



Building the Digital City: the People, the Smarts, the Buzz

Brook Dixon

**Churchill Fellowship
Report**

**To accelerate the creation, connection
and application of digital city
technology for citizens**

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Report by Brook Dixon, 2015 Churchill Fellow

To accelerate the creation, connection and application of digital city technology for citizens.

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EXECUTIVE SUMMARY

The digital revolution is ablaze in cities around the world. The fires of big data, open government, smart city, digital innovation, cities 4.0, and the internet of things, burn bright.

But what is the object? How can cities most effectively engage with digital? And what lessons from international experience are there for Australian cities? This Churchill Fellowship Report examines these questions based on visits to 11 cities – Hong Kong, Shenzhen, Seoul, Barcelona, Copenhagen, Stockholm, New York, Raleigh, Lima, San Francisco and San Jose.

This study trip was a remarkable journey of digital city exploration and discovery. From the creation of new public-private data markets in Copenhagen, to the evolution of civic democracy in Seoul enabled by a range of digital initiatives, to partnerships in New York transforming 7,500 old pay phones into new digital hubs (unlocking billions of dollars in new value), to portable digital labs made from shipping containers for schools in Lima.

However, the key lessons relate less to such wonderful digital projects, which are specific to each city, but to the principles of purpose, planning and process which can be applied in any city. The ten digital city principles propounded by this Report are:

1. Be a digital democracy. Digital for the people – the object and centre of a digital city.
2. Get a digital city plan! The digital world is too complex for an ad hoc approach.
3. Find your leaders and governance. Mandate and participation are critical for success.
4. Develop digital city standards to ensure consistency, security and quality of service.
5. Prioritise digital projects. Assess all options and set benchmarks to invest best.
6. Leverage new business models. New York unlocked billions with a new model!
7. Partner for the win. Make it easy to partner, and stay focused together on outcomes.
8. Modernise regulation. Digital improvement must be supported by regulatory reform.
9. Gear your city for innovation. Encourage and showcase real innovation, on the street.
10. Set digital targets. Measuring progress is the only way to know if we are doing right.

To encourage application, these findings will be disseminated at a series of speaking events in coming months, and will be the subject of direct collaboration with cities around Australia.

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INTRODUCTION

Digital technology can cut both ways. Delivering efficiency, convenience and connection. Or disruption, exclusion, and unwanted complexity. But this is no revelation, nor singularity. For all technology can allot good and bad. Sir Winston Churchill spoke of this duality at his 1949 MIT address in Boston. There he heaped praise on the sciences and attendant progress for humanity, while also warning of less wholesome consequence. Churchill's words about the 'conquest of air' exemplify, and equally he could be speaking of the current digital revolution:

The whole prospect and outlook of mankind grew immeasurably larger, and the multiplication of ideas also proceeded at an incredible rate. This vast expansion was unhappily not accompanied by any noticeable advance in the stature of man, either in his mental faculties, or his moral character. His brain got no better, but it buzzed more. While he nursed the illusion of growing mastery and exulted in his new trappings, he became the sport and presently the victim of tides, and currents, of whirlpools and tornadoes amid which he was far more helpless than he had been for a long time.¹

The prospects of digital reform are bright indeed. But, with any technological advancement, as Churchill recognised, its true value is measured by the advancement of man. What we want is digital technology applied in our cities to deliver benefits to people and our civilization - livability, creativity, resilience, sustainability, and participation. And our ability to reap these benefits, are, as always, in the seeds and the sowing. Herein are two critical points. First, we are sowing digital seeds for our citizens, and accordingly, they must remain the focus, both as object and participants. Civilization, as Churchill defined it, "means a society based on the opinion of civilians."² And so it should be as we seek to create digital cities for people. Second, how we go about sowing, can be effective or less so. Being guided by imitation, apathy, fortune, or custom, is not recommended. Always we should apply diligence and the best methods if we hope to reap productively.

