# DELIVERING THE SMART CITY

## Governing Cities in the Digital Age

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#deliveringsmartcities

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# FOREWORD

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## BRISTOL – THE LABORATORY FOR CHANGE WHERE THE PEOPLE ARE NOT TREATED AS GUINEA PIGS

Running cities effectively is a complex enough task already. Why make it even harder by talking about smart cities? In Bristol the answer is simple, there is no choice. We need the capacity to respond to, and in some instances to lead, technological, environmental and societal changes that are happening right now so that we can shape a sustainable, healthy and prosperous future for Bristol and for cities in general. This requires an equal focus on the evidence, on the imagination, and of course on the people. Cities will only be truly smart when the benefits and opportunities they offer are accessible to everyone. If city authorities are not championing inclusive smart cities, then who else will?

So what will our cities be like when people no longer want to own cars but have access to them as and when they need to? When libraries become places you go to upload and connect rather than download? When your phone is your brain, your memory and your wallet and open data is a utility that is as ubiquitous, exciting and potentially dangerous as electricity?

What will happen to our most vulnerable communities when the climate gets hotter and wetter and energy costs soar? When the money for delivering care services can finally no longer stretch to meet the rising demands of an ageing population? What skills will young people need when all of the world's knowledge is available at the touch of a screen and disconnecting from it is far harder than connecting to it?

These seem to me to be questions not of the future but of the present and as city officials if 'the day job' is not about asking ourselves these questions and trying to work out smarter city solutions, then what are we doing?

Building capacity to think about and shape the future is not about creating bigger and bigger council teams, but it is about being a highly networked, highly connected player in a large ecosystem and it is about acting with integrity.

Cities are complex systems that will always continue to change and grow. Being comfortable as a facilitator of city outcomes rather than a deliverer of services; using the convening power of the city to bring together and mobilise the key players around common goals and holding the risk associated with operating in a state of constant change should be seen as key skills and competencies that underpin good smart city governance. Certainly, in Bristol, this is how we deliver the vision set by our elected Mayor, George Ferguson, to position Bristol as a city laboratory for change – where the people are not treated as guinea pigs!

I welcome this important report from Arup and UCL which clarifies the fundamental concept of the smart city, outlines what cities can and have achieved and offers practical and grounded insights into the challenges they face.

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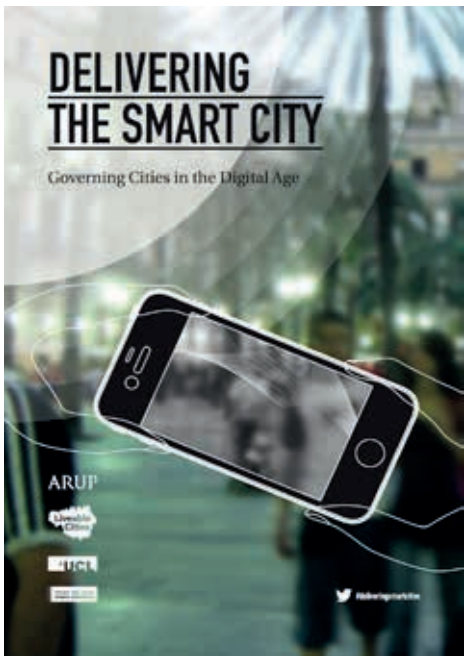
# EXECUTIVE SUMMARY




But of course, technological capability is only one part of the answer and is interwoven within layers of complexity. City governments are faced with the challenge of exploring the economic return in smart city investment, the business models, the value that it brings to citizens and the role that they should play within an ecosystem of delivery partners and stakeholders. They must decipher funding options, measurement and reporting regimes and the implications for their organisational structure, operational requirements and responsibilities. On top of this, they must understand how these investments align to existing local and national political priorities and strategies. This is not trivial.

Cities must be responsive to the changing context within which they operate- especially when that context is offering significantly improved capability or efficiency, or where the general population is adopting new patterns of behaviour that are no longer served by traditional modes of governance. In that sense investment in smart city capabilities can't be left to the leading few cities. This is not about implementing the latest smart grid in Amsterdam or the best control room in Rio. It is about responding with integrity to a changing context.

We know that digital technologies are offering new opportunities for cities to meet the challenges of the 21st century.

There is an opportunity to use ubiquitous urban sensing, big data and analytics to better understand the real-time functioning of our cities, as well as inform longer-term planning and policy decisions. Smart grids could enable efficiency within our energy infrastructure and intelligent transport systems may encourage multi-modal low carbon urban mobility. Anywhere-access to information through smartphones and mobile infrastructure could transform the way people use the city, and support the development of new products and services.

This is relevant to all city authorities. It's time to understand what can be achieved and it's time to take some action.

# EXECUTIVE SUMMARY

## CHAPTER 1: THE SMART CITY IS HERE

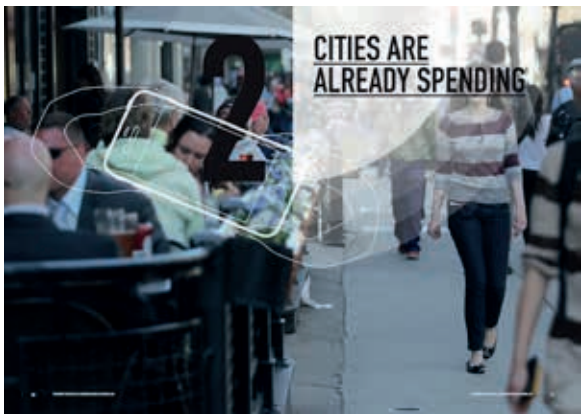
Ideas around the smart city have garnered much attention in recent years, but the diversity in classifications and definitions have left many confused as to what is really meant by the term. This report re-frames the smart city in terms of the capabilities offered by smart technologies. Namely that they are information-rich and interconnected. This approach purposefully avoids defining the outcomes of investment, and holds that the smart city is a means to achieve a vision rather than the vision itself.

Importantly, this is not just about foresight, there are many internal and external drivers that are forcing city governments to take action now. These are not technologies and practices that might appear in the next decade, they are technologies that are already exist, that are already operational and that most companies and civil society have already adopted and use. The smart city is about leveraging real and feasible technologies through sustainable business models to have a direct and measurable impact on citizens, service delivery, business, and governance operations and practices.


## CHAPTER 2: CITIES ARE ALREADY SPENDING

As smart technology starts to feature in the visions and tenders of city governments, does this herald a new cost item on our cities' balance sheets? The research in this chapter shows that cities are already investing a significant amount in information technology (IT), at around 6% of expenditure in the 8 U.K. cities studied. This figure is comparable to the expenditure from financial services sector, who typically have significant IT governance structures in place, including IT leaders like Chief Information Officers (CIOs), Chief Technology Officers (CTOs), who are responsible for aligning IT with business needs. While UK city authorities are spending similar amounts on IT, they do not have comparable governance structures in place to strategically monitor and manage this expenditure.

What is more revealing from this research is the implication that cities do not financially need to start from scratch to realise the opportunity of smart technology. Instead of requiring a new budget, smart technology could provide an opportunity to maximise a city's existing investment in IT.



## CHAPTER 3: TAKING SMART STEPS

There is no blueprint for city governments investing in smart technology- no universal approaches that are relevant to all jurisdictions. Instead, city governments must forge their own paths that respond appropriately and effectively to their individual needs and opportunities. However, by exploring eight global city case studies, this research has found that there are common governance challenges faced by cities, which are met by a variety of approaches. These are drawn out as 7 principles for smart city investment that all cities should be cognisant of when developing their programmes:

- CLARIFY THE OPPORTUNITY
- TAKE OWNERSHIP
- ENGAGE
- PREPARE
- ACT
- CHECK & REFLECT
- REPEAT & SHARE LEARNING


## CHAPTER 4: SMART CITY ECOSYSTEMS

City governments are not the sole actors in shaping, developing and delivering action for change based around smart technologies. In fact there is a vast ecosystem of stakeholders, each with differing priorities and capabilities that together shape the trajectory. This chapter finds that there is an opportunity for academia to develop a more holistic research agenda around smart cities, to take greater leadership in developing smart city agendas and capabilities in the city they are located in, and to incorporate an understanding of the smart city into their approaches to teaching and learning. It finds that national government could facilitate city networks, review the bureaucratic processes around procurement, promote innovation in large infrastructure programmes and take leadership on standards. Industry could form strategic partnerships that offer more sustainable business models to city governments.

# EXECUTIVE SUMMARY

All smart city projects and programmes have impacts on citizens. To date there has been a failure to seriously interrogate the impact of these on citizens that are perhaps unknown and certainly not always benign. These issues must be adequately incorporated into a holistic understanding of place-making in a digital age.

It comes back to city governments- the custodians of public welfare – to convene the actors in the smart city ecosystem in order to support and safeguard positive outcomes for all citizens. This requires strong leadership founded on a clear vision and a comprehensive understanding of local capabilities and aspirations. It requires practical and sound organisational capacity within the city council. It requires an understanding that no one party has all the answers and it requires strong partnerships across the city and beyond.

# 1

# THE SMART CITY IS HERE

Technology has always had transformative effects on the way cities are designed and operated. The automobile encouraged sprawling suburbs; the elevator enabled high-rise developments; shipping and affordable air travel has fostered a global economy that is cultivated in urban agglomerations; and advances in civil infrastructure (such as public transport networks and waste management systems) have equipped mega cities of tens of millions of inhabitants to continue growing. In the 21st century, cities are being transformed by the latest wave of technological development brought about by Information Communications Technology (ICT), which is again challenging the nature of city functioning and experience.

The internet, smart phones, increasing storage and processing capacity of computing, improvements in sensing and modelling capabilities and the Internet of Things (IoT) are collectively re-shaping the operational, economic and social dynamics of cities. These technologies represent a significant opportunity for cities and city governments to create more efficient, effective and equitable urban environments.

These digital developments are being played out against a backdrop of rapid urbanisation and growing pressure on natural resources. By 2050, an estimated 6 billion people will live in urban areas, amounting to 75% of the global population[1]. These cities must be supported whilst reducing carbon emissions to as much as 1/10th of current levels if we are to mitigate catastrophic climate change[2]. The urbanisation trend also escalates the economic importance of cities in the global supply chain and will increase the political position of cities within their nation states. Cities around the world are turning to the challenge: how do we do more with less, and ultimately decouple resource use from economic growth?

ICT is affecting every city on the planet, irrespective of whether they choose to invest in or incorporate the smart city concept into their governance agenda. It's time for all city governments – not just the global 'leading-lights'– to interpret the impact of ICT on their cities and organisations and determine how they might respond effectively and ethically.

While smart technologies are offering opportunities for governments to improve their service provisions, they are also being used by a wider group of stakeholders to drive change. In order to respond effectively, local governments must understand the nature of this change from both external and internal drivers.

**By 2050 an estimated 6 billion people will live in urban areas, amounting to 75% of the global population**

# THE SMART CITY IS HERE

## THE EXTERNAL DRIVERS

### Transparency Agenda

The technological advances that have opened up access to information and accountability of public services have also put immense pressure on public managers and politicians. Gains and Stoker (2009) explain that if not managed properly, lack of transparency and the poor use of ICT systems can become "politically salient and feed into a loss of public confidence about the stewardship of both manager and politician."

### Digital Disruptions & the Sharing Economy

Unique digital platforms created by innovative and entrepreneurial companies like AirBnB and Uber are challenging and transforming economies in cities. The sharing economy brought about by such digital platforms is putting pressure on existing service providers and ecosystems. These may represent both an opportunity and a challenge for local governance. For example, the number of lawsuits filed against the taxi-booking app Uber shows how local governments have to respond to new forms of digital commerce. Disruptive technologies produce winners and losers – the creative destruction of new technology simultaneously creates jobs and renders others redundant.

Arguably, e-commerce has already transformed patterns of behaviour and movement in cities (through increased van movements and the move away from the high street) but as online platforms continue to change patterns of behaviour in cities (through the sharing economy, transport systems, and even dating and social interaction) governments must gain a clearer understanding of their role and responsibilities in both facilitating and regulating these economies. Interventions by governments may determine whether these technologies are more enabling or disruptive.

Increasing automation in service provision also impacts the structure of employment. This issue is currently evidenced on the London tube network through the closing of ticket offices with the advent of ticketless transport, resulting in job losses and a strike action from the unions. Government must recognise the nature of this challenge and plan for it in both the immediate and longer term.[3]

**Increasing automation in service provision also impacts the structure of employment**

## Changing Citizen Expectations

Social media and 'anytime anywhere' communication is pressuring local governments to adapt to changing citizen expectations of accountability and interaction, driving new forms of public engagement. In Los Angeles, the local planning and transport authority are utilising social media to engage and consult the public on their new transport strategy, through the virtualisation of traditional engagement processes[4]. Their LA/2B 'online town hall' invites citizens to join virtual debates and share their opinions on key issues related to transport in the city. "The virtual town hall has allowed for a wider range of citizens to participate outside of traditional workshops and focus groups, with participants representing 79 of the 108 (73%) zip codes associated with the City of Los Angeles." They also claim that "the online format also allowed staff to identify geographical gaps in participation and focus additional outreach efforts in those communities."


Many private sector organisations such as Amazon, Facebook and Google leverage technology and data to understand trends in customers' needs flexibly, instantaneously, and in a way that fits with people's lives. There are opportunities for public sector organisations to increase capacity in this area, which has begun to be addressed by some local councils through e-government services.

Some companies are creating services that are transforming how citizens are able to interact with their local councils. For example, MySociety is developing applications that encourage simple and direct communication with local authorities. FixMyStreet is a reporting tool where citizens can inform the local council of problems which might include potholes or abandoned vehicles. In this way, citizens are increasingly expecting to interact with their local councils through social media platforms, and dually expect their local authorities to be responsive and accountable.

Interpreting this opportunity for local government is slightly problematic in that councils need to balance different people's rights in a way that many private sector organisations don't. If, for example, city governments decide to allocate resource towards fixing potholes in places where people have reported, what happens in the areas where people don't or can't report? The challenge is therefore around using digital platforms as a means of opening up a channel of communication between citizens and local government, rather than expecting the council to adhere to the customer service norms we expect from business.

