delivery.

### Providing communications infrastructure

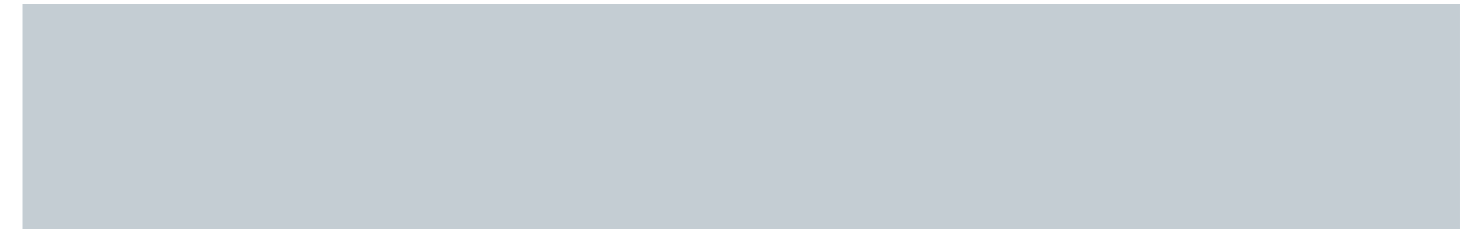
Backhauling the vast volume of data created by such things as utility meters in smart grids, traffic information sensors in roadside infrastructure and micro-payment data in mass-transit transport systems requires high capacity ubiquitous network connectivity that is well integrated with scalable data-centres. Telecoms operators' fixed and mobile networks are ideally placed to deliver the required connectivity and network intelligence. The busy hour profile of these urban services is likely to be out of phase with the peak times for traditional voice and mobile internet traffic, allowing operators to improve the asset utilisation of their telecoms networks and augment the business case for capacity increases.

While operators are perhaps the natural choice for connectivity in the city, their incumbency is by no means guaranteed. We are seeing increasing numbers of tenders for licensed spectrum by utility companies intent on building their own proprietary networks, or proposals to use powerline networks to provide data connectivity (broadband over powerline). Discussions are even taking place in the automotive industry about gaining access to high-frequency spectrum for proprietary vehicle-to-vehicle communication. Operators cannot be complacent in assuming that their networks will be the default connectivity infrastructure. They need to make the case for the value of ubiquitous and scalable connectivity to the key municipal buyers. Anchor tenancy of large connectivity municipal clients, in return for an accelerated roll out of high speed networks, could be a powerful bargaining chip to convince municipalities of the strategic value of using telecommunications networks for connectivity.

### Enabling services provider

For consumers to interact and transact with municipal services in a private and secure manner, a sophisticated and horizontally-scalable enabling platform is required. This platform would perform tasks such as authenticating users; obtaining permission to use private data; real-time pricing, payment and transaction capabilities for paid services; secure storage of data and reporting and analytics on service utilisation. A technology platform that delivers services of this type is often called a Service Delivery Platform (SDP), but in a city environment this platform has been defined by several multinationals as the Urban Operating System ("Urban OS").

Professor Carlo Ratti (Senseable Cities Lab Director at MIT) explains, it has been "difficult to monitor urban dynamics in real time." Traditional methods use head counts, surveys, aerial inspection and satellite image analysis, but they are "costly and slow to produce quantitative results." Real-time data collected from operator networks, and processed by a service delivery platform that sits upon an integrated data warehouse,



would make the Urban OS "the nerve centre for the city....with the potential to influence many urban functions that can help local authorities, service providers, businesses, and citizens themselves to improve the economic, social, and environmental sustainability of the places they inhabit."<sup>xi</sup>

The value of the Urban OS increases with the extent of integration across the multiple industry verticals and across multiple communication networks. As well as amortising the platform costs across multiple verticals, a common platform also leads to a more consistent experience for the end user. Perhaps even more importantly, a common platform approach allows data from different industry verticals to be combined or 'mashed up', to generate new data-insights.