¹ (Churchill, MIT Mid-Century Convocation Keynote Speech, 1949)

² (Churchill, Civilization, 1938)

These are the two pillars of this Report: that people are central to creating a digital city, and should hold such place; and that good digital city outcomes depend on good planning, process and delivery (not on luck, vogue, indifference or opportunism). We wish not to have our citizens' brains buzzing by confusing and unnecessary application of digital, nor do we want to be the sport of whirlpools and tornados. Rather, we want our citizens 'buzzed' (i.e. pleased and excited) with the manifold benefits of digital technology in their city, and to chart a course with clear objective that rides the tides and currents of social and technological change. So we build our digital city around these pillars.

The stated object of this Report is to accelerate the creation, connection and application of digital technology. This object bears some points of clarity.

- *Where* are we talking about? In cities, and by that primarily larger metropolitan areas, due mainly to the size of the places I studied during the Churchill Fellowship. Hence I will use the term digital city throughout this Report, however, the conclusions of this Report can be equally applied to smaller cities, regional and country towns and municipalities.
- *Why?* Why do we want this acceleration of digital technology? (We have already foreshadowed this question and its answer.) Certainly not for the sake of technology itself! Rather, to optimise the benefits of digital for the city and its people. Convenience, intelligence, efficiency, connection, accessibility. To make the city smarter, more livable, productive, sustainable, inclusive, creative, and resilient. A better city. Better environment. For citizens. For visitors. For you. For me. For the community.

When I say digital city, I refer to both digital technology itself and the attendant digital innovation philosophy of connecting technology, people, ideas, things and organizations in the city to engage, empower, inform, experiment, disrupt, reform, and improve. At times I will interchangeably use the term 'smart city', both because this is a common interchange, and because there is great overlap between the two concepts in aspiration and action.³

But digital city is a big topic, and accelerating the creation, connection and application of digital city technology a bold objective. How then does this Report approach this challenge?

³ If a distinction must be made, for the purpose of this Report we will define 'digital city' as the application of digital technology and solutions to help deliver a 'smarter city'.

- First by focusing on the role of city government. As this Report argues, city governments have the critical role in leading, coordinating and catalysing digital city plans, partnerships and action. They are a sensible primary subject for this Report then. And my research methodology reflects this subject, being founded on interviews with city government officials, and assessment of public digital city documentation.
- Second, by concentrating on *how* city government should lead, not on *what* digital projects should be implemented. And this because the planning, process and principles of digital (in both practice and theory) are often overlooked in the haste to deliver digital. And digital projects (while immensely interesting) should be peculiar to each city and, in any case, are the logical and improved product of sound digital planning, process and principles.

Thus, this report will focus on the role of city government, in three dimensions:

- building digital city foundations – plans, governance, and frameworks/guidelines
- enacting digital democracy – engaging with people, co-creation, putting people first
- optimising digital city action – prioritising and sequencing projects, new business models, digital partnerships, and digital innovation.

Our desired audience, however, is much broader than just city/town governments, councils and public officials. Citizens should take a centre stage in the digital city, as ultimate beneficiary and as co-designer, and must recognize and own this position, including by making government accountable for less than satisfactory digital administration, policy and service. And innovators too must both partner and disrupt city government, working with and possibly (at times) against to drive positive digital transformation. Academics offer valuable digital city expertise and knowledge and should understand the best points of engagement. And private companies and vendors, the developers and providers of digital city technology, need to pitch their products and services at the city and the citizens, so to build their business stronger as they help build cities better.

So dear readers, of wide background and interest - forward to our digital city foundations!

BUILDING DIGITAL CITY FOUNDATIONS

DIGITAL CITY PLANS AND PLANNING

See ye to be a leading digital city? A most worthy aspiration! Long is the path and many the steps. But first, and before all else, get thee a plan. A plan for digital excellence. A plan to signal the way. A plan to inspire.