Organisations like @amazon @facebook and @google use #bigdata to understand customer needs and trends flexibly and instantaneously

# THE SMART CITY IS HERE

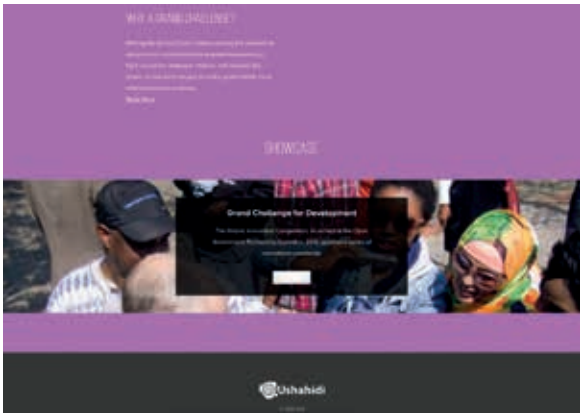
## Activism

Citizen groups are using ICT and media to challenge political norms. "In the Arab Spring, social media facilitated action in the Middle East and North Africa (MENA) region, providing a free and accessible method of organising and coordinating demonstrations."[5] This was echoed in the London riots in 2011, and the subsequent clean-up operation. This activism is directly and effectively challenging incumbent governance systems, and enabling increasing global scrutiny.

Online platforms such as The Everyday Sexism Project are also giving voices to groups of people that would not traditionally be collectively represented. The testimonies from this campaign are being analysed by the British Transport Police in the U.K. to create more effective policies and training for officers on how to deal with sexual offenses, as part of 'Project Guardian'. As part of this project, officers made 15 arrests in connection with various sexual offences over one single week of action in December 2013, and has seen a 21% increase in reporting of sex offences on railways over one year[6].

Modern governments and policymakers must be able to understand and respond to these online campaigns if they are to continue to be effective and accountable to the public they serve.
In Kenya, the non-profit organisation 'Ushahidi' provides platforms to map reports of violence after the post-election fallout at the beginning of 2008. Since then, their mission and capabilities have grown, now equipped with the tools to "monitor political unrest, measure the impact of natural disasters, uncover corruption, and empower peace makers." They also founded a technology hub in Nairobi, helping to catapult the technology community in East Africa, incubating 150 tech start-ups that have created over 1000 jobs. Ushahidi also runs the 'Making all Voices Count' Grand Challenge, a $55 million fund to revolutionize accountability between citizens and governments and help seed innovative solutions.

Again, governments are being faced with the challenge of placing these new types of campaigns in context of understanding the voices they represent as well as those that they don't. Many marginalised groups will not have the political, social, educational or technological capital to raise their voices through social media, while other voices may be amplified despite being non-representative.




**@ushahidi runs 'Making all Voices Count', a $55 million fund to revolutionize accountability between citizens and governments**

## INTERNAL DRIVERS

### Operational Efficiency

It is well documented that smart technologies such as intelligent transport systems and smart grids have the capability to improve the efficiency of city systems. More than 50 countries worldwide are currently investing in smart grid technology, where they aim to create operational efficiency and avoid black-outs through load balancing, while reducing the carbon footprint of energy supply. In the U.K., it has been estimated that efficiency gains from smart meter adoption could deliver total benefits of around £18.8 billion and costs of around £12.1 billion. This is reflected in an individual's annual bill reduction of around £24 a year by 2020, rising to £39 a year by 2030[7].

In the U.K., it has been estimated that efficiency gains from #smartmeter adoption could deliver total benefits of around £18.8 billion

### Economic Development

Many companies and governments are citing substantial economic advantages in investing in the smart city economy in their locales. In the Arup report commissioned by the U.K. Department for Business Innovation and Skills, the global market for smart city solutions and the additional services required to deploy them is estimated to be worth USD$408 billion per annum by 2020[8]. GVA Connect estimate that the cloud industry alone will be worth $107 billion by 2017[9].

There is also significant action at the national government scale. In South Korea the government are investing $2 billion to improve the quality and quantity of public open data over the next five years as part of their Government 3.0 strategy[10]. They expect this investment to create 150,000 jobs and an economic effect of $22 billion[11]. Under their '100 Smart Cities' programme, India plans to invest $1.2 trillion over the next 20 years, with $1.2 billion allocated for smart cities in the 2014/15 budget, as well as an additional $83 million allocated for the Digital India Initiative. They forecast that this investment will directly affect the economy through a 10-15% rise in employment and skills development[12].

In South Korea the government are investing $2billion in #opendata. They're expecting 150 000 jobs and an economic effect of $22 billion

# THE SMART CITY IS HERE

### Civic Engagement, Education & Empowerment

Smart technologies and digital platforms can also empower local communities to share knowledge and resources, and are enabling access to services that might otherwise be out of reach– especially to vulnerable groups such as the elderly or victims of domestic violence. Bristol's Knowle West Media Centre is a community group that uses technology to empower citizens across all aspects of their lives. For example, the web-based platform "University of Local Knowledge" harnesses local knowledge and disseminates it amongst the community. Here, citizens can add to the wealth of information already available on the site by uploading and sharing videos of their own knowledge and putting together their own playlist-like courses[13]. They also run training sessions for the elderly, teaching them how to access basic online services like online shopping, booking holidays or using applications such as Skype. These community-run sessions enable vulnerable people to access basic services and feel more connected to their families and local community.

Smart city technologies and digital platforms can also enable community groups to take more ownership over their local environment. For example, the community-based organisation 596 Acres in New York (which emerged out of the NYC 'Big Apps' competition) helps to unite neighbours through online tools, enabling them to clear hurdles to community land access. The tools translate city data into information about particular pieces of land and help connect people to one another through social networking functions. These tools have already enabled local communities to transform spaces that had been derelict for years into spaces designed by, and for, the community[14].

Community-run sessions enable vulnerable people to access basic services and feel more connected to their families and local community

### Understanding City Dynamics in Real Time

Companies like Google are already mining mobile phone data in cities to map congestion patterns in real time – and relaying that information back to citizens[15]. This information is layered onto Google Maps to provide users an indication of the level of congestion expected on various routes at any given moment.

Many city governments are now using digital platforms to understand the real-time dynamics of their cities. For example 'Listen London' is a bespoke tool that mines social media data about London-related issues from a variety of platforms. It then analyses the findings to provide overviews by topic and opinions expressed online, providing strategic input to governance decisions[16] such as the locations of victim support centres.

**@Google are mining mobile phone data in cities to map #congestion patterns in real time and relaying that information back to citizens**

## THE CHALLENGE

The challenges and opportunities inherent in the smart city concept are complex and multiple. It's not just about operational efficiency and modernisation of infrastructure. It's not just about facilitating a new information marketplace. Nor are the discourses solely about enabling and empowering citizens. Real-time and big data are parts of the conversation. It's simultaneously about all of these things and more. The potential benefits of ICT and digital infrastructure are vast. City governments must first understand how and what they are investing in – what, exactly, can smart technologies do for their city? Many cities know there is an opportunity around smart but are not sure what it means for them.

### The problem with the 'smart city'

The smart city has garnered much attention in recent years, with both strong advocates and highly critical opposition. Much of the criticism stems from a feeling that the smart city has been portrayed as a techno-utopian ideal dreamt up by 'self-congratulatory' technology companies marketing their products. Purpose-built 'smart cities' like Songdo and Masdar have failed to inspire great changes in cities with existing systems and infrastructures, and were unsuccessful in discounting the view of the smart city as simply media hype.

As Lee et al. explain "despite the rapid growth of smart city development, few academic studies address smart cities from a holistic or typological viewpoint."[17] Madner et al. support this sentiment claiming, "at first glance, the term smart city is a catchy phrase that people like to use as a label to emphasise innovation, sustainability and

**Many cities know there is an opportunity around #smartcities but are not sure what it means for them**

# THE SMART CITY IS HERE

competitiveness… A look at the relevant literature reinforces the impression that there is no clear explanation of the smart city as a term or as a concept."[18]

Some proponents of the concept argue that ICT systems are the new urban panacea. They argue that ubiquitous urban sensing, big data and analytics will help us to better understand the real-time functioning of our cities, as well as inform longer-term planning and policy decisions. They claim that smart grids will enable efficiency within our energy infrastructure and that intelligent transport systems will encourage multi-modal low carbon urban mobility. They say 'anywhere access' to information through smartphones and mobile infrastructure will transform the way people use the city, supporting the development of new products and services. They claim that the smart city offers a complete and holistic solution to modern urban functioning.

Getting to an accepted definition of the smart city, or at the very least a common understanding, will be imperative to moving the debate and research along in a way that is not biased to the needs of particular stakeholders. An agreed definition will allow researchers, industry and government to ensure that explorations in this field are comparative and underpinned by the same conceptual understandings. It will also allow debate to be more nuanced and progressive, just as the Brundtland definition of sustainability was able to build attention and begin to align global research.

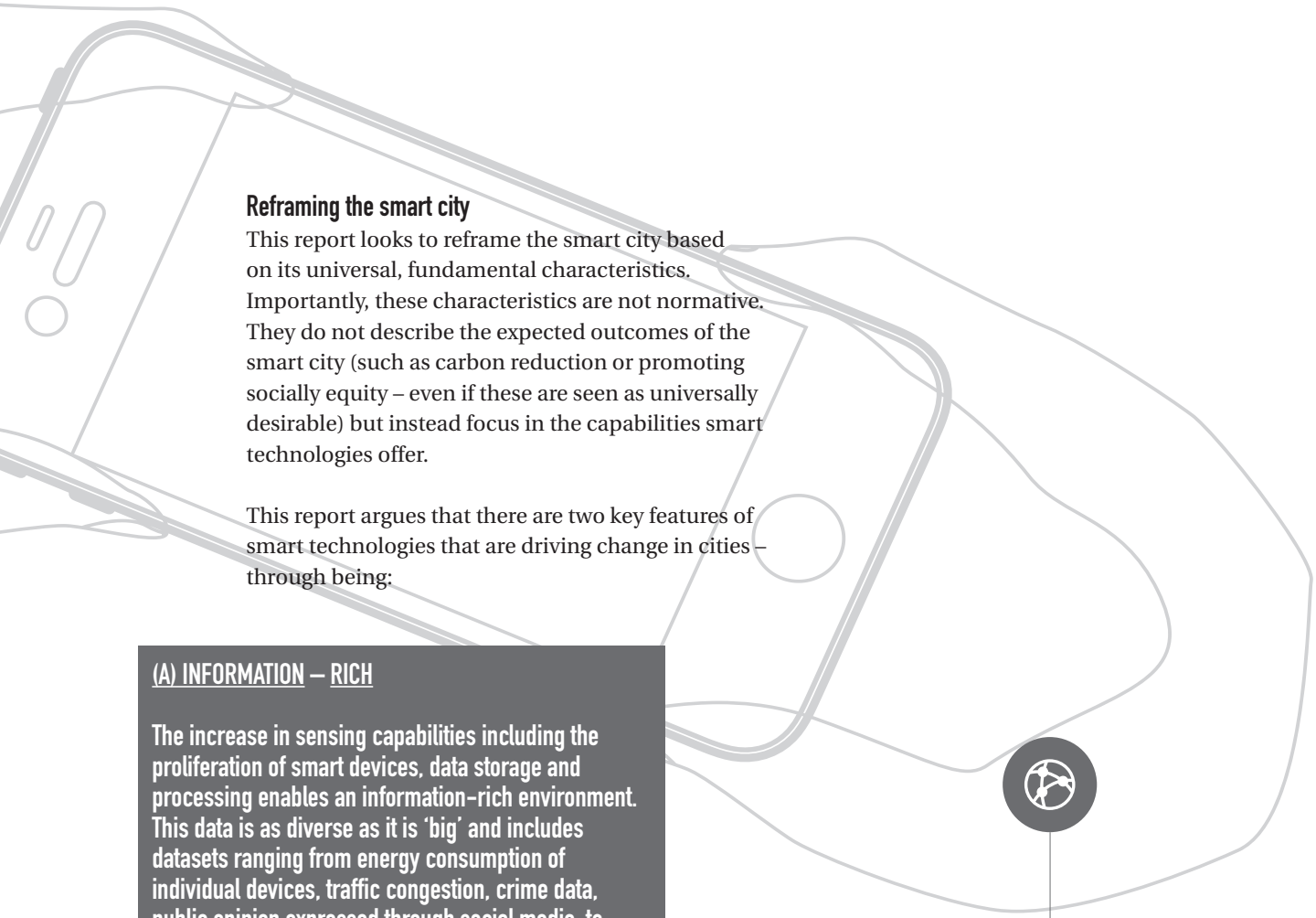
Several attempts have been made to classify cities and rank them against their perceived 'smartness.' The two most cited smart city rankings identify different cities as among their favourites. The earliest study, published by Giffenger et al[19] focused on medium-sized European cities and identified the top three cities as Luxemburg, Aarhus and Turku. Boyd Cohen's top three however were Vienna, Toronto and Paris[20]. This disparity is partly due to their differing focuses, but underlines the fact that smart city researchers have not yet converged on a common understanding or definition of the smart city.

Many approaches to defining the smart city detail specific outcomes that the city will provide. For example, Cisco defines smart cities as those who adopt "scalable solutions that take advantage of information and communications technology (ICT) to increase efficiencies, reduce costs, and enhance quality of life."[21] IBM defines a smart city as "one that makes optimal use of all the interconnected information available today to better understand and control its operations and optimize the use of limited resources."[22]

These definitions tend to focus on prescriptive outcomes that the smart city offers e.g. resource efficiency, improved decision-making, etc. This leads to definitions that tend to be overly generic which can lose clarity and meaning. A significant challenge when reaching a common understanding of the smart city is how broadly it should be articulated: too wide and it becomes all-encompassing, too narrow and it becomes exclusive, specific and unrepresentative of the plurality of characteristics that a smart city can maintain.

**Smart Cities as those who adopt "scalable solutions that take advantage of Information and Communications Technology (ICT) to increase efficiencies, reduce costs, and enhance quality of life".**

CISCO



## Reframing the smart city

This report looks to reframe the smart city based on its universal, fundamental characteristics. Importantly, these characteristics are not normative. They do not describe the expected outcomes of the smart city (such as carbon reduction or promoting socially equity – even if these are seen as universally desirable) but instead focus in the capabilities smart technologies offer.

This report argues that there are two key features of smart technologies that are driving change in cities – through being:

**(A) INFORMATION – RICH**

**The increase in sensing capabilities including the proliferation of smart devices, data storage and processing enables an information-rich environment. This data is as diverse as it is 'big' and includes datasets ranging from energy consumption of individual devices, traffic congestion, crime data, public opinion expressed through social media, to public sector spending.**

**(B) INTERCONNECTED**

**The interconnectedness of data and 'things' through processing, actuation, digital platforms and social media is another fundamental capability of smart technologies. The interconnectedness creates value through increased ability to understand patterns and trends, allowing immediate action in real-time and informing longer term decision-making.**

**This report looks to re-frame the #smartcity based on its fundamental characteristics**

# THE SMART CITY IS HERE

These are the fundamental characteristics delivered by smart technologies. However, in and of themselves they do not improve cities or make them 'smart places'. If cities are to leverage these capabilities to create better places, they must integrate them effectively into appropriate decision-making processes and governance structures. For example, an increase in information about how a privileged segment of society feels about their waste disposal doesn't necessarily lead to better decisions from the council, especially if they lack understanding of the concerns expressed by people in nearby social housing developments. In that sense, the fundamental principles of being 'information-rich' and 'interconnected' only lead to better decision-making if they are appropriately interpreted and acted upon by city authorities.