The managed service provider of the Urban OS is likely to extract significant value from the urban services value chain, and so we expect this to be a highly-contested market. For this reason, we expect aggressive competition for the managed service provider role to come from large software vendors, such as IBM and Microsoft; system integrators, such as Accenture and EDS, and infrastructure providers, such as Cisco. Even the SIM manufacturers have indicated interest in extending their trusted service manager role to providing a subset of the service delivery platform functions. Telcos will need to act quickly to establish themselves as credible competitors in this land grab for urban ICT influence.

### Key functions of the Urban OS

- Authentication, identity management, security, authorisation
- Device management (pre-provisioning, in service re-provisioning, disconnect)
- Data-warehousing, mining, analytics, alerts
- Workflow/rules engine
- Location based services
- Developer & test environment, software development kit (SDK)
- Enterprise integration (APIs, web service)
- Payments, billing and settlement, real time pricing
- Self-service and customer service







### Full service delivery

In some markets telecoms operators are already looking to provide full end-to-end service delivery of urban services, including connectivity, the technology platform and an operator-branded consumer service. The GSMA has conducted extensive case studies on operator pilots and full scale launches of branded mHealth solutions, transport solutions, ticketing and mass-transit solutions and mobile-enabled smart metering services. These initiatives clearly demonstrate that operators can be successful in full service delivery beyond their traditional communication services.

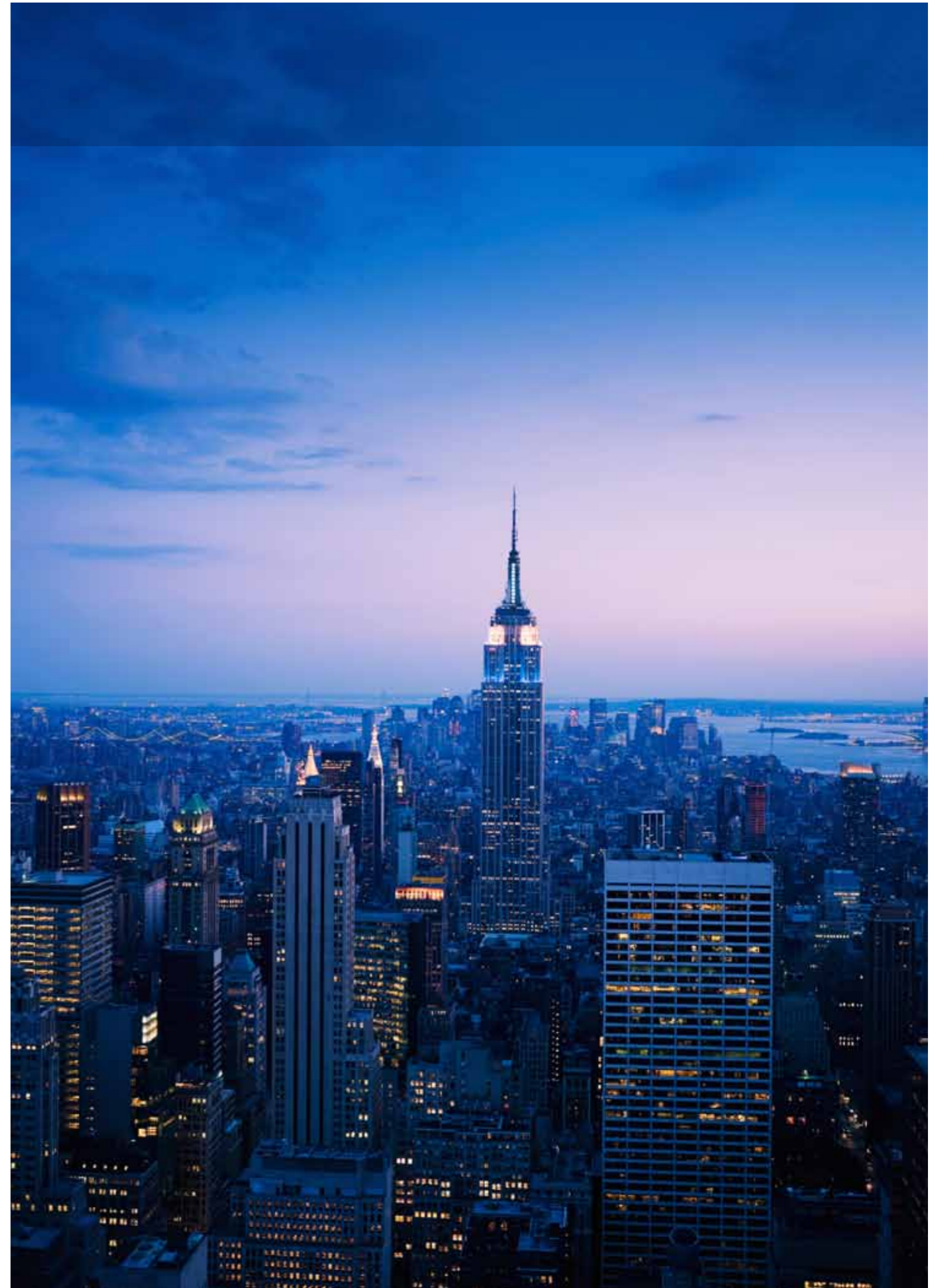
Full service delivery is clearly the most challenging strategy for operators, because it requires significant investments and insights into adjacent markets that are likely already crowded, highly organised and (depending on the services offered) can offer lower margins than operators are accustomed to. In addition, many municipal services, such as remote-healthcare or mass-transit, would likely require multi-service provider tenders, requiring operators to collaborate in providing the platform - traditionally a highly competitive aspect of the telecoms business.