“Those who plan do better than those who do not plan, even should they rarely stick to those plans”

A plan? Who says, you well ask. Why, the great and wise Sir Winston Churchill, no less, dear readers. Hark now these Churchellian quotes most apt. “He who fails to plan, is planning to fail”. Now that’s a pithy maxim, and such heft. We desire no failing, certainly not! Perhaps another quote, rather than succumb to subtlety. “Those who plan do better than those who do not plan, even should they rarely stick to those plans”. The very same point hit again! We are indeed competitive, and appreciate the practical admission that plans must change. And one more quote, grant me leave, the pile driver, with all rhetorical flourish. “Plans are worthless, but planning is everything”. A third hit! Hyperbole, antithesis, balance – marvellous! The tremendous whack! Plans and planning are critical; the point is inescapable, and from Churchill himself, irrefutable.

Thus the general proposition of planning’s necessity is agreed. The specific value of digital city planning is worth expounding too. And so I will make three points.

- First, the digital cosmos is vast, its philosophy and technology concerns every part of the city – people, processes, services, administration, economy, and places. It covers infrastructure, networks, data collection and analysis, service reform, connections and partnerships. It can be applied to health, education, municipal services, utilities, social services, justice, police, emergency services, transport, the environment, and more. Facing such breadth of scope, and depth of opportunity, without the focus and direction of a digital plan, too easily will digital actions be fragmented - a congeries of disparate projects and partnership. To plan is to examine the particular circumstances of each city, and to concentrate attention where digital transformation can make the most difference. The larger the possibility and the complexity - and digital ticks these boxes - the more important is having a plan.

- Second, as signified in Churchill quote number two, if you are not planning well (or at all), you can be sure that other cities will be, and so too will digital city vendors. And this means, falling behind other cities, losing our competitive position for investment, innovation, ideas, liveability, and sustainability. Cities cannot afford to cede such ground, especially not by rolling up to the digital field having neglected the basic condition of engagement – planning. Lack of digital planning also leads to indiscriminate forays and advances, enticed forward by opportunism and the promise of easy rewards, as shiny new digital products and vendors draw attention. The digital plan ensures that ranks are drawn up and a clear strategy presides, so that digital action is both coordinated and purposeful.
- Third, there are a great many stakeholders in the digital city, and great benefit accrues when they have a common standard and agreed purpose. The very process of planning (note Churchill quote number three) should bring stakeholders together to create a shared vision. And the resulting plan should be a banner each stakeholder can wave with conviction. Without a unifying plan, the many stakeholders will create duplicative or discordant plans, and will spend much time speaking different languages and disputing priorities.

Digital city planning should be:

- i. *led by the city government*
- ii. *a continuing exercise*
- iii. *aligned with the city's strategic plan*

So we have established the importance of a digital city plan, by appeal to broad principle and specific rationale. Now it remains to examine the practical manifestation of such planning, viz. examples of plans from leading digital cities. Before this, a few words about process.

- First note that digital city planning should be led by the city government. They have the greatest responsibility for city services, the broadest knowledge of city operations, and are the most appropriate leader (both independent and mandated) to coordinate planning with the community and myriad digital stakeholders. City governments should be wary of relinquishing (either by omission or commission) their planning and coordination mandate to other external parties, in the name of expertise or

expedition. For a digital city agenda has great breadth, many competing interests, efficiency and equity considerations, direct community implications, and, most critically, is specific to each particular city. Accordingly, it is the city government itself that is best equipped, by long experience and appointment, to manage (collaboratively) and weigh these matters.