This approach also holds that the smart city is a means to achieve a vision, rather than the vision itself. The smart city is not a utopian dream that incorporates philosophical and political ideals about a way of life, or a future civilisation. The technology itself is broadly neutral; it is the technology-in-practice that has political, social, economic and environmental impacts. City governments are responsible for responding to, interpreting and directing what this technology-in-practice resembles in their municipalities. If city governance systems do not take this initiative they risk not only being 'left behind' in terms of modernisation, but they also risk being unable to effectively deliver on their responsibilities as custodians of public good. The smart city, simply, is a place where technology is leveraged effectively by city stakeholders to achieve their goals in both the short and the longer term.

If cities are to get the most from #smartcity investment they must integrate them into decision making processes and governance structures

This approach acknowledges that each city will have different priorities and that these will change over time

The #smartcity is a means to achieve a vision, rather than the vision itself

# NOW

With this view in mind, the smart city is not about buying state of the art technology because it looks cutting-edge or flashy. It is not even about spending money on infrastructure upgrades – and it certainly shouldn't be a political flash in the pan, or a brief media moment. Real smart city investment is about recognising the evident trends, challenges and opportunities that are known to be being brought about by ICT in cities, it's about understanding how ICT is fundamentally and systemically transforming modern city living.

This is not just about foresight, these are not technologies and practices that might appear in the next decade, they are technologies that are already exist, that are already operational and that most companies and civil society have already adopted and use. The smart city is about leveraging real and feasible technologies through sustainable business models to have a direct and measurable impact on citizens, service delivery, business, and governance operations and practices.

**#smartcity investment is about recognising the trends, challenges and opportunities that are known to be being brought about by ICT**

# HERE

**Technology itself is broadly neutral, it is the technology-in-practice that has political, social, economic and environmental impacts**

**This is not about foresight, these are not technologies that will appear in the next decade – they already exist and are already operational**

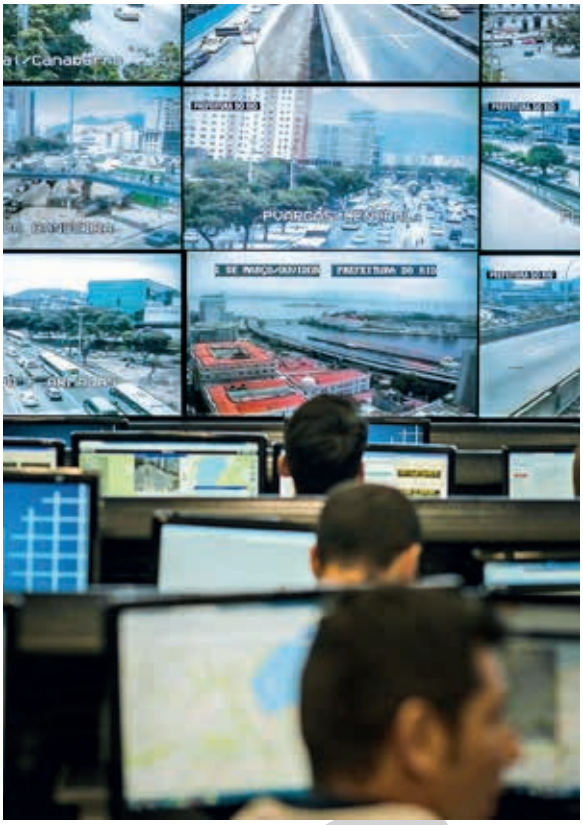
# THE SMART CITY IS HERE

## Call to action

Smart city technologies and the political, social and economic ecosystems that surround them have not, for the most part, been interpreted for local governance. Collectively, we are still grappling with what the everyday implications might be for service delivery (i.e. the services that need to be delivered by city authorities as well as how they choose to deliver them), the business models that will enable change, how digital innovation is nurtured within a city economy and what happens when innovations cause transformative disruption to city functioning. We don't fully understand the political implications of the transparency and open agenda, and we haven't developed insight into how city authorities might convene and direct the information economy.

To make progress in this understanding cities need to engage with the challenge. But more importantly individual cities must engage for their own benefit, and if they are to continue to be ethical custodians of public interest. It is not acceptable for a city authority to be unresponsive to the changing context within which they operate – especially when that context is offering significantly improved capability or efficiency, or where the general population is adopting new patterns of behaviour that are no longer served by traditional modes of governance.

In that sense investment in smart city capabilities can't be left to the leading few cities. This is not about implementing the latest smart grid in Amsterdam or the best control room in Rio. It is about responding with integrity to a changing context. This is relevant to all city authorities. It's time to understand what can be achieved and it's time to take some action.



ACTIONS

**#Smartcity technologies and the political, social and economic systems that surround them have not yet been interpreted for local governance**

# 2

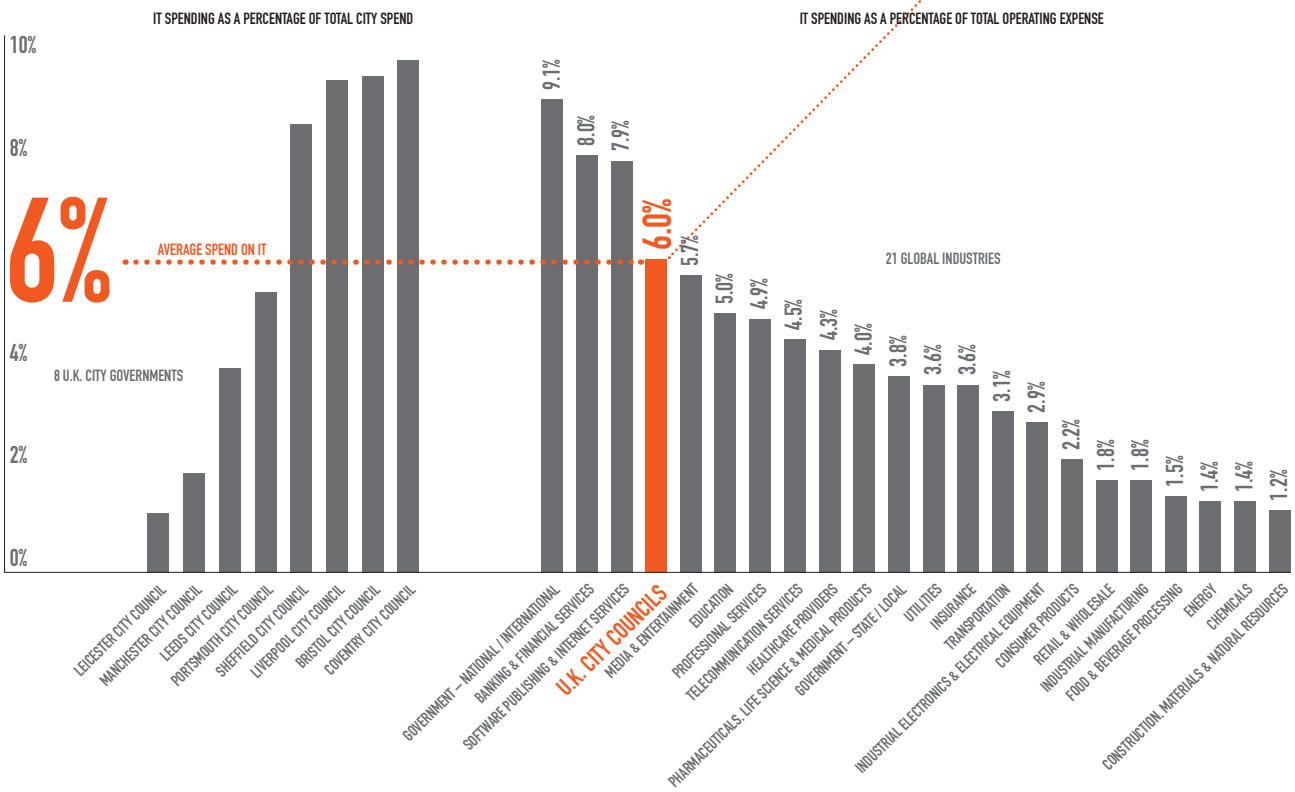
# CITIES ARE ALREADY SPENDING

As smart technology starts to feature in the visions and tenders of city governments, does this herald a new cost item on the balance sheets of our cities? The research in this chapter shows that cities are already investing a significant amount in information technology (IT). This finding is perhaps unsurprising when one considers how IT underpins many of the services offered by city governments today – from public security and health, to transportation, public works, natural resource management and business licensing. Rather than adding to these costs, smart technology can enable cities to get more value from their existing IT investment. Cities do not need to start from scratch to realise the opportunity of smart.

We analysed the spending patterns of eight U.K. cities to gain an insight into how much cities are spending on IT. The open data movement in the U.K. has generated significant amounts of newly accessible data in the area of government spending and procurement. From this public data we extracted how much eight U.K. city authorities had spent on IT over the last three years. The analysis showed that the eight cities were spending on average 6% of their total expenditure on IT.

**U.K. city authorities spend approximately 6% of their budgets on IT**

## COMPARING IT SPEND




Source: Analysis of public spending data from eight city councils for last three years (April 2011 to March 2014) by Spend Network.

Source: Gartner IT Key Metrics Data (December 2013) with the average IT spending of 8 U.K. city councils included for comparison.

# CITIES ARE ALREADY SPENDING

## CITIES SPEND A SIGNIFICANT AMOUNT ON IT

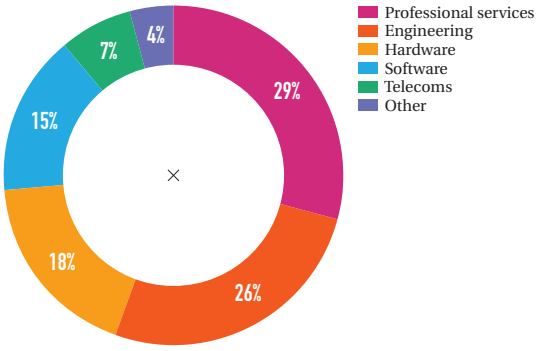
Our U.K. finding supports other research showing that city governments globally are spending a significant proportion of their budgets on IT. The technology research company Gartner analysed the IT spending patterns of 99 local governments across 80 countries and found that that IT accounted for 3.8% of their total operating expenses[23]. In the U.S.A. local governments, including 3,200 counties and 19,000 cities, spent approximately $34 billion on traditional IT goods and services in 2013.[24] Our eight U.K. cities spent on average £23 million a year on IT. Across geographies and the varying functional remits of city governments, IT represents a significant component of city spending.

City governments are spending more on IT than many industries globally. The banking and financial services industry spends on average 8% of operating expenditure on IT, while utilities and transportation spend 3%, and construction 1%[25]. The eight U.K. cities are spending nearly as much on IT as technology intensive sectors, such as financial services, software publishing and internet services. While these private industries typically have central IT functions to monitor and manage IT investment across the organisation, including Chief Information Officers (CIOs) and Chief Technology Officers (CTOs), city governments do not tend to have comparable IT governance structures to strategically manage IT spending.

In addition to the IT spending identified within each U.K. city government, there would also have been IT spending embedded within government contracts undetected by our analysis. For example, a contract between a city government's waste department and a waste collection service provider could include IT services within a single spend item classified as a 'waste service'. An increase in outsourcing by U.K. city governments in recent years means that this 'shadow' IT spending may be substantial as cities seek to reduce costs due to budget cuts.[26]

What does city IT spending comprise of? The identified IT spending by the eight U.K. city authorities covered a range of services and products, including hardware, software, professional services, engineering, and telecommunication services and infrastructure.

CITY IT SPEND BREAKDOWN




These cities are investing in far more than office computers. In the U.S. spending analysis showed that local governments are increasingly procuring cloud-based services, such as online portals for tax collection and business licensing, and software and applications to modernise customer services and reduce operational costs. Big data and analytics are also being procured to guide resourcing, shape services and generate additional revenue – from crime analysis and detecting fraud, to integrating social services. fraud and integrating social services. These IT projects are usually part of wider modernization projects being carried out within departments rather than standalone technology initiatives at the city level.[27]

**U.K. cities are spending nearly as much as banks on their IT**

Source: Analysis of public spending data from eight city councils for last three years (April 2011 to March 2014) by Spend Network. Spend breakdown is an average across the 8 cities and three years.

City governments are not the only organisations investing in IT to support city operations. An array of public and private organisations provides IT infrastructure and services to support our cities. The installation of 5,000 smart meters in homes and businesses across London involved investment from a range of private companies including EDF Energy, Siemens, Logica, as well as the electricity transmission and network operators, National Grid and U.K. Power Networks, the transport operator Transport for London, and the city government Greater London Authority[28]. City government IT spending must be considered in the context of this wider ecosystem.

## OUR APPROACH: CALCULATING CITY IT SPEND

To examine the extent of U.K. city spending on information technology (IT) we analysed publicly available spending data from eight U.K. city authorities. This involved gathering over 1.2 million rows of data from 3 years spending (April 2011 to March 2014) from the eight authorities.

### What do we mean by IT spend?

IT spending by each city was identified as:

- Any spending by the IT department within the city authority;
- Any spending that had been classified as 'IT' by the city authority;
- Any spending with firms defined as IT companies according to the U.K. Standard Industrial Classification of Economic Activities (UKSIC 2007).

CITY AUTHORITY IT SPEND


Spending data that met one of these three criteria was classified as 'IT spend' and then reviewed for anomalies and any expenditure that was not IT was removed.

# CITIES ARE ALREADY SPENDING

### How did we analyse the data?

Data that met one of the three 'IT spend' categories above was further analysed to identify any weaknesses. Large items of spend were focused on and more accurate data extracted where possible. For example, a long-term joint venture between a city authority and IT companies included a range of activities and costs, which were classified as IT spend but were not directly related to IT, such as staffing costs for the maintenance of highways. To normalise this data, only a percentage of this joint venture was estimated as IT spend.

Each item of IT spend was classified according to the United Nations Standard Products and Services Code® which has 14 categories for IT products and services. We grouped these 14 categories into six categories to give a simpler view of the types of IT spend: hardware, software, professional services, engineering, telecommunication services, and other.