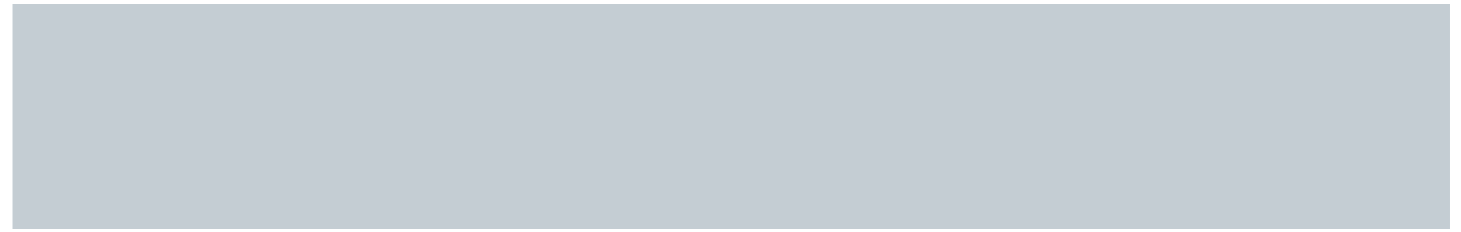
The adoption of a collaborative services platform in no way prevents operators from delivering competitive services on top of this platform. The platform must be seen as the enabler and not the differentiator in delivering attractive services to end users.

### Why telecom operators are well placed

Telecoms operators have many attributes that position them well to be the managed service provider in the Smart City value chain. These attributes include the following:

- Trusted brand – valued for high availability, QOS, privacy, security
- Sophisticated authentication and billing capability, potentially integrated across multiple bearer networks (fixed, mobile, WiFi).
- Mass-market customer care and self-service capability
- Consumer and commercial distribution and marketing channels
- Real-time customer insight – presence, location, usage
- Data centre scale
- Technology expertise in both networking and IT