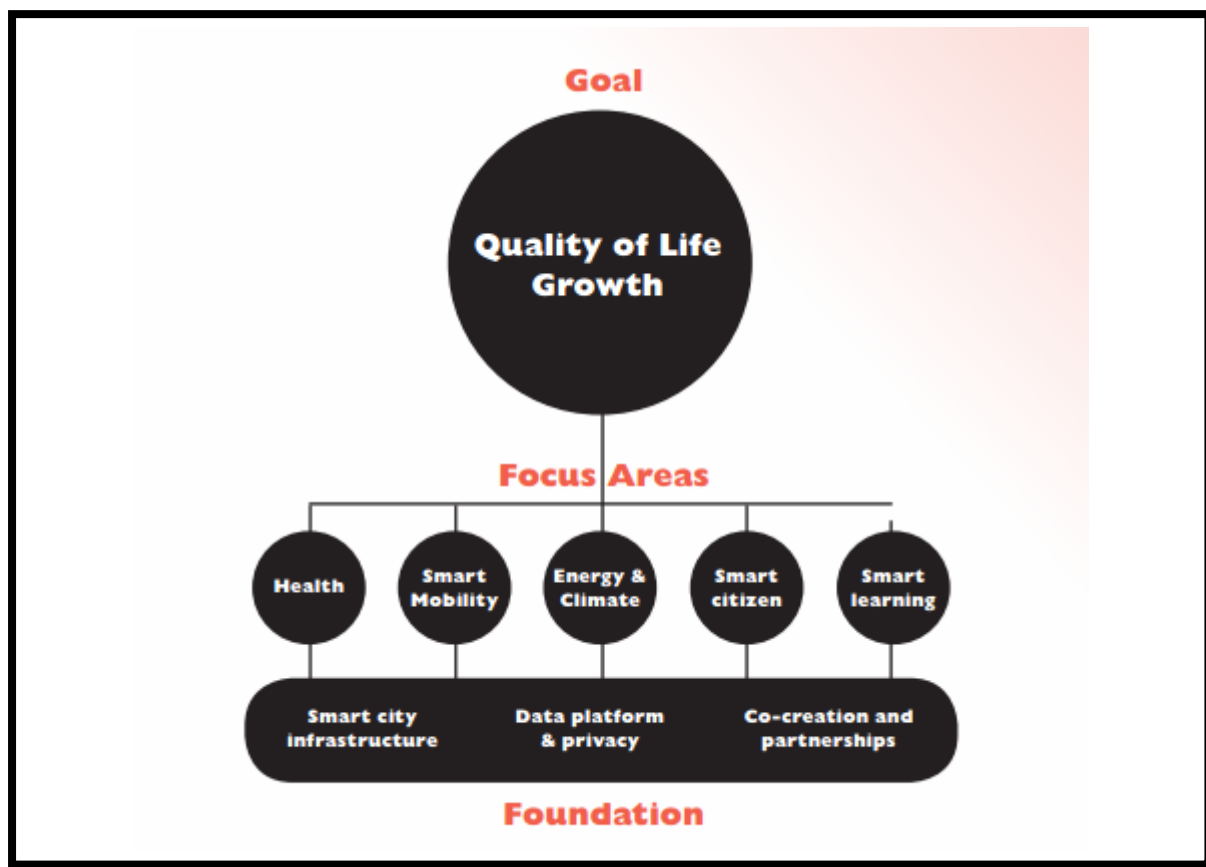
- Second, digital city planning must be a continuing exercise (see Churchill quotes two and three). Static plans are inadequate at the best of times, but in the dynamic and rapid currents of digital change, the fault is magnified. A rolling planning process will help maintain technological relevance, sustain stakeholder engagement, and protect the digital city plan from becoming rigid or reliquary. Note also that leading digital cities (take Seoul and New York for example) have a long chronology of digital city plans that reflect this ongoing cycle of engagement and planning (and delivery).
- Digital city planning should not be rigid or reliquary.*
- Third, the digital plan should be aligned with the city's strategic plan. That is to say, the long term aspirations, outcomes and targets expressed in the city strategy (e.g. reduced air pollution, improved education access) should guide the objectives and actions of the city digital plan (e.g. better monitoring via air quality sensors, enhanced online education options for target groups). Such hierarchy and harmony of planning is demonstrated by the City of Lima whose Smart City Plan is aligned with the *Plan de Desarrollo Concertado de Lima 2012 – 2025* (the Overall Plan for Lima's Development 2012-2025). Thus Lima's Smart City Plan defers to the overall city vision of the *Plan de Desarrollo Concertado de Lima*, which is higher in the planning hierarchy, and the smart city actions are prioritised and designed to realise this vision.⁴