### How did we analyse the IT suppliers?

We classified IT suppliers as 'small' or 'medium and large' businesses based on the threshold set by Companies House, where a small company must meet at least two of the following conditions:

- Annual turnover must not exceed £6.5 million;
- The balance sheet total must not exceed £3.26 million;
- The average number of employees must be no more than 50.

This analysis was done by Spend Network, a start-up consultancy that uses open spending data to create new insights for Government and its suppliers.

www.spendnetwork.com

### Which cities were analysed?

8 U.K. city authorities were analysed based on the availability and accessibility of their spending data:

| CITY AUTHORITY | ANNUAL TOTAL SPEND (AVERAGE 2011–2014) | ANNUAL IT SPEND (AVERAGE 2011–2014) | CITY POPULATION (SOURCE: OFFICE FOR NATIONAL STATISTICS) |
|---|---|---|---|
| Bristol City Council | £384 million | £35 million | 440,000 |
| Coventry City Council | £237 million | £22 million | 330,000 |
| Leeds City Council | £682 million | £25 million | 760,000 |
| Leicester City Council | £244 million | £2 million | 330,000 |
| Liverpool City Council | £362 million | £34 million | 470,000 |
| Manchester City Council | £505 million | £8 million | 510,000 |
| Portsmouth City Council | £256 million | £11 million | 200.000 |
| Sheffield City Council | £617 million | £49 million | 560,000 |

Source: Office For National Statistics, 2014.

## UNDERSTANDING CITY IT SPEND

In all of the eight U.K. cities analysed, the same IT services and products were often purchased by different departments within the city using different suppliers. Without a city-wide IT function, it can be difficult for cities to identify opportunities for strategic IT investments and cost sharing. When IT spending is monitored within a city government, it is usually tracked by individual departments rather than as a central, standalone category of spend, like transport or education. A more integrated view of IT spend within cities could help to finance initiatives, like a city data platform, whose benefits spill over multiple agencies.

The open data movement has the potential to provide a better understanding of city government IT spending. In the U.K. and U.S.A. city authorities are increasingly sharing their spending data with the public. This published data is, however, often difficult to understand. Detailed analysis was required to extract the IT spend from the spending data of the U.K. eight cities for this research. Despite the great quantity of government spending data available in the U.K., its varying format and quality makes comparison difficult within and across city governments. Transparency of government data does not necessarily imply clarity.

The pervasiveness of IT in city operations makes this lack of clarity on IT spending important. Cities will increase their level of IT investment in years to come just as we individually are spending more on personal technology. According to a 2013 study, Americans spend an average of $166 each month on technology, the equivalent of 17% of their monthly mortgage or rent[29]. Despite this significant spend we tend not to track our technology spend as a whole because it cuts across so many different areas of our lives – from monthly phone and internet bills, to live streaming of music and videos, a GPS system for our car, mobile apps, and privacy software and computer hardware. The situation is similar for our city governments. Having an aggregate view of technology spend would help cities to make more informed investment decisions and identify cost savings.

An integrated view of IT spending can also enable city governments to collaborate on their IT investments. Our U.K. analysis shows that the eight city authorities were buying a wide variety of IT systems and services to support similar operations, from managing parking violations to processing tax payments. While aggregation is not always the answer, opportunities exist to pool IT spending across U.K. cities. Research carried out by the open data research consultancy, Spend Network, revealed that the U.K. public sector used over 2,000 different tendering portals (unique domains) over the last five years. The Local Government Association in the U.K. has embarked on a programme to evaluate and coordinate IT expenditure. Publishing city government spending to common standards could support this initiative, helping cities to address joint procurement opportunities. It could also enable cities to share insights on which IT products to procure, such as 'off the shelf' products that do not require expensive customisation.

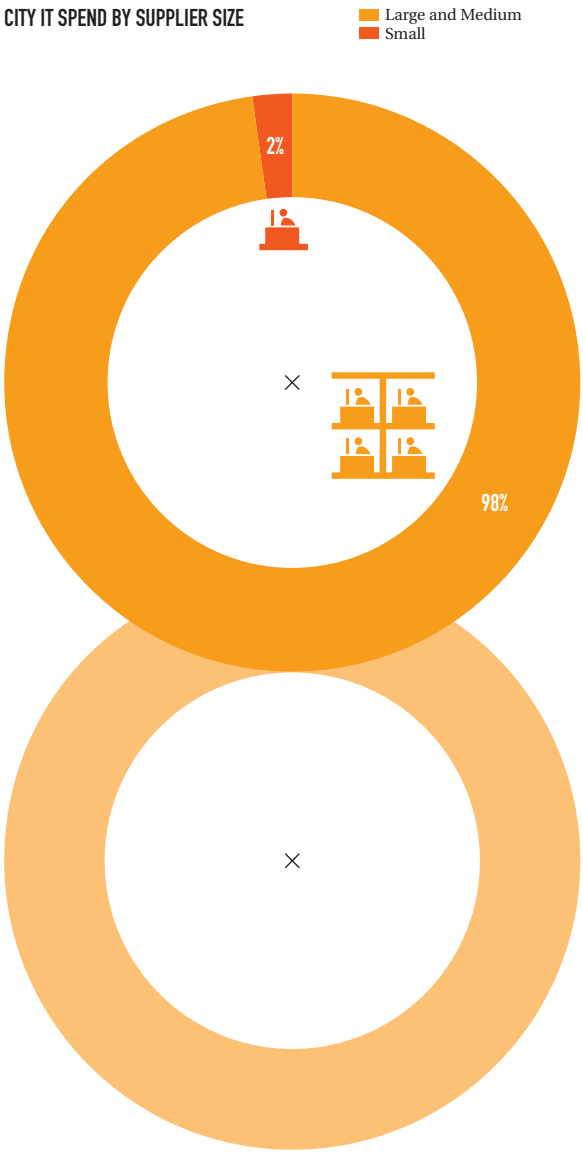
**Cities will spend more on technology just as we are spending more on our personal IT – yet it is not something we closely monitor**

# CITIES ARE ALREADY SPENDING

## THE OLIGOPOLY OF BIG IT SUPPLIERS

City governments in the U.K. tend to purchase their IT products and services from large businesses. Across the 8 city authorities in our analysis, middle and large businesses accounted for the majority of IT spending (98%) with small businesses only accounting for 2%.

CITY IT SPEND BY SUPPLIER SIZE




The U.K. government has often spoken about "breaking the oligopoly" of big businesses supplying government ICT by dividing contracts into smaller projects with less risk and opening the market to newer providers[28]. Our research shows that this government push has not yet altered the supplier base for city governments. As governments around the world focus on digitising their services, large global technology service providers are ramping up their digital government services offerings. The emphasis on using digital technology to improve the accessibility of government services and to increase interaction with citizens provides a market opportunity for smaller businesses, such as mobile application developers and cloud service providers, which may be missed by city governments due to their spending patterns.

The analysis of city IT spending in this chapter highlights the need for city governments to view IT spending as an investment across their organisations rather than as an embedded cost within their departments. The fragmented spending data gathered across eight U.K. city governments shows the value that a strategic city IT department could play in providing clarity of spend across departments and identifying synergies in IT investment internally and externally with other cities.

## CITIES

Bristol City Council
Coventry City Council
Leeds City Council
Leicester City Council
Liverpool City Council
Manchester City Council
Portsmouth City Council
Sheffield City Council

Source: Analysis of public spending data from eight city councils for last three years (April 2011 to March 2014) by Spend Network. Breakdown by supplier size is an average across the 8 cities and three years.

# 3

# TAKING SMART STEPS

Chapters 1 and 2 have explored the reasons why city governments should be considering the impact of smart technologies strategically across their departmental functions. It has shown how smart city capabilities are being driven by both external pressures and internal opportunities for development, which is shaping governance priorities and capabilities. But chapter 2 has also shown us that ICT expenditure is already a significant in cities, and that there is an opportunity to maximise this benefit. The smart city concept is relevant to all modern cities, and that in fact cities who choose not to address these issues face greater risks than those who do.

However, there is no single blueprint for smart city action; no universally relevant way for a city governments to invest. It would not be possible, or even desirable to create a standard smart Ccity model and expect it to perform well universally. As Madner et al explain:

> "the fact that every city is entirely unique precludes a 'one size fits all' approach. Elements of a smart city concept often cannot be taken out of the context in which they worked well and transplanted into a different environment."[29]

Instead, city governments must formulate bespoke plans and priorities for investment that are appropriate in addressing their unique aspirations as a city. This requires a strategic view on the role of ICT within the council and more broadly, as well as a realistic and practical understanding of implementation and development.

But in this complex landscape where should a city government start?

This section explores eight case study cities that have been globally recognised as taking effective action in this area: Barcelona, Boston, Bristol, Chicago, Hong Kong, London, Rio de Janeiro and Stockholm. Drawing out the commonalities of challenges and opportunities in these exemplar cases creates strategic lessons that other cities interested in investing in Smart might be able to learn from.

The analysis has found 7 interconnected principles for smart city action:

- CLARIFY THE OPPORTUNITY
- TAKE OWNERSHIP
- ENGAGE
- PREPARE
- ACT
- CHECK & REFLECT
- REPEAT & SHARE LEARNING

# RIGHT TO THE SMART CITY

Governing Cities in the Digital Age

ARUP | LIVEABLE CITIES | UCL STEaPP

7 PRINCIPLES

# 7 PRINCIPLES

## RIGHT TO THE SMART CITY

Governing Cities in the Digital Age

## TAKE OWNERSHIP

### ACTIONS

CREATE A VISION
- Create a vision and strategy around how smart city technologies and programmes will deliver key city objectives. This should be created in partnership across the council as well as with the broader urban ecosystem.

GAIN POLITICAL MANDATE
- If there is an aspiration for transformational change, ensure political buy-in, endorsement and leadership.

IDENTIFY GOVERNANCE STRUCTURE
- Identify and implement appropriate organisational change that may enable innovation in public services. This might include a 'digital champion', director of futures, Chief Innovation or Technology Officer, a new department, or a more embedded approach.

## CLARIFY THE OPPORTUNITY

### ACTIONS

UNDERSTAND DRIVERS OF CHANGE
- Understand strengths, weakness, opportunities and threats for your city;
- Baseline current activity and projects;
- Map the digital ecosystem – government, academia, SMEs, civic organisations involved in 'smart city' activity.

UNDERSTAND THE VALUE PROPOSITION
- Understand overall short term and long term value (and limits to value) to both civil and political aspirations.

## ENGAGE

### ACTIONS

ENGAGE WITH CITY DEPARTMENTS
- Create mechanisms to engage effectively with council departments. This might be through providing funding opportunities, collaboratively bidding for funding, providing advice and support, or convening workshops to explore joint aspirations and complimentary capabilities.

ENGAGE WITH CITY STAKEHOLDERS
- Understand the capabilities and roles of the wider ecosystem of city stakeholders;
- Develop mechanisms to support the ecosystem. This might be through smart city boards, partnerships, consultation or conferences.

## PREPARE

### ACTIONS

PROCUREMENT
- Understand how procurement procedures affect the city's ability to procure from a diverse range of suppliers;
- Develop appropriate procurement approaches that enable innovation such as pre-commercial models or through early engagement with the community of suppliers.

FINANCING
- Develop a range of financing options that reflect the vision, strategy and organisational structure of the council. These might include PPPs, partnerships for innovation, internal investment, grant/ external funding, or direct or embedded budgets.

HUMAN CAPITAL
- Re-skill and train council employees to understand the technical and strategic implications of ICT and smart technology programme investment for the city.

## CHECK & REFLECT

### ACTIONS

MEASUREMENT
- Create measurement regimes and processes to embed reflection into the operational and strategic planning in the city;
- Understand appropriate mix of quantitative and qualitative measures that deliver desired insights.

PARTNERSHIPS
- Create partnerships with institutions that specialise in understanding social and economic impact of complex programmes (such as universities).

## ACT

### ACTIONS

INVEST IN PROJECTS & PROGRAMMES
- Collaborate with local stakeholders to deliver sustainable and appropriate projects and programmes;
- Understand the varied scale and scope of project potential projects and where they sit in the authority.

INVEST IN LONGER TERM POLICY & GOVERNANCE CAPABILITIES
- Invest in training and organisational change programmes to support longer term capacity to direct smart city investment.

## REPEAT & SHARE LEARNING

### ACTIONS

CONTINUOUS PROCESS
- Share learning consistently within the council in order to feed into future strategy processes and programmes of work.

SHARE LEARNING
- With wider city stakeholders through reporting. This helps to fulfil accountability and transparency requirements as well as enabling stakeholders to respond by evolving capabilities accordingly;
- With other cities through networks of cities such as the C40 or through partnerships like MONUM.

# CLARIFY THE OPPORTUNITY

## UNDERSTAND DRIVERS OF CHANGE / IDENTIFY VALUE PROPOSITION

As described in chapter 1, the benefits of smart technology are wide ranging – from civic empowerment, to economic development to infrastructure upgrades. Each city will have different priorities and aspirations for the role of smart technologies in their cities, which will be responding to varying political, social and economic drivers. To guide investments in smart technology, cities need to understand the drivers of change in their own cities and the role that ICT can play in responding to these challenges and opportunities.

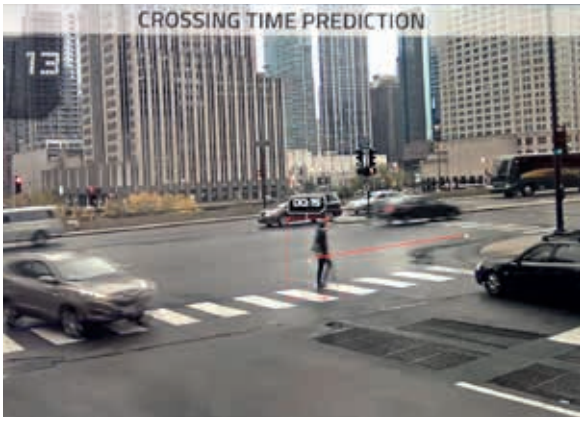
For example, Stockholm's investments have been driven around the digital economy. Stockholm has a history of telecommunications innovation dating back beyond a century, which has been particularly driven by domestic companies like Ericsson. Maintaining and developing this economy was therefore a significant driver for Stockholm to invest in state-of-the-art telecommunications infrastructure and service capabilities.

Rio de Janeiro's smart investment priorities have been focused on enhancing the city's capability to respond to natural disasters while promoting the city as a safe and attractive place to visit and invest. Rio City Council saw an opportunity to jumpstart technology investment and showcase Rio as a modern, vibrant and global destination as part of the world-wide attention they were getting ahead of the football World Cup and the Olympics. In Chicago, the four core drivers for smart city projects were transparency, accountability, analytical capability and economic development.