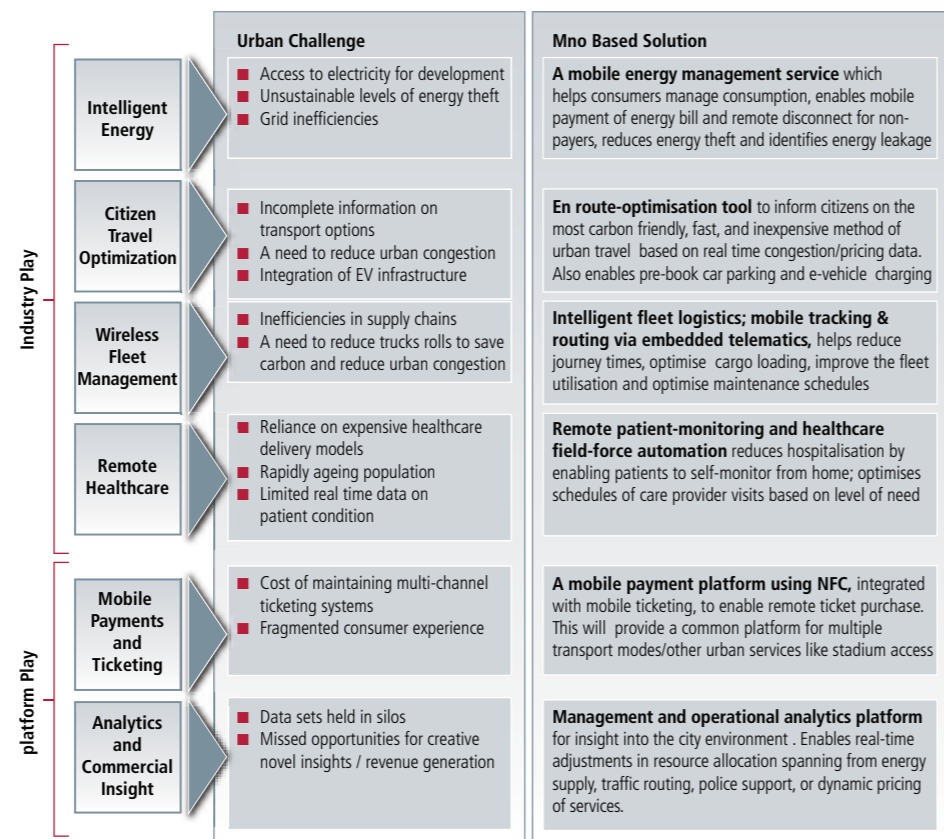


## Mobile Operator's Intelligent City Propositions

A successful pitch to a municipal buyer from mobile operators must include a compelling long term vision, but also some near term pilot opportunities that can be rolled out and tested. Some services are very attractive private sector propositions as they can be readily monetized.

Other services have greater strategic value for the citizens, making them worthy anchor tenant initiatives and investment from municipalities. A successful pilot should generate immediate commercial and strategic value for the citizens and the entire intelligent city value chain and be relatively quick to market and easy to implement.

Our research identified six new intelligent city business propositions across the value chain where mobile operators can deliver value to citizens, and generate new revenue streams beyond basic access and connectivity. These services are either industry plays, solutions targeted at specific industries, or platform plays that support a diverse range of intelligent city solutions.



## 6



## Prioritised Operator Propositions

We assessed these six intelligent city propositions along two dimensions: 1) expected economic benefits to mobile operators, third-parties and society; 2) the ease of implementation in terms of required capabilities, regulation and technical challenges. Based on this screening, mobile ticketing and payments, intelligent energy and analytics and commercial insight are the highest Intelligent City priorities for mobile operators to pursue.

### Strategic Opportunity – Mobile Ticketing and Payments

Mobile operators have an important role to play in developing an integrated platform for managing ticketing and micropayments throughout the urban environment.

For example, public transport is an example of an urban service that involves a high volume of low value transactions that take place in highly-congested parts of the city. Both citizens and the transport authority would benefit from moving to a cashless transaction process that enables the purchase and payment for tickets to be made over a mobile device. The ticket itself would be distributed back to the mobile device, rather than to a proprietary smart card (see below for additional details on mobile ticketing).