As promised we will now highlight a few digital plans to make tangible this section. First to *Smart City Copenhagen*, a Plan most elegant, in brevity, style and digital essence. Embedded in the overarching city goals for Copenhagen, the Plan aims to “sustain a well functioning

⁴ (Municipality of Lima, 2016.)

city, where citizens have a high quality of life, and where environmental concerns go hand in hand with economic growth”. So digital and technology are, as the Plan states, “not an end goal in itself, but a means to ensure quality of life ..”. To harness digital and smart city solutions for these higher outcomes, the Plan works on two levels: laying a sure foundation composed of smart city infrastructure, data platform and privacy and co-creation and partnerships; and focusing on five areas identified as priorities by collaboration, with reference to the city goals. This planning framework is depicted in the diagram below.⁵

FIGURE 1: SMART CITY COPENHAGEN

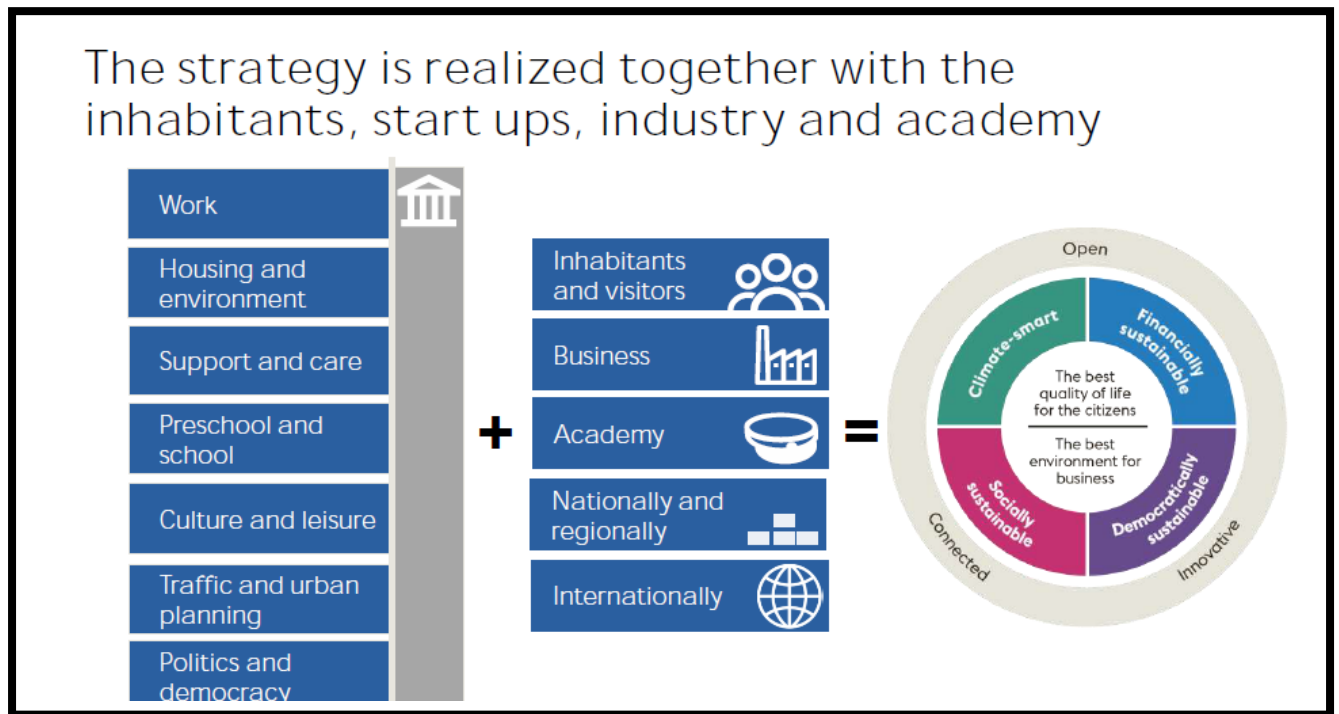


Second, *Smart City Stockholm*, again points towards the city vision, “the best quality of life for the citizens” and “the best environment for businesses”, and cocooned in a quadruple bottom-line of social, environmental, economic and democratic sustainability. The Smart City aspect is focused on Stockholm being open, connected and innovative. And these