**Economic development was a significant driver for @CityofSthlm to invest in state of the art telecommunications infrastructure**

# TAKING SMART STEPS

The Smart Cities movement in Barcelona is growing rapidly and has evolved from previous movements such as 'digital cities' of ten years ago. In Barcelona, the city believes that investment in the smart city will enable sustainability and also work towards fostering citizen participation, mobility and other fields. The city describes this as a 'transversal approach'. As such, the Barcelona Smart City strategy places technology as an enabler for a range of desirable outcomes including environmental sustainability, business friendliness and the capability to attract capital, social cohesion, transparency and democratic culture.




In @ChicagoCTO the four drivers for #SmartCity projects where transparency, accountability, analytical capability and economic development

## ACTIONS

### UNDERSTAND DRIVERS OF CHANGE

- Understand strengths, weakness, opportunities and threats for your city;
- Baseline current activity and projects;
- Map the digital ecosystem – government, academia, SMEs, civic organisations involved in 'smart city' activity.

### UNDERSTAND THE VALUE PROPOSITION

- Understand overall short term and long term value (and limits to value) to both civil and political aspirations.

# TAKE OWNERSHIP

## CREATE A VISION

Cities hoping to drive long-term commitment based around Smart City principles should translate their understanding of the drivers of change and understanding of the value proposition into a compelling vision. This vision might be integrated into the existing local strategy or it might be a stand-alone vision that articulates the role and trajectory of digital technology in the city.

This vision serves to lay out the purpose, remit and expectations for investment in this area simply and clearly, and can be used to structure both investment decisions and governance structures. This vision also acts as a commitment to citizens to which the council may be held accountable, and provides some level of security to local businesses who might be considering developing capabilities in this area.

An overarching vision might also help to mitigate the traditional low success rate of government ICT projects by understanding how ICT investment might be effectively leveraged across the council. As Kanter and Litow explain, "Governance structures must create a clear vision and strategy for the city. While technology can be the spur or spark, it cannot solve problems without a vision and commitment for new ways of working together in communities."[30]

Overarching visions can also be used as an opportunity for innovation and differentiation in the global smart city marketplace. For example, New York's 'Digital Roadmap' not only communicated the strategy to local stakeholders, but also articulated a global message that they were a leading global city for smart city investments. The targets set out in the report also allowed them to continue to report on progress in the following years, maintaining global attention.


**Visions lay out the purpose for investment simply and clearly, and help structure both investment decisions and governance structures**

# TAKING SMART STEPS

One of the early steps in the development of London's strategy was to create a vision document which was used to steer the direction of the Smart London Board. In Bristol, the vision and strategy for the smart city investment was aligned to the existing Bristol 20:20 Plan, which is the sustainability strategy for the City.

A new, compelling vision for smart city capabilities was not always derived at the outset in the case study cities. In Barcelona, for example, existing city investment projects were instead brought together under one vision. For Barcelona, the development of a smart city strategy was to align existing investments into a coherent structure for their activities. Most cities will not be starting from scratch, and therefore will need to employ a combination aligning existing investments under a strategic plan with creating a new vision and investment initiatives.


Overarching visions can also be used as an opportunity for innovation and differentiation in the global smart city marketplace

The city of Stockholm adopted a vision in 2007 that detailed the core priorities to achieve by 2030. A cornerstone of this strategy was to become a more citizen-focused city, and thus they developed the e-service programme as a response. Staffan Ingvarsson, Vice CEO of Stockholm, explained the importance of a vision for smart cities:

> "Driving the vision around smart is at least as important as delivering the infrastructure, because if we are very clear that we want to create this it helps a lot, because the other stakeholders then adapt to that. If the political statement is clear and firm, then it will work."

In 1998, Hong Kong identified that ICT investment had the potential to create positive economic impacts. However, they were also aware that driving change in this area would bring about new challenges. In response to this they developed the Digital 21 Strategy as the blueprint for Hong Kong's ICT development.

For @barcelonasmartc, the development of a #smartcity strategy was to align existing investments and create a more coherent structure

For Bristol, developing a compelling, cross-disciplinary vision around technology innovation has been fundamental. The council's Future City Manager explains that this brings a dynamism and optimism to the initiative and supports the development of a highly effective team:

> "I think we've got fantastic leadership – especially from Stephen Hilton (the Director) – it's his vision. I think also because that vision is really interesting and energising it's drawn out the right individuals to work on it."

Roderic Yates (Mobility Leader, IBM) adds to this, saying that the clarity of the vision has taken the Council in the right direction and has helped them to avoid some of the traditional pitfalls of technology investment:

> "Bristol is ahead because they have really understood that the work on smart cities is about the outcomes the technologies can support – the technology is not the thing! Bristol understands that you only invest in technology for a purpose (social economic, environmental etc.) not because you want something shiny."

Futhermore, setting out an explicit vision that was linked to the political objectives of the city in the 20:20 Plan was central to allowing the council to direct resources to Connecting Bristol.

## GAIN POLITICAL MANDATE

In the cities studied, political endorsement has been a key success factor when investing in any significant programme of smart city work. For example, Chicago had been lagging behind other cities in its smart programme investments before the election of Mayor Emanuel in 2011. Since this appointment, strong political leadership and well-aligned governance structures have allowed the city to take great strides towards achieving their goals.

On arrival in Chicago's municipal offices, Mayor Emanuel brought a strong mandate for ICT and smart city investment with him. He had a very clear understanding of the role of technology and data in transforming a city, and prepared the digital agenda very clearly from the beginning. John Tolva (Chicago's then CTO) explains:

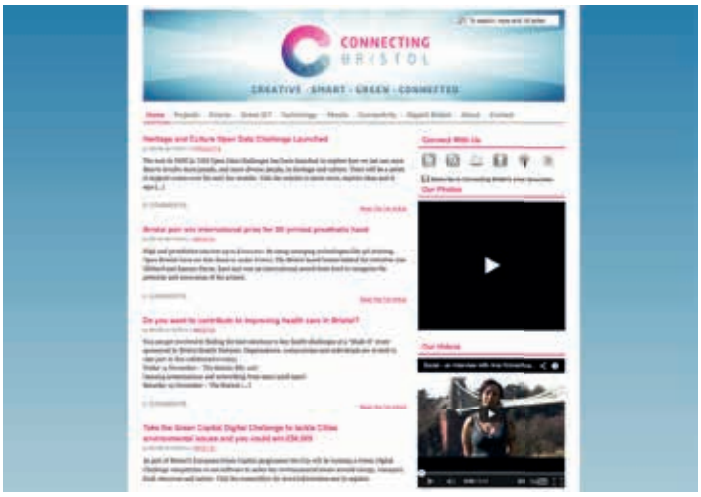
> "At that point (Mayor Emanuel's election) we were a little behind our peer cities. The previous administration had no open data policy. There was a pent-up demand so that when Mayor Emanuel came along the floodgates opened. I believe there was more attention paid to it than if it had steadily built up over time like New York and Boston."

# TAKING SMART STEPS

When the Mayor of Barcelona was elected in 2011, one of the earliest commitments was in investment in digital innovation and entrepreneurship through investment in smart cities, as outlined by Mayor Xavier Trias[38]:

> "We should not waste the opportunity we have to apply these new technologies to improving people's quality of life, by generating a new 'economy of urban innovation' based around smart cities. This is another of our future commitments."

Political endorsement and encouragement is key if a city wishes to drive transformative change around ICT and digital services in their city. Without this endorsement, change can only be incremental as the vision and resources to implement it are lacking. Furthermore, a political mandate for action from an elected official gives legitimacy for the transformation required.




In the early days, Connecting Bristol (the council's digital partnership) had strong political support from the leader of the council, Barbara Janke. This gave them security in their decision-making and credibility within the council, as well as a certain amount of freedom in the programmes they chose to operate. In Bristol, the political leadership had a willingness to innovate and experiment, which was an essential part of the group's success.

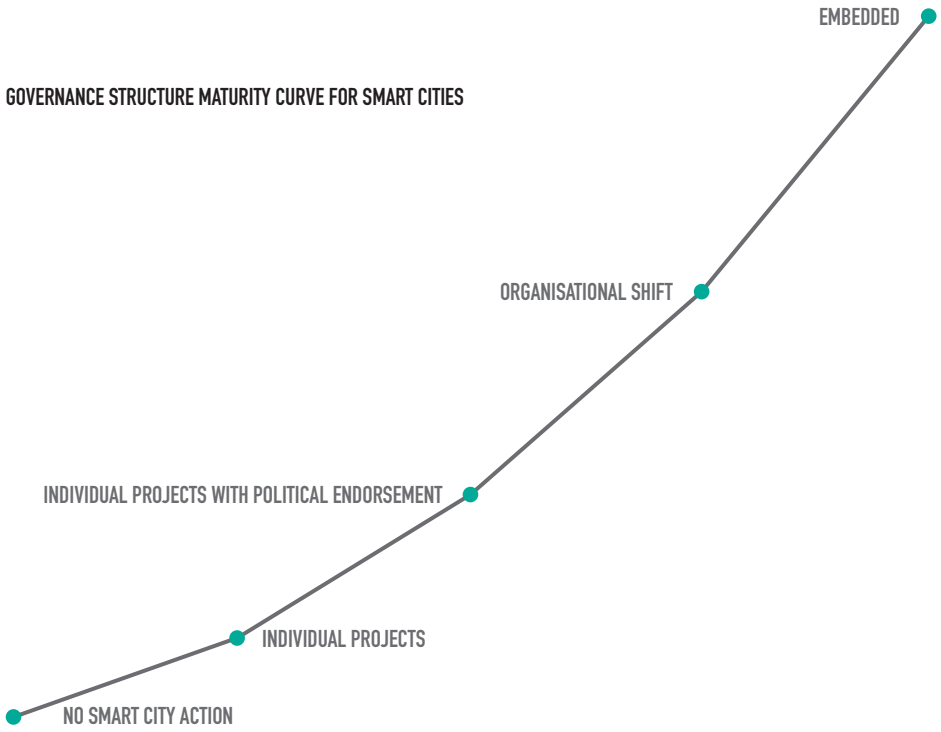
Later, as the first Mayor of Bristol was elected in 2012, he was able to continue to drive the smart city agenda in a local and national scale and enhance its profile in the political agenda.

**Political endorsement and ownership is key if a city wishes to drive transformative change around ICT and digital services in their city**

## IDENTIFY GOVERNANCE STRUCTURE

It is unlikely that any one city will choose to completely rearrange their governance structure around smart city technologies and services. However, it is clear that effective strategies must have a clear and reasonable place within the government organisation and a plan for how it should be implemented and executed.

This research has identified five levels of maturity in governance structure with respect to ICT within local councils, which is broadly correlated to how embedded smart concepts and actions are across the council. These maturity stages tend to reflect the level of interest and political support the city has for smart city investment, as well as their understanding of the value of smart cities for them. This is not to say that all cities should be aiming for a particular level of maturity, or that one level of maturity is universally any better than another. Instead, cities should recognise that the structure they select will impact their ability to achieve their aspirations, and as such, the governance structures (or level of maturity) adopted by the council should reflect their expectations.



# TAKING SMART STEPS

### No Smart City action

While cities may be aware of the smart city concept, they have taken no explicit action towards implementation. They may have rebranded existing projects as 'smart city' work, but this is largely for marketing and positioning purposes rather than being representative of a change of approach.

### Individual Projects

These cities have made use of grants or other financing mechanisms to begin to explore smart city projects – generally in projects siloed in a singular department. These projects are used as pilots of new technology and are generally focused on incremental change of a specific city council sector (e.g. transport or energy specific solutions).

### Individual Projects with Political Endorsement

In some cities, the political leadership has endorsed and compelled action towards smart city investment. This endorsement has supported civic managers in seeking funding for smart city programmes and schemes. The result has been that civic managers are able to pursue funding options more freely and invest in a wider range of programmes and technologies. They are also freer to develop new partnerships with city stakeholders.

Positioning the city as a test-bed for new technology is a model that Boston has used repeatedly. In these cases, the city's offer to innovators is deep access to how the city works, to back-end systems, and high-quality feedback as to how systems are working.

### Organisational Shift

These cities have created functional departments within the city specifically to address ICT innovation. These departments are often funded by a variety of mechanisms and are able to act outside the everyday functioning of the city. This affords these groups the opportunities to accept higher levels of risk and test innovative approaches to urban technology. They are also able to work within and manage complex systems of stakeholders and interested parties. For example, Boston's model of the Mayor's Office of New Urban Mechanics, The Smart Chicago Collaborative and Bristol's 'Connecting Bristol' group all adopted this role.

An important caveat to this stage is that, while creating these departments can deliver a significant increase in capacity, and their position as arms-length government entities gives them a certain freedom, it also makes them vulnerable to political turbulence. It is relatively easy for new political leadership to eliminate them as a 'line on the budget' – especially during times of austerity.

**Political endorsement and ownership is key if a city wishes to drive transformative change around ICT and digital services in their city**

## MONUM

In Boston, the Mayors Office of New Urban Mechanics (MONUM) is a group within the council that "pilots experiments that offer the potential to improve radically the quality of city services",[39] and is a civic innovation incubator and R&D lab. It focuses on enabling connections between government, citizens and social entrepreneurs to innovate service delivery in the city, enabling partnerships between people inside and outside of government to tackle city challenges.

MONUM was set up by Mayor Menino in response to the challenge of being able to innovate within the public sector. MONUM is trying to instil a culture of innovation within the city and promote civic innovators within government. Nigel Jacob, Co-Chair, Mayor's Office of New Urban Mechanics explains that, like many cities, there is an ingrained culture of risk-aversion and that MONUM de-risks projects by taking them out of the responsibility of the specific department, giving them 'permission to fail'. MONUM has attracted significant grant funding from private organisations which effectively acts as what Mr. Jacob describes as 'a pool of risk-capital' that can fund projects deemed too risky to spend public money on.

MONUM is focused on delivering value to citizens through acting as an interface between government and the public. Mr. Jacob explains:

> "We developed an approach that is about active experimentation in what we call the 'civic engagement space', how people are able to get involved in civic life generally and with their government."