Most cities today have multiple, independent ticketing systems for the different modes of public transport and other municipal services such as stadium access, library cards, and museum entry. For example, in Paris, travellers use different payment mechanisms and ticketing systems for the Metro, RER, Paris Bus and Paris Bicycles. The result is a fragmented user experience, higher rates of theft or loss, and a missed opportunity for generating a consolidated data set of urban traffic patterns.

Contactless mobile payment and ticketing could be provided by cities and mobile operators through the use of Near Field Communication (“NFC”) technology. This will enable consumers to use their mobile phones as a contactless payment and ticketing device. Trials, such as the O2 NFC initiative in London, highlight the potential for mobile ticketing services. Payment for the ticket may be linked to the operator bill or third-parties such as Visa, Mastercard or PayPal. Mobile ticketing and payment for transport represents an ideal opportunity to stimulate the broader contactless payment market in the city, across multiple services. In many cities, contactless infrastructure is already in place and the benefits of mobile ticketing for consumers, operators and



transport authorities are clear and well-understood. Once launched, mobile ticketing and payments will stimulate the launch of other innovative contactless services across an Intelligent City. For example, an universal mobile ticketing service will encourage broad adoption of NFC handsets for ticketing and payments which will in turn stimulate adjacent sectors (such as retail and other municipal services) to invest in contactless ticketing infrastructure. These innovative new services could include, but are not limited to the following:

- Universal payment (retail, vending machines)
- Data transfer (real time schedules, advertising, real time information for tourists)
- Coupons (PoS redeemable vouchers, loyalty schemes)
- Access (replacement of keys for building or vehicle access, personal ID)
- Tracking (asset management, public health and patient tracking, field staff management)

The move to mobile ticketing and payments would benefit citizens, public services and numerous adjacent industries. The retail industry, in particular, will stand to benefit as it is clear that retailers will not invest en masse in mobile ticketing and payment solutions until there is a strong indication of interest and adoption from the citizens. Mass adoption of mobile ticketing and payment as the primary public transport ticketing system would send the ideal signal to retailers that consumers are ready to shift to a cashless society and that enabled handsets are readily available. This in turn would stimulate further investment in mobile payment infrastructure in the retail setting. Municipal support of mobile ticketing and payments for its transport infrastructure is a critical strategic move to stimulate the wider market.

Consumers benefit from mobile ticketing and payment by being able to use a single device across all transport platforms, a consistent user experience, speed and convenience, security, and near universal availability (e.g., non-credit card holders and tourists). The benefits for the city transport provider(s) include reduced costs as a result of having a scalable, integrated ticketing platform across all modes of transportation, dematerialisation (i.e. reload platforms) and reduced fraud. Tickets could also be acquired from outside congested stations, reducing crowding and the need for multiple ticketing staff and ticketing machines.



#### Global Case Study 2

##### Mobile Payments and Ticketing in Practice

###### Project: Cityzi in Nice

The Cityzi Project is a large-scale pre-commercial roll out of mobile contactless services. Customers are able to discover, for the first time in France, a multi-service offer of mobile contactless services, delivered through the support of mobile operators (Bouygues Télécom, SFR and Orange).

The first commercial mobile NFC handsets were marketed to 500,000 residents in the Nice metropolitan area along with a set of mobile NFC applications. In the summer of 2010, Orange sold NFC phones in its nine stores in Nice and nearby Manton and Beau Soleil. In total, approximately 30 retailers sold the NFC-enabled phones.

The scope of the initiative covers the entire urban community of Nice, including the city, as well as the 24 neighbouring communes.