⁵ (City of Copenhagen, 2016)

smart objectives are to be achieved by the addition of action across seven priority areas and a range of complementary partnerships, as represented below.⁶

FIGURE 2: SMART CITY STOCKHOLM

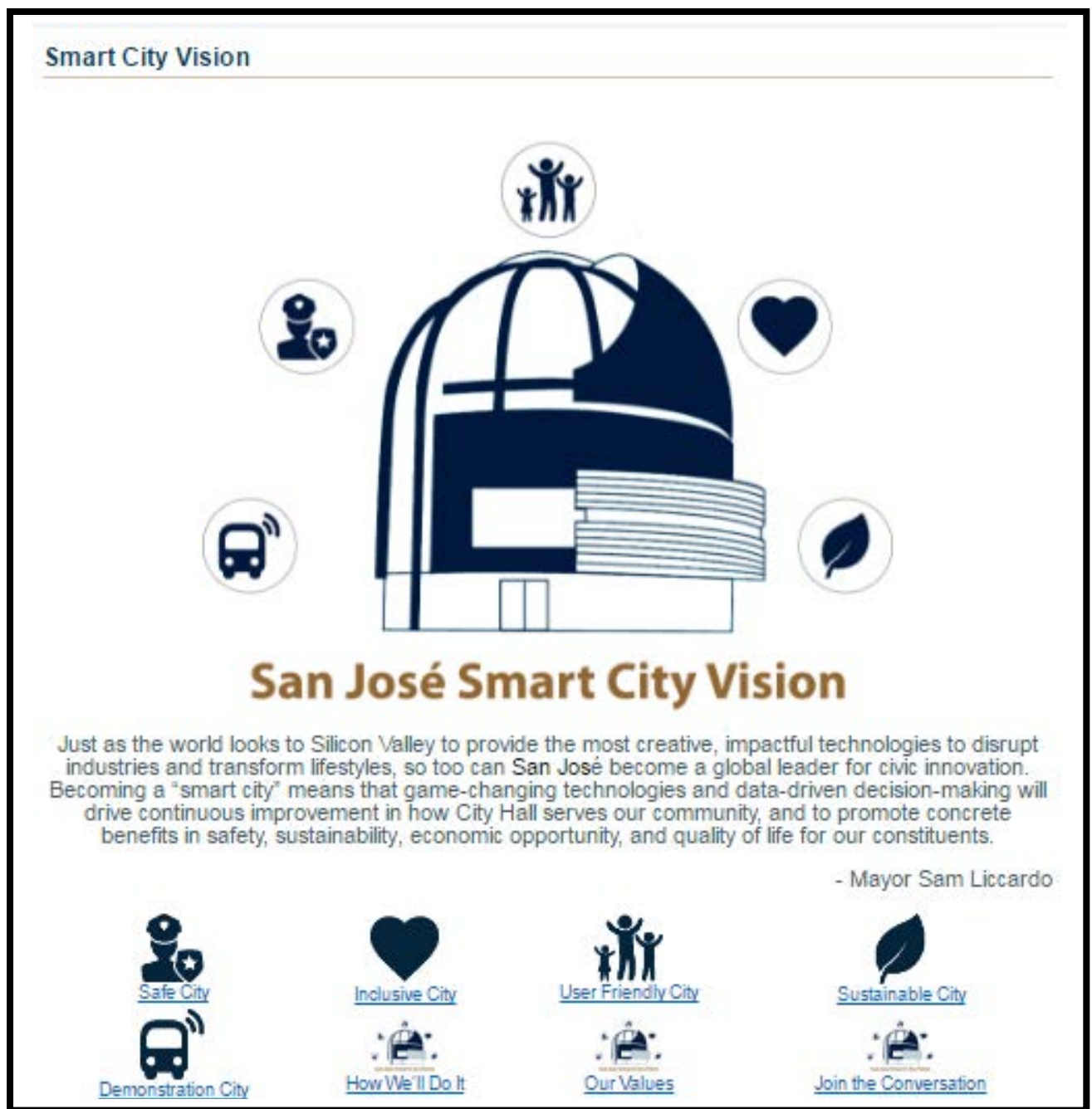


A third and final example, from San Jose where being a smart-city “means that game-changing technologies and data-driven decision-making will drive continuous improvement in how City Hall serves our community, and promote concrete benefits in safety, sustainability, economic opportunity, and quality of life for our constituents”. The San Jose Smart City Plan details five priorities (safe city, inclusive city, user-friendly city, sustainable city and demonstration city), and articulates key smart city capabilities and values to drive delivery, as per the diagram overpage.⁷

⁶ (City of Stockholm, 2016)

⁷ (City of San Jose, 2016)

FIGURE 3: SAN JOSE SMART CITY VISION



DIGITAL CITY LEADERSHIP AND GOVERNANCE

Our digital city plans are the goalposts. It's always important to know which way we are running.

But we need players - captains, coaches and team managers - and action on the field to score goals and win games. And this is the place for leadership and governance: the

framework of people (the champions, decision-makers, directors, doers, allies etc), roles and responsibilities, performance and accountability, decision and communication processes, to get things done. And these elements should in no way be undervalued. Across interviews with 11 digital cities around the world, this theme was universal: Leadership and governance are critical for digital city results; and where it lacked, it was lamented, and where it was sound, it was lauded. Such high regard was not simply due to the general principle that good governance is good practice, but because of the specific challenges of digital city delivery, which reinforce the necessity of good governance. These challenges are much the same as for digital city planning, as discussed earlier. That is to say, as complexity, breadth of scope, interdependence, and the number of stakeholders increase the need for planning, so too does it increase the need for leadership and governance.