## THE SMART CHICAGO COLLABORATIVE

The Smart Chicago Collaborative is a partnership between the city council, the MacArthur Foundation (one of America's largest philanthropic foundations) and the Chicago Community Trust. It is a civic organization that focuses on using technology to improve quality of life in the city. The Collaborative "was born in the conversations of the early to mid-2000s around closing the digital divide. As the Internet became an essential tool for citizenship and a central place for people to gather, it became clear that uneven access to the internet was a problem to be solved".[33] Mr Tolva, the previous CTO explains:

> "The Smart Chicago Collaborative has been vital; it really helps us to be a lot more nimble than we could otherwise be. They give grants on our behalf and they really are the engine behind what is a pretty broad community of interested developers. They host meet-ups, and I know that sounds soft, but actually the social work that goes into a policy of smarter cities is really important. There is a momentum that sustains beyond the government. You can't have the Mayor's office constantly trying to drum up interest; it's got to come from its own momentum. Smart Chicago is one of those ways of fostering that. It would be very difficult to do the work we do without a function like that. This is an organisation that is specifically focused on digital literacy and government efficiency and it really is proof that this outside-in approach to smart cities works in Chicago."

# TAKING SMART STEPS

## CONNECTING BRISTOL

Connecting Bristol was set up as Bristol city council's Digital Partnership. Originally it was an arm's length group within the council tasked with innovating around the use of technology and digital media. The Director of Bristol Futures, Stephen Hilton, who led Connecting Bristol describes this arm's-length relationship with the council as a 'huge advantage', explaining that:

> "We therefore had the ability to do projects and programmes without some of the complications that can be associated with a large public sector organisation."

The Future City Manager adds that:

> "We didn't have any particular oversight and we didn't have any budget holder to answer to, so it did give us that flexibility and opportunity to be a bit more creative about the way we did things. But there was also the requirement to produce significant results in order to cement our status with the main council body."

The flexibility of this group enabled Connecting Bristol to assume an innovation role within the Council, allowing them to be more creative about funding models and take on non-traditional projects. Stephen Hilton explains:

> "We were responsible for bringing forward innovative ideas and trialling and improving new ways of doing things which might in the future have mainstream traction with people who are delivering those services 24hrs a day. So it's sort of like having an innovation role within local government. It is all about having space. Part of the difficulty nowadays is that the funding constraints are real within local government, so it's hard to create space for people just to try things."

## Embedded organisationally with political and civil authority for action across departments

These are cities with smart city principles articulated as a core strategic priority and whose organisational structure is such that the CIO has executive authority to work in an integrated way across city departments, representing the top tier of the ICT governance maturity curve. This approach requires heavy investment from the council, as well as a comprehensive understanding and relationships with the ecosystem of stakeholders. Bristol successfully transitioned its ICT capabilities from a separate department to becoming embedded centrally in the council. This change was accelerated when the department began to receive significant funding from the council budget.

On his arrival in Chicago, Mayor Emanuel created two new positions to focus specifically on the role of technology and ICT in the city. The first was the Chief Technology Officer, a policy level position to advise the Mayor on strategic technology matters, which was originally held by John Tolva. Mr Tolva, who had previously worked for IBM, had an understanding of the philosophy behind how city optimisation can result in a more efficiently managed city. The second position appointed was a Chief Data Officer (CDO), held by Brett Goldstein, who had previously set up the predictive analytics group in the Chicago Police Department. Situating these positions in the Mayor's Office has facilitated the process of working with different city departments. This is because they sit directly under the Mayor's mandate, rather than within a departmental silo.

Stockholm's responsibility for ICT investment sits in the Chief Executive Office and has received more than €70million funding to support the programme. Following this, the management level of the organisation was able to take full ownership of the initiative and propel it forward. The strategic mandate gave other departments in the city the flexibility and freedom to act without needing to take all the decisions up to the political level. They simply had to report on their progress against the vision and goals in the integrated management system in the yearly budget. A key pre-requisite for getting money from the programme budget was that it would create greater value for citizens, Mr Ingvarsson, vice CEO of the city of Stockholm explains:

> "That was a way for us at the executive office to make it happen across the organisation without doing everything ourselves. We set up a framework and we put the money into it to make it happen."

When the Connecting Bristol programme became more established, it was given more significant funding from the Council through the 20:20 plan, Bristol's sustainability strategy. This meant that the work became more mainstream part of the city council. The Bristol Futures Group was consequently established, which was centrally embedded within the council. The Director of Bristol Futures, Stephen Hilton explains:

> "The decision to link our work on sustainability, economy and digital and our European/international work in one department under the stewardship of a Director post was really taking that mainstream to the full, by making what we do part of the organisational structure."

# TAKING SMART STEPS

The new Centre of Operations in Rio de Janeiro houses representatives from over 30 different departments at any one time. This has required significant organisational change from the previously siloed city departments. The technology has helped with the coordination of this, but as Mr. Rosa explains:

> "This is more than just the screens in the situation room; it's a significant organisational shift and a degree of professionalism for us. It's actually a whole change of mindset in terms of how you plan and how you deal with public management in general."

The Centre of Operations is a manifestation of a considerable cultural change for the city as an organisation. In that sense, the Centre of Operations is as much about supporting strategic organisational change as it is about the ability to optimise the Smart City disaster response.

## ACTIONS

### CREATE A VISION

- Create a vision and strategy around how smart city technologies and programmes will deliver key city objectives. This should be created in partnership across the council as well as with the broader urban ecosystem.

### GAIN POLITICAL MANDATE

- If there is an aspiration for transformational change, ensure political buy-in, endorsement and leadership.

### IDENTIFY GOVERNANCE STRUCTURE

- Identify and implement appropriate organisational change that may enable innovation in public services. This might include a 'digital champion', director of futures, Chief Innovation or Technology Officer, a new department, or a more embedded approach.

# ENGAGE

Effective engagement within and between city departments, as well as the broader city ecosystem of stakeholders in the city, has been the hallmark of successful smart city schemes to date. This engagement helps councils to understand their role in the ecosystem of smart city actors, giving them insight into how best to facilitate the ecosystem.

A mixture of stakeholder engagement approaches were witnessed in the cities studied. In Bristol, the Connecting Bristol programme was able to use engagement to understand the bottom-up activity happening in the city. An existing culture of openness supported effective two-way dialogue, whilst being an organisation at arms-length from the council meant they were able to bypass public mistrust that people associate with government. Furthermore, a secondment of the department to the Watershed (a digital creativity centre) supported informal engagement with the community of stakeholders. Later, when the group began to formalise a strategy through this research, the council already had an understanding of the appropriate people to invite to the steering committee. This also meant they had established so much trust and mutual understanding that these stakeholders were willing to volunteer a significant portion of their time towards the cause. In London, the Smart London Board (SLB) was convened as a mechanism for stakeholder engagement and to leverage the value of a broad range of city actors. However, the GLA acknowledged that further engagement beyond the SLB would be required if it was to be truly representative of the entire city.


Most other cities studied also adopted this open culture for stakeholder engagement, placing central importance on developing personal relationships and building trust. This is particularly true in Boston, where MONUM is an obvious point of contact, or platform, for stakeholders interested in this field.

**Effective engagement within the council and the broader city ecosystem has been the hallmark of successful #smartcity schemes to date**

# TAKING SMART STEPS

Stockholm City Council also operates through structured dialogue between citizens and private companies; citizens are asked what services they would like the city to provide, and private companies are also given space to interact with the council. For the smart cities market, Stockholm finds good two-way communication with private stakeholders especially important. For example, Mr. Ingvarsson (vice CEO of Stockholm) hosted a conference for all the ICT deliverers in the city to present their products and service offerings. This was also an opportunity for the city to present their priorities and strategic direction. Mr. Ingvarsson explains:

> "The aim was to create some common ground, to tell people this is where we are, where we are going and to get all the good knowledge from the private companies – many of whom have their own R&D departments. Having that dialogue all the time is very important."

Another key role that the city plays in facilitating the market is to act as a mediator between the universities and industry. The city is able to create a platform where they can meet and test new ideas.

City councils must also engage effectively within their own organisation. One way of achieving this is to offer incentives. In Stockholm a €70 million central pot of money was used as an opportunity for city departments to pitch their smart city ideas to the central budget holder. This ensures that smart city investment is aligned both to the needs of the smart city vision owner and the more operational departments in the council.

In Boston, Mayor Menino's emphasis was citizen-centric. He focused on the quality of service delivery to the residents of Boston, the sense of safety that people have in their communities and the sense of trust people have in their school system, as opposed to a business objective. That was a very clear message set out by the Mayor and it drives the decisions made at MONUM.

The structure and organisational culture set out by the Mayor and MONUM encourages and facilitates entrepreneurial actions both inside and outside government. They achieve this by focusing on what they call the 'civic innovators'; people that are trying to tackle issues within their communities. Mr. Jacob explains:

> "We are increasingly finding that there are people who are interested in finding solutions themselves and operating as social entrepreneurs – and Boston has a thriving social entrepreneurial community. More and more of those people are realising that government needs to be part of the solution."

In this way, the city leaders in Boston are focused on facilitating a group of entrepreneurs from inside and outside government to work together to achieve their goals.

# ACTIONS

## ENGAGE WITH CITY DEPARTMENTS

- Create mechanisms to engage effectively with council departments. This might be through providing funding opportunities, collaboratively bidding for funding, providing advice and support, or convening workshops to explore joint aspirations and complimentary capabilities.

## ENGAGE WITH CITY STAKEHOLDERS

- Understand the capabilities and roles of the wider ecosystem of city stakeholders;
- Develop mechanisms to support the ecosystem. This might be through smart city boards, partnerships, consultation or conferences.

# PREPARE

There are many challenges that a city council must prepare for in order reap the benefits of smart city investments. These include directing procurement processes and procedures, financing models and investing in human capital.

## PROCUREMENT

Procurement procedures can often stifle innovation capabilities in cities and restrict small companies from working with city councils. According to The Climate Group, procurement cycles for cities can take up to 3 years from initiation to sale, which can prevent innovative, under-resourced companies from participating in smart city development opportunities[31]. This can be overcome by a reassessment of the procurement guidelines and by proactively supporting small companies through the tendering process.

Stockholm, for example, is required by Swedish and European law to undertake standard procurement procedures. However, the council believes that by having a good dialogue with the community of providers, they are able to understand what kinds of projects and programmes they can tender. To promote innovation, the city has also launched Sweden's first pre-commercial procurement with the Swedish Transport Authority concerning new smart traffic solutions. Instead of procuring for a specific solution, they have advertised the problem, with the aim of getting different companies and organisations to formulate solutions. This is an open competition and encourages innovative and creative approaches to problem solving.

In Rio de Janeiro, the new administration made a very strong fiscal re-alignment in the first two years of government. The previous budget was not seen as sustainable and the city was unable to meet its operational needs. As such, the first fiscal action was to cut all spending in the city by 20% and to re-negotiate all City contracts. Mr. Rosa (special advisor to the mayor) claims that this re-focusing was a key enabler for developing new, more effective ways of operating the city and incorporating new smart city technologies.

Bristol combats bureaucratic hurdles by offering free training to SMEs on local government procurement procedures and requirements. The Head of Product Development at Clean Energy Prospector Ltd, an SME in Bristol explains:

> "There was a procurement day for small companies a few months ago. That's the right sort of initiative that's really useful and specifically designed to help smaller companies and engage, so it's a really good initiative".

**Procurement can take up to 3 years which can prevent innovative but underresourced companies from participating in #smartcity programmes**

## FINANCING

City councils developing smart technology programmes have leveraged a variety of funding mechanisms. Different funding models enable different outcomes and can be 'mixed and matched' by city departments to tailor their programmes of work. The key funding models that have emerged from this research include:

### Public Private Partnerships (PPPs)

Many cities have used a PPP models for a variety of means. These models enable large-scale redevelopment of a city region without being fully funded by public money. For the most part, council-owned land is leased to developers with a set of legal guidelines about the use and purpose of the land. This enables the council to have a certain control over the type of space created whilst allowing private companies to develop the area for a return.

In Rio, 35% of the investment managed by the municipal government is from private investors and PPPs are being newly exploited in Rio to manage these investments. Rio now has the three largest PPPs in Brazil, including the port renovation area, a $4 billion PPP. Previously legislation had prevented private investment in the area, so policy mechanisms and urban regulations were introduced to ensure that private investment could support local development. Rio sees PPPs as capable of delivering virtuous schemes where the contractors are paying extra for the construction rights and contributing to regenerating the area.

The Olympic Park is also being built using private money; contractors will build the Olympic buildings, which they will own and sell to the market. The city has therefore been able to concentrate public money on public spaces, infrastructure and facilities like transportation. Additionally, the Centre of Operations in Rio was a PPP with IBM, which invested a significant proportion of the finance to showcase the concept. The city now has a service contract with the company for support of the system.


### Partnerships for innovation

Other cities have used partnerships in a different way by working with local SMEs to test and trial products and services. The Connecting Bristol programme partnered with small companies by adopting their innovative solutions and providing feedback on its use and functionality. This partnership helped to produce proof of concept for the innovative service as well as supporting both product development and marketing. Other city councils like Boston have provided direct seed capital to support the development of innovative projects. In this way, relatively small pots of money can be used as 'innovation capital' to de-risk investment in new products and services.

**Small pots of money can be used as 'innovation capital' to de-risk investment in new products and services**

# TAKING SMART STEPS

### Citizens connect

In Boston in 2008/09 there was a need to improve channels of communication for citizens to report to government. At the time there was no off the shelf solution that the city could buy. MONUM approached a local start-up (Connected Bits) and proposed the opportunity to provide lightweight tools for governments to collaborate better with citizens. If they were willing to do the technology development for below market costs, the city offered to be a test bed for the technology. They were able to develop the first version of the app for $25,000. Based on the success of the deployment in Boston, the company scaled it up and out to at least two-dozen American cities.

### Internal Investment

Some city councils have developed entirely new departments where personnel are funded to develop programmes, but are not given budgets for investment. This gives the department the flexibility to explore and investigate opportunities for the council outside the restraints of normal government operation and service management. It encourages city governments to become active participants in the ecosystem of stakeholders, and allows them to become a key player in connecting organisations across the city who have commons goals and complementary skills. However, these departments must find creative ways to fund smart city projects, which can put strains on their capabilities. This model is demonstrated through the Connecting Bristol programme, MONUM in Boston and the Smart Chicago Collaborative.

### Grant / External Funding

Many national and international (e.g. European Commission) authorities provide funding opportunities for cities to explore and invest in innovative smart technologies. These have included the FP7 projects, as well as the TSB funded Future Cities Demonstrator competition. These funding opportunities allow cities to roll out smart city projects at scale, to learn from them and to share their experiences with other cities. Other grant funding might come from large private funding bodies, such as the McArthur Foundation, which has supported investment programmes in Chicago.