The first services on offer within the framework of "Mobile Contactless Nice" include:

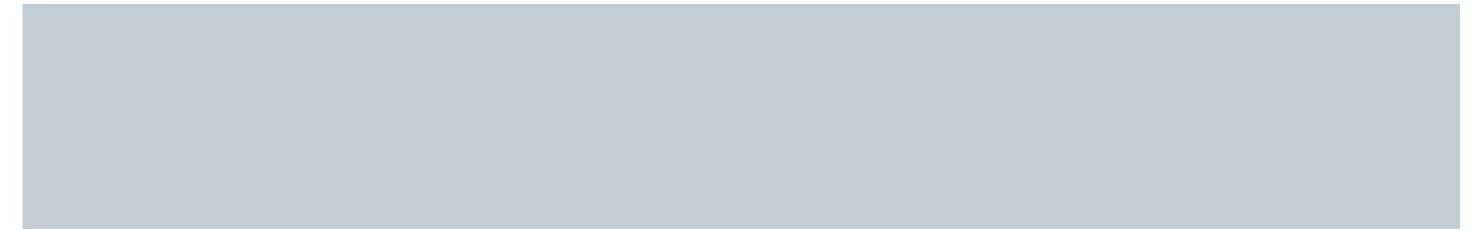
- **Public transport:** ticketing, passenger information
- **Promotion of local heritage and education:** e-campus project
- **Trade and retail:** local bank transactions, mobile loyalty and couponing programs
- **Cultural/tourist information:** museums

The Nice transport company, Lignes D'Azur, which operates buses and the trams in the city, has an NFC ticketing option similar to Oyster in London or Octopus in Hong Kong. Cityzi customers can load up the Bpass Java application, resident on the phone, with credit through an over-the-air transaction. Tickets can be bought at €1 each, or for €2 with parking, or in packs of €10. Each tram journey costs €1 and users can have credit of up to €19 on a phone at any one time. The price of the tickets is charged to the subscriber's phone bill and the mobile operator runs a revenue share with Lignes D'Azur. The phone can be used to take the tram or bus for journeys even if the phone's battery is flat, although you need a connection to add a ticket to the phone.

Perhaps the most powerful part of the technology is the use of NFC tags with a link to the phone's web browser. Waving the phone over a tag takes the browser straight to a pre-programmed page, providing access to real-time tram and bus times, TV listings, news, weather, restaurant booking and directory enquiries.

The scheme has been a huge success and other cities are anxious to replicate the programme. Strasbourg, Paris and Caen are all scheduled for trials in 2011.

Source: Nice Case Study: I do like to be beside the "NFC side" – more information at [www.orange.cityzi.fr](http://www.orange.cityzi.fr)



#### Monetisable Opportunity – Intelligent Energy

Mobile operators will play a crucial role in providing secure and robust communications infrastructure that will support the deployment of smart meters, and add intelligence to the electricity grid globally.

In the developed world, the future of the energy supply is changing rapidly. Aging infrastructure, decentralization of energy generation and the anticipated arrival of the electric vehicles in the cities are key drivers behind the need to upgrade the existing utility networks to smart grids. By 2020, for example, renewable energy is earmarked to account for 20 per cent of the European Union's energy consumption. If this objective is to be achieved, consumers and businesses will need to become active participants in the energy supply chain. However, the existing electric grid was designed and built to support large-scale production and one-way energy flow. The introduction of renewable, distributed sources of energy, such as solar and wind, requires the construction of an "intelligent" grid, capable of balancing supply and demand. At the same time, energy companies are aiming to minimize grid losses through improvements in the transmission and distribution networks.

The mass roll out of smart meters to individual's homes in the developed world is the first step toward making the grid more intelligent. The UK recently announced a nationwide residential meter roll out to 22 million homes.<sup>xii</sup> In 2009, 76 million smart metering devices were installed around the world, and that figure is expected to increase more than fourfold to 302.5 million smart meters by 2015.<sup>xiii</sup> In California alone, Pacific Gas & Electric plans to install 10 million smart meters by 2012.<sup>xiv</sup> The rationale for all this investment is that better information will enable consumers to adjust their daily usage patterns and help smooth peaks in energy demand, thereby reducing the need for carbon-intensive power generation to cover peak loads.