Leadership and governance are critical for digital city results; and where it lacked, it was lamented, and where it was sound, it was lauded

To reinforce this point, note another common factor of digital city complexity, viz. that city councils often have another layer of government sitting above them with responsibility for parts of their city, and/or there are contiguous city councils with their own digital city concerns and plans. As if there were not enough moving parts to create a digital city already, add another few governments into the mix - now here is policy and implementation complexity! Thus, even if we do have the best digital city plan, without strong governance – particularly clarity about who is doing what and when - we risk the confusion and waste of enthusiastic but uncoordinated (and duplicative) action, or perhaps worse still, the disappointment and shame of inaction, where each agent supposes another agent to be responsible.

So let us explore the **principles of good governance** for leading digital cities in a little more detail:

i.

We have already argued that the city government is the best leader and coordinator for digital city planning. And for the same reasons they should form the axis of digital city leadership and governance.

ii.

Because digital city action contributes directly to a host of overarching city goals, and often involves difficult multilateral reform and coordination, budget machinations, complex change management, and trade-offs between city government departments and their individual objectives, digital leadership and responsibility will be most effectively situated in the centre of the city government. That is to say, since digital reform has whole of city/government implications, it requires whole of city/government authority and mandate, which already exists in the central policy/coordinating/oversight/budget division of city governments.

iii.

A dedicated position (operating from the centre of city government) should be established with clear responsibility, authority, performance standards and accountability for digital city objectives. This position should chair the key governance body.

iv.

As digital city aspiration reaches across all city government departments, so too should governance and leadership reach.

v.