### Direct budgets

In other cities, significant pots of funding have been made available from the council's central funding for smart city investment projects. For example, in Stockholm a €70 million central budget for ICT innovation was created specifically for smart city projects that could be accessed by all city departments that could develop a strong enough business case for a specific project. Mr. Ingvarsson explains:

> "The key success to this is that we didn't have to use the regular budget, we got money on the side so that we can really drive the innovation."

The €70 million investment was used as an upfront financer for technology that the city needed throughout the organisation. The city established guidelines and rules for optimising and using data and would fund appropriate projects across all departments. This meant that if proposal proved added value for the citizens of Stockholm through a cost-benefit analysis, it could be funded by this central pot. This took the pressure off tight budgets in individual departments.

## Embedded budgets

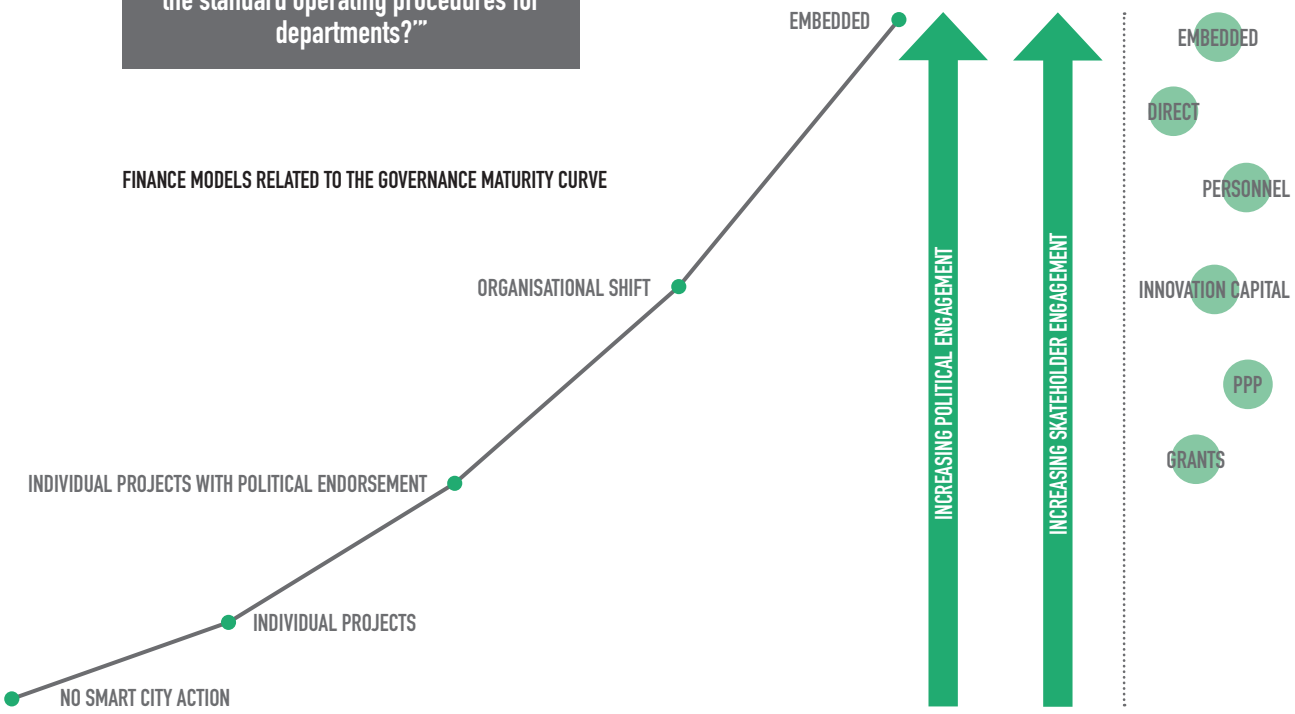
In other cities, smart city projects have been developed to the point where they are now funded by the operational budgets of council departments.

In Chicago, for example, the open data strategy is now part of individual budgets. Many of the longer-term roles are also funded through the council's central budget. Mr. Tolva explains that if funding for this work is to be sustainable there needs to be a strong cultural shift in the city council so that each department can capitalise on the opportunities. He says;

> "The open data strategy is now part of individual department budgets. They have had to budget for what is now required of them. So it's not that I am worried about the sustainability of external funding, the question becomes 'has this become institutionalised in a way that is the standard operating procedures for departments?'"

The investment models used to fund smart city programmes are related to the types of programmes (and therefore impact) that a city government can have. For example, PPPs are helpful with large infrastructure projects, whereas supporting innovation requires the availability of 'innovation capital'. Importantly, the finance models available to the city are directly related to their organisational structure. As cities progress up the governance structure maturity curve, they are able to manage a greater mix of funding mechanisms.

The governance structures adopted by the council will dictate the financing available to them, the types of projects they are able to invest in, the stakeholders they are able to engage with, and ultimately the value outcomes that they are able to achieve. As such, city authorities must be aware of the implications of their organisational structures on their ability to deliver the types of smart city value that they envision.



# TAKING SMART STEPS

## HUMAN CAPITAL

Gartner's 2014 CIO Survey reports that many government CIOs feel overwhelmed by the pace of technological change and do not feel equipped in terms workforce skills to meet all of the challenges they are facing.[32] Many of the cities studied have noted that a certain degree of re-skilling of city departments was required in order to make the necessary changes. They cite that investing in smart city programmes requires skills that are not historically associated with the technical capability of the ICT department, and that more strategically-minded and entrepreneurial characteristics are required.

In Chicago, a key challenge was in re-tooling the IT department in the city to be able to respond to these new types of challenges they were beginning to face with the open data movement. Previously, the IT department contracted development work, but now the city has a development and design resource and a director of data analytics. Boston attests that is essential to maintain this human capital to drive such work. Mr. Jacob explains:

> "The kind of work that we engage in requires people that can operate in this entrepreneurial mode. In a lot of ways it's a mindset to empower your workforce to become entrepreneurial and to resource them that way. A lot of our work is trying to promote these cultures of innovation. We need people that are willing to be creative and take some risks with our support."

# ACTIONS

## PROCUREMENT

- Understand how procurement procedures affect the city's ability to procure from a diverse range of suppliers;
- Develop appropriate procurement approaches that enable innovation such as pre-commercial models or through early engagement with the community of suppliers.

## FINANCING

- Develop a range of financing options that reflect the vision, strategy and organisational structure of the council. These might include PPPs, partnerships for innovation, internal investment, grant / external funding, or direct or embedded budgets.

## HUMAN CAPITAL

- Re-skill and train council employees to understand the technical and strategic implications of ICT and smart technology programme investment for the city.

# ACT

Once investment opportunities are understood and the political and civil structures are in place, cities can begin to implement their smart technology projects and programmes. This research has shown that the purpose, application and scale of many of these projects are as diverse as the technologies themselves. As such there is no single blueprint for approaching a smart city project or programme roll out.

Some projects like 'Hello Lamp Post' in Bristol are intended to encourage play in the city and increase citizen engagement with one another and their city infrastructure. Hello Lamp Post is an interactive system that gives everyone in Bristol a new tool to talk with each other, through prompts and questions – all facilitated by the city's physical infrastructure. By referencing the thousands of pre-existing identifier codes that label items of street furniture across the whole city, players can send text messages to particular objects, including (but not limited to) lamp posts, post boxes, bollards, manholes, bins, or telegraph poles. This fun project encourages citizens to look at the city with fresh eyes and engage with systems are often taken for granted.[30]

Other programmes are of a vastly different scale both in terms of investment size and legacy of impact. For example the London Borough of Croydon, which is undergoing major regeneration work over amounting to £3 billion of investment over the next five years, is planning to use a digital platform to capture and predict the impact of any changes within the regeneration programme.

The dashboard is intended to:

- Assist with the data capture of the 167 separate projects which make up this programme;
- Facilitate categorisation and integration of the project data avoiding unnecessary complication;
- Allow intuitive and easy interrogation, from which conclusions and recommendations could be made.[31]

Many cities are now collaborating with academia and industry to transform cities themselves into research labs – known as living labs. The European Network of Living Labs now cite the existence of over 200 living labs across the EU – a number that is rapidly growing.[32] One such Living Lab is situated in the 22@

**Many cities are now collaborating with academia and industry to transform cities themselves into research labs – known as living labs**

# TAKING SMART STEPS

innovation district in Barcelona. This lab consists of a partnership between public and private companies with the aim of developing innovation around digital services. This project is headed by 22@Barcelona in collaboration with Barcelona Digital Foundation.[33]

Taking action for smart cities does not always require investing in technology projects or programmes. Many cities are investing in their local community capabilities in through education programmes, hackathons and engagement activities. The Smart Chicago Collaborative, for example have collaborated with three local organisations (Mikva Challenge, which develops the next generation of civic leaders, activists, and policy-makers; Free Spirit Media, which provides education, access, and opportunity in media production; and Adler Planetarium, which has a mission to create experiences enabling youth participants to more effectively engage in science and technology communities) to deliver the #CivicSummer programme. This programme worked with 140 young people to explore digital tools and activism strategies to increase awareness and understanding of critical issues, develop digital and media creation skills, build youth-inspired policy solutions, and develop advocacy campaigns to seek resolution and change.

Cities are also investing internally to develop the longer term capability of the authority to deliver positive outcomes from smart technology. In Bristol this is being achieved through the investment in reskilling of council workers. More broadly we have seen investment in organisational change to support smart city programmes through the creation of new departments such as MONUM in Boston.

## ACTIONS

### INVEST IN PROJECTS & PROGRAMMES

- Collaborate with local stakeholders to deliver sustainable and appropriate projects and programmes;
- Understand the varied scale and scope of project potential projects and where they sit in the authority.

### INVEST IN LONGER TERM POLICY & GOVERNANCE CAPABILITIES

- Invest in training and organisational change programmes to support longer term capacity to direct smart city investment.

# CHECK & REFLECT

The progress and impact of smart city investment programmes should be reflected upon at various stages throughout its lifecycle. This should be undertaken from both an operational (project management) and strategic perspective in order for projects stay on target and realise their desired impact.

In Chicago, a key metric for the council is based around cost savings. For example, they saved $400,000 by moving to cloud-based productivity tools. Similarly, the WindyGrid application is intended to save money by enabling insight into how the city operates, informing longer-term policy decision-making. But quantifying these ingishts is a core challenge for Chicago. Nevertheless, measuring impact though metrics is not trivial, Mr. Tolva explains:

> "Right now, we have to take a common-sense approach to this, because the system isn't fully built out. There is more work that needs to be done and once it is I think we will be quantifying it – we're going to have to put numbers to it. I'm not worried about that, because if there is one thing that we have now more than ever it's data and that's a good thing. For example, we know what the baseline is for expenditure in various classes."

The city also plans to work with universities to help understand the impact of their work. The 'City that Networks' report outlines that the city plans to work with universities to "undertake statistically valid baseline surveys and track progress."[33]

However, this reflection should not be purely quantitative, but should incorporate a consideration on the softer and broader aspects of the programme's overall functioning and delivery. Critical reflection of this nature, carried out through focus groups and interviews, should be undertaken at all stages throughout the programme, including its potential feed into new project cycles.

In Rio, a Public Management Office (PMO) has been created to ensure they were making tangible steps to achieving their goals. This group monitors activities and has two main purposes:

- To monitor project progress (time and cost).
- To ensure that its projects have achieved the impact and citizen value targets. The PMO office investigates the real impact of investment on people's lives, rather than simply the physical outputs.

**Effective engagement within and between city departments as well as the broader city ecosystem of stakeholders in the city has been the hallmark of successful smart city schemes to date**

# TAKING SMART STEPS

One of the challenges in creating smart city investment metrics is that it takes time to create a system that is easy to use, transparent and understandable. As Rio employs 15,000 public sector staff, a core challenge is aligning all stakeholders in the same direction. Progress in this area takes clear leadership, cultural change and time.

In Stockholm, monitoring and evaluation are also integrated into the council's management systems. They require that the departments that have used funds from the e-services programme report how they have cut costs annually. Mr. Ingvarsson claims that "this gives them the credibility to keep doing what they are doing."

When evaluating projects in Boston, MONUM also endeavors to understand its broader impacts. A key challenge here is in understanding longer-term implications, because it is still a fairly young field. Importantly, the interconnected and complex nature of city investment means that causation is difficult to identify. The city has developed a collaboration with a local university (Emmerson College), called the Design for Actions Research in Government (DARG). The aim is to begin to understand this iterative model of innovation, how the city can learn from these experiments and how they can rigorously understand their broader impact or their work.

Bristol measures the success of their programmes through traditional indicators and reporting mechanisms. The Future City Coordinator explains that these are often tied to individual projects that are agreed with the funding body:

> "individual projects would have their own metrics depending on what angle they've got, so if they have an energy angle then they might have a metric around energy saving or carbon saving or it might be about engagement or – but across the piece in terms of if we have metrics to measure the success of the programme as a whole, we don't at the moment"


**Rio employs 15,000 public sector staff – making aligning all stakeholders a challenge. Progress takes leadership, cultural change and time**

When looking to develop more holistic measures of success for the programme, The Future City Manager believes that there will always be a challenge because of the nature of the work:

> "Metrics are necessarily a bit arbitrary because this is innovation work, there isn't anything to look back on and say how did they measure it? What was done in the past?"

Rodric Yates from IBM supports this, saying:

> "KPIs are really difficult to work with – it is difficult to get right to the point of what you mean with them. Do they really show what you think they show? We need to be able to use more qualitative measures, try to understand trends and what factors have instigated those trends."

However, they are exploring how they can better understand their impact, and see benchmarking with other cities and creating better economic models to be a way forward. Stephen Hilton explains how he would like to invest in this more in the future:

> "What I would like to see is that more of those are translated into economic terms… We still haven't quantified the economic opportunity – it's almost like we need a Stern review for smart cities, we need something that quantifies the economic value and potential of smart cities."

# ACTIONS

## MEASUREMENT

- Create measurement regimes and processes to embed reflection into the operational and strategic planning in the city;
- Understand appropriate mix of quantitative and qualitative measures that deliver desired insights.

## PARTNERSHIPS

- Create partnerships with institutions that specialise in understanding social and economic impact of complex programmes (such as universities).

# REPEAT & SHARE LEARNING

Outcomes of critical reflection should be fed into planning cycles for upcoming programmes in order to support continuous improvement and learning. As well as sharing lessons within the council, many councils are beginning to see the value of more open approaches. As discussed, some have collaborated with local stakeholders such as universities to understand their impact and develop new ways of improving future work and programmes. This way, city councils gain insights into how to better meet the needs of their community and focus in the most appropriate areas. This open approach also helps to fulfil the council's accountability and transparency requirements, as well as enabling stakeholders to respond by evolving capabilities accordingly.