Mobile operators may have a key role to play in providing connectivity between devices and the utility company, delivering energy management alerts and applications to mobile devices and offering new intelligent energy services to consumers. Operators can leverage their existing ability to transport and bill end-users for large amounts of real-time data and discrete transactions. They can also manage communications networks for utilities that chose to focus on their core function of generating and distributing energy.

The challenges in emerging markets are somewhat different, where the priority is to provide safe, affordable energy to a rapidly increasing number of urban residents. Today, almost 1 in 7 of the global population live in substandard housing or slum conditions and this number is growing by 500,000 every week.<sup>xv</sup> In these slum environments, utilities face high levels of losses on their networks, due to inefficiencies in the electricity supply system (technical losses) and wide scale energy theft through meter tampering and illegal connections. In some residential areas of Rio, for example, the percentage of energy losses has been recorded at over 50%.<sup>xvi</sup> Many low-income citizens lack bank accounts, financial acumen and have limited awareness of their energy consumption or the methods for paying for energy. Still, mobile device penetration is high in low-income areas.



## Global Case Study 3

**Intelligent Energy in Practice**Project: **Rede Ampla in Rio**

Ampla is an electric energy distributor, owned by Endesa Brazil, which provides electricity to 73% of the state of Rio de Janeiro, serving over 2 million customers. The rate of urbanisation, the nature of the accommodation (slums) and the high crime rate led to an unsustainable level of energy theft and bad credit risk. A large number of customers did not have access to personal banking services and were limited in their ability to budget and manage their finances. Meters at residential and commercial sites were prone to tampering and bribes to employees encouraged fraud.

Ampla was averaging 23.6% energy losses on its network, reaching up to 52% in some areas. The result was a negative impact on the utility's profitability and a higher cost of energy passed through to its customers.

In 2003, Ampla began to roll out a pilot for a new mode of smart meter – located at the pole top – entitled Rede DAT. With Rede DAT, the consumption per household is recorded at the transformer and energy consumption data is communicated by the utility over a mobile network. Energy customers receive consumption data through their mobile phone.

The pilot proved a great success with losses from theft reduced by more than 50%, the number of supply interruptions reduced by more than 40%, and lower operating costs. A wider roll out followed, providing hundreds of thousands of Ampla's residential and business customers with access to the Rede Ampla service.



Pilot studies have shown that even in very low-income urban regions, where energy theft is as high as 50%, the majority of households will pay their energy bills if they are provided with a simple method of payment, quality of service in energy supply and a reasonable price point. Case studies, such as Ampla (see box below) suggest that energy theft can be reduced from 50% to 10% through a low-cost smart metering scheme, which uses the mobile device to provide energy consumption information. Rather than smart meters located within the residence, a pole top-based “shunt meter” sits on the distribution network and measures the consumption of tens of households. The device can identify the usage patterns of the individual households within the cluster, and can backhaul these energy readings via 3G connections to the utility. The application of mobile networks to manage energy is also increasingly common in South Africa where users buy prepaid energy credit through their mobile phones.

**The result of a more efficient electricity distribution grid is that we avoid hundreds of thousands of tonnes of carbon dioxide from entering our atmosphere.**

Intelligent energy services empower consumers by providing valuable information on their energy consumption levels. Consumers may also receive support in managing their bills (e.g. high usage alerts) and options for structuring their repayment schedules; all helping them to avoid a bad debt situation. Customers can make utility bill payments directly through their phones, which is especially relevant in those geographies where people are familiar with using their phone for personal banking. Additionally, this channel can become an important upselling platform for the utility, for value-added or premium services (such as Mi-Fi and /or home entertainment packages).

**Anchor Platform Opportunity – Analytics and Commercial Insight**

Intelligent Cities rely on a wealth of data, information and insights that can guide real-time decision making and responses, and inform longer term planning. Cities are hungry for data that will allow them to respond to changes in urban dynamics, such as traffic congestion, pollution threats, health issues and security risks, in a rapid and effective manner. In addition, they are looking for a much richer fact base and insights to help them to plan for the future in important areas, such as transportation, and utility build-out. Equally, private sector companies in everything from retail to insurance and advertising crave better urban information on which to run their businesses.

Mobile operators sit on a wealth of valuable urban data. Aggregated and anonymous data on mobile users' location can provide a real-time picture of changes in traffic patterns, congregations or mass exoduses of people, and long-term patterns of movements of people, indicating the need for additional public transportation, or the ideal site for a new store or billboard advertisement.

Pioneering visualisation techniques employed by the Current City Research Foundation ([www.currentcity.org](http://www.currentcity.org)) are helping to provide answers to these challenging urban questions. The team is using sophisticated modelling analysis of aggregated and anonymous mobile user data, combined with other spatially-aware data to produce real-time maps of urban flows and time patterns. The insights are being used for everything from catastrophe planning, to developing better tourist strategies, to studying the impact of new urban development projects. Organizations, such as the Dutch Ministry of Transportation and Waterways (Rijkswaterstaat) and the Netherlands Environmental Agency (PBL), have seen so much value in this information that they decided to assess its use for operational and strategic decision making.

The value of this information is exponentially increased when it is “mashed-up” with a diverse range of public data or private, commercial data. The Live Singapore! case study demonstrates how combining this basic mobile data with weather forecasts can improve traffic flows and the allocations of taxis. Many municipalities are now working to make all of their public data readily available for use by application developers and third parties. London has created the London Database, making all of its data freely available – everything from bicycle rental locations, to house prices and locations of local playing fields. Private businesses are interested in combining the mobile and urban data sets with their own internal sales, operations and customer data to help them identify the best location for their next store, or to create much better targeted pricing for auto insurance, for example.

Analytics and commercial insights is a core piece of the Intelligent City value chain. Already numerous parties are positioning themselves to be the provider of this capability. Mobile operators are in a unique position to be the platform that collects, stores and integrates these huge and diverse sources of urban data. Not only do they sit on one of the most important kernels of urban data in the mobile user data, but their trusted brand, dedication to security and vast capabilities and infrastructure make them prime candidates to be the providers of this critical piece of value chain.

**Key questions around urban dynamics**

- How many people are in a city district?
- Where is traffic congested?
- What is the current demand and supply of public transportation?
- How much CO2 was emitted today?
- How much footfall passes a specific billboard?
- Where are hot spots for crime or infectious disease?
- Where are potential national security risks?



## Conclusion and Next Steps

This report has highlighted three specific opportunities for mobile operators to assume a key role and derive benefit from the delivery of Intelligent Cities.

- The roll out of NFC-enabled mobile payments and ticketing for mass transit and other urban services, such as stadium access, parking and bicycle hire, is a strategic investment that will encourage much further investment in mobile payments in the retail sector, leading to a cashless society, in which mobile operators play a vital role.
- Intelligent energy is an innovative solution for conveniently providing urban energy to a massively growing market in developed countries and making energy consumption much more efficient in developed cities. It provides significant added value to all stakeholders and offers mobile operators an important entry point to the energy sector and the opportunity to sell higher margin services to existing mobile customers.
- Data analytics and commercial insights form the platform that provides the foundation for the Intelligent City. Combining mobile urban data with vast and diverse public and private data sets, provides the real-time information and insights that allow the Intelligent City to operate, plan and provide additional value to its businesses and citizens.

Demographic, environmental, economic and social factors are forcing the world to design and implement Intelligent Cities. Mobile networks will be a critical component of these new and re-designed cities. Not only in providing the connectivity glue that ties all of the devices, information and people together, but mobile networks are also critical in providing the information, insights and value-added services that will truly make our cities intelligent.

Success will require new capabilities, ways of thinking, strategies, and new partnerships. Mobile operators have a great role and opportunity in Intelligent Cities, beyond simply providing network connectivity. Now is the time for operators to begin to further explore and pilot these opportunities .



## 8

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