In Bristol, a core element of their approach is to drive collaboration and openness. Stephen Hilton explains:

> "It is the persistence and openness around collaboration that is special about Bristol… the thing that carves us out is about being competitive but also being open to sharing in order to give and to learn from others."

Other councils have taken this a step further by formalising their relationships with other cities that might have previously been considered competitors. MONUM in Boston, for example, is actively encouraging other cities to adopt a similar capability in their administrations so that the experiences, networks of stakeholders and success stories might be replicated across cities. Philadelphia was the first of such city councils outside Boston to follow this approach, and now the two departments work very closely together. These partnerships and knowledge-sharing also raises the global profile of the city and publicises their activities. Cities that do this effectively are often perceived as the 'place to be' for smart city work and as such attract inward investment.

Barcelona has also taken strides in sharing their learning and showcasing their activities by hosting global smart city events such as the Smart City Expo World Congress, the World Bank's Sixth Urban Research and Knowledge Symposium on "Rethinking Cities: Framing the Future", and through international collaborations such as the City Protocol.

City networks are also an effective way for cities to share ideas, learning, and develop collaborations. These include networks like the C40 that brings together cities committed to climate action – this forum enables collaboration, knowledge sharing and drives meaningful, measurable and sustainable action on climate change[34].



# ACTIONS

## CONTINUOUS PROCESS

- Share learning consistently within the council in order to feed into future strategy processes and programmes of work.

## SHARE LEARNING

- With wider city stakeholders through reporting. This helps to fulfil accountability and transparency requirements as well as enabling stakeholders to respond by evolving capabilities accordingly;
- With other cities through networks of cities such as the C40 or through partnerships like MONUM.

# 7 PRINCIPLES

The seven principles in this chapter are presented not as a flowchart of actions or an exhaustive list, but as an indicator of the principal elements of successful investment in smart cities. In that sense, it is not expected that cities should follow the contents of this chapter as a linear methodology, but instead use the principles in informing their own approaches. This means, for example, that the principle of 'check and reflect' is an iterative process alongside other principles, and not a concluding practice. These principles are intended to provide city authorities with the opportunity to consider how smart city investments in their own municipality might be directed, anticipate hurdles they may confront, and offer some tangible actions they may take.

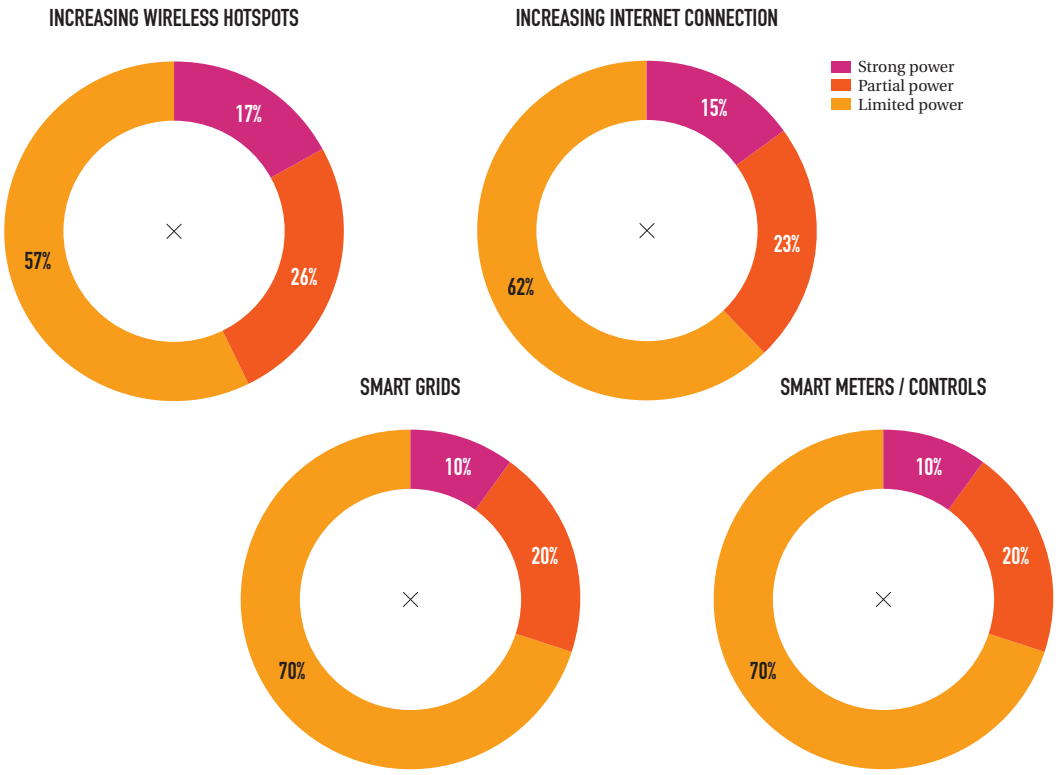
# 4

# SMART CITY ECOSYSTEMS

## PARTNERSHIPS & ECOSYSTEMS

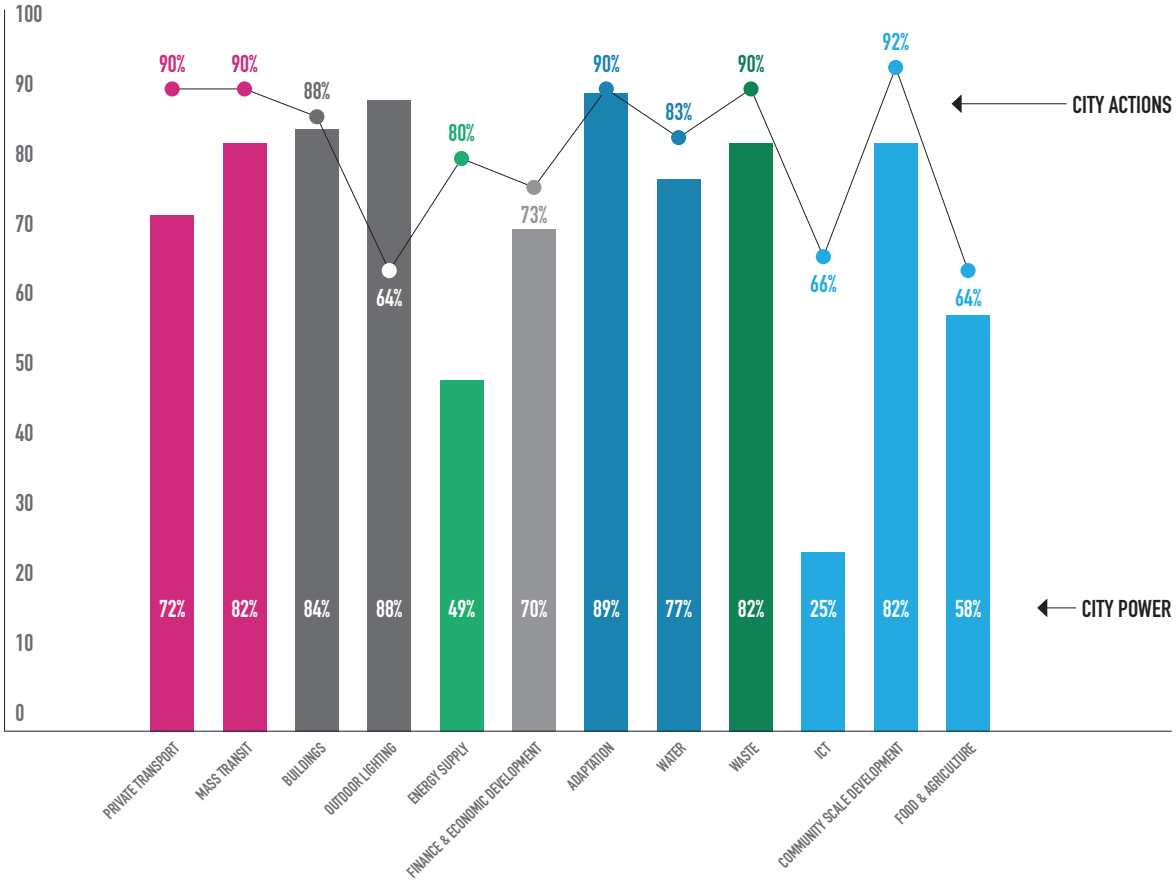
The previous chapters have explored the roles, responsibilities and capabilities of city councils to deliver progress on the smart city agenda. However the city government is not the sole actor in shaping, developing and delivering action for change based around smart technologies. In fact, there is a vast ecosystem of actors, each with differing priorities and capabilities that together shape the trajectory.

The latest Climate Action in Megacities report[35] found that over half of climate actions taken by cities came from the ICT sector, demonstrating the increasing interest in the 'smart city' agenda. However, the study also find that Mayors have little power over ICT-based infrastructure investment in their cities and that the ICT sector is least dependent on the city government to deliver action. This is reportedly due to the private sector having higher levels of involvement and power as compared to sectors like water, for example. Given that smart technologies are becoming increasingly important for cities there is a significant role for all city stakeholders to play in moving this agenda forward.




**There is a vast ecosystem of actors, each with differing priorities and capabilities that together shape the trajectory**

# SMART CITY ECOSYSTEMS




## ACADEMIA

Many of the smart city technologies, systems and analytics capabilities and processes are emerging from and spinning out of universities who are investing in cutting-edge technology development.

These insights include work coming out of research carried out in real life urban spaces through living lab and citizen science projects. It is promising to witness the methods of technologies tested in their in-use environment, but there is a need for a more coordinated research agenda. While universities are providing much of the technological grounding, there is an opportunity to create a more holistic research agenda around smart cities. This would incorporate a broader articulation of the social, cultural, economic, political and environmental implications of these technologies for cities.

Source: Climate Action in Megacities report.

Topics that need future research include:

- Open data architecture for cities which produce agile, adaptive capabilities;
- Theories around personal data ownership, autonomy, safety and power;
- Urban governance and economic impacts of digital disruptions;
- How digital technology affect how people experience place;
- Economic models for micropayments.

Universities are also able to develop thought leadership on the city they are situated in. They are able to convene policy makers, industry partners and community groups around specific local issues and access resource (e.g. through the FP7 funding) to support the exploration of these issues with respect to their own cities and in partnerships with others nationally and internationally. Universities should take greater leadership in this convening role, which would have the positive benefits of local impact, as well as a level of the rigour of approach to draw out fundamental principles and theories that are relevant across cities.

Universities are training the next generation of urbanists. They provide a forum for discussion and debate on how technology is transforming city functioning, and are developing human capital and capability in this area. Some universities like NYU are developing Smart Cities Masters courses while others, like the University of Bristol are integrating the topic into their undergraduate engineering courses. Other universities are developing open lecture series such as the London School of Economics Cities lecture series and Urban Age Symposium,[36] in which the challenging issues are debated and disseminated amongst the community of thinkers.


**Some universities like NYU are developing Smart Cities Masters courses while others, like the University of Bristol are integrating it into their undergraduate engineering courses**

# SMART CITY ECOSYSTEMS

## NATIONAL GOVERNMENT

As chapter 3 demonstrates, networks of cities can be convened nationally in order to share learning and capabilities. National government can support such networks through providing both resources and leadership. Networks of cities that are able to coordinate behind a mission have the opportunity to collaborate in their purchasing of systems and services, which not only improves the potential for interoperability between cites, but also escalates the purchasing power of cities.

National governments could also help to remove procurement barriers faced by cities through supporting innovative procurement procedures, as highlighted in chapter 3. These might include the adoption of procurement standards such as the European Commission standard on the public procurement of innovation, or opportunities for pre-commercial procurement practices.

Large infrastructure investment is often owned by national government. Such large budget projects have a potential role in supporting innovative solutions and the development of integrated solutions by allocating a small proportion of the existing investment to demonstrate novel technologies and approaches. This can help to develop skills and understanding that can then be applied to smaller-scaled projects and programmes.

Interoperability between technologies is essential if they are to be scaled significantly. Governments must take leadership on interoperability by developing standards in partnership with industry. The need for national government action in this area arises from the fact that there are multiple applications of these technologies, and hence no single sector or stakeholder is able to elaborate such standards and regulation[37].

National government can take stronger leadership on understanding the privacy and data protection implications of smart city investment.


**Interoperability between technologies is essential if they are to be taken to significant scale**

**Networks of cities can be convened nationally in order to share learning and capabilities**

## INDUSTRY

Industry stakeholders identified the new market around the smart city early on, and have played a significant part in driving demand for it. However, they are struggling to access the full potential of this market because city governments are not always set up to easily purchase from them. Industry could improve the capacity of city governments to procure innovative services by developing innovative business models that could, for example, come to the city with the financing in place.

Many industry-developed 'smart city solutions' have been criticised for failing to understand how they fit with the existing capabilities and functionality of city governments. Industry must therefore work more closely with cities to understand where novel services fit into cities current practices.

More broadly, industry should be aware of the benefit and power of partnerships. The problems they are attempting to address are complex, multi-dimensional and messy, and will not be solved by any single technology programme. As such, effective and sustainable holistic programmes will take strong collaboration between a variety of organisations that have complementary assets and capabilities.

**More broadly, industry should be aware of the benefit and power of partnerships**


## CITIZENS

The smart city agenda has been criticised for its tendency to oversimplify a complex picture and present neat, clean, techno-centric ideas and solutions. This oversimplification often arises through an inadequate analysis of the messy nature of social systems within which technology is acting.

All smart city projects and programmes have impacts on citizens. They all embody assumptions around access and political agency which may not have been explicitly articulated. To date, there has been a failure to seriously interrogate the impact of these on citizens that are perhaps unknown and certainly not always benign. These impacts sit across social, political and economic boundaries and may end up disenfranchising people or increasing inequality. These issues must be adequately incorporated into a holistic understanding of place-making in a digital age.

Citizens are using ICT and social media to track, report and lobby on political issues – as exemplified by groups such as the Everyday Sexism Project and Hollaback! However it is less clear which voices are not being amplified by these technologies. What about the sections of society that do not have the political or social capital to access these tools to represent their concerns? In the digital age, what happens to their voices? about the sections of society that do not have the political or social capital to access these tools to represent their concerns? In the digital age, what happens to their voices?

It comes back to city governments – the custodians of public welfare – to convene the actors in the smart city ecosystem in order to support and safeguard positive outcomes for all citizens. This requires strong leadership founded on a clear vision and a comprehensive understanding of local capabilities and aspirations. It requires practical and sound organisational capacity within the city council. It requires an understanding that no one party has all the answers and it requires strong partnerships across the city and beyond.

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