At the apex of governance should be an elected official (e.g. the City Mayor, or a Digital Deputy Mayor) responsible for leading, promoting and overseeing the digital city agenda. This is not only good governance, but vital for visibility, momentum, and mandate. Without strong and convicted leadership from elected officials the digital city agenda is much weakened.

vi.

Responsibility for coordinating budget proposals and prioritising digital city projects should be allocated to the key governing body. Such a model of budget coordination and oversight, to identify synergies and potential duplication, is used in Shenzhen for example.⁸

vii.

Contiguous councils or senior governments must be part of the governance matrix, their level of integration commensurate to their level of city responsibility or interdependence.⁹

viii.

Other stakeholders, including citizens, community and environmental advocates, business and industry, innovators and entrepreneurs, and the academic and research sector, should be represented in the governance framework.¹⁰

ix.

To leverage broader perspective and innovation (and insure against blinkered decision-making or parochialism), governance should include links to expert advisors, thought leaders, peers, and other jurisdictions beyond the immediate environs of the city.

Here are **nine principles** – and I think this more than enough for our patience and our memory - upon which strong digital city governance might be founded. How they are applied, in combination and degree, or if indeed they are relevant at all, depends on the objectives and circumstance of each city. But leading digital cities will certainly consider such principles in constructing their governance. For governance is the fulcrum of digital city delivery, determining the ability to leverage action and results from vision and plans.

⁸ Interview with Shenzhen.

⁹ Note the multi-jurisdictional governance example of Stockholm on proceeding pages. The same challenges have been identified by Dr Tim Williams (2016) in Sydney, who reasons that because of the multitude of city councils (overlaid by the NSW State Government), and a fractured system of governance, Greater Sydney will not be a 'smart city' until it has 'smart governance'.

¹⁰ (Anttiroiko, Valkama, & Bailey, 2014) emphasise smart governance which works to harness and coordinate the enthusiasm and capabilities of residents stakeholders.

Enough of principles! Now a few real life examples of governance from leading digital cities:

- Copenhagen's smart city strategy is governed by a Smart City Project Board including representatives from all municipal departments. Digital governance also includes an independent advisory Privacy Board.¹¹
- San Jose established an Office of Innovation & Digital Strategy in the City Manager's Office to direct and drive results, and strategically invest in staff to expand capacity for implementation. To ensure accountability they also created a dedicated City Council Committee on Smart City and Continuous Improvement to track progress.¹²
- In Stockholm, the Council of Digitization (consisting of high-level executives across the City) coordinates planning, prioritises projects by a structured selection process, decides funding, and assigns a Project Coach to oversee the project and build value. For Stockholm, the greater governance challenge is cooperation with other governments, and they have a long term goal of strengthening joint governance of common infrastructure between the City, the County Council (responsible for health care, regional traffic planning etc) and all the other cities in the county.¹³

DIGITAL CITY GUIDELINES, STANDARDS AND POLICIES

Clear digital objectives and governance are important. We need to know what goalposts we are running towards, and who the captain, coach and team managers are and how they will communicate on the field. But, as we have already noted, there are just too many players on the digital city field for our leaders to shout out directions all day every day. Even within government, there are hundreds of public officials who are full-time digital city players, and many thousands with indirect interest who might come off the bench as digital city playmaker, coordinator and champion. To be a leading digital city we need all our players to work as a team, play at a high standard, and score goals when

¹¹ Survey response from Copenhagen.

¹² (City of San Jose, 2016)

¹³ Survey response from Stockholm.

opportunity presents. To do so in sport, players need empowerment, confidence, training and team standards. The analogous condition for digital cities is to have clear, explicit digital city standards and guidelines – documents that define the framework, principles, requirements, processes, methods and benchmarks for creating a digital city. It is such guidance that can harness all the digital forces of a city, leveraging enthusiasm, resources, independence and innovation, while ensuring coherence, consistency and synergy. Just the same way a sporting team must allow all individuals to participate and play with skill and flair, while applying team rules, structure and organisation. Without the guidelines and frameworks, for either a sporting team or a digital city, the players play their own games, are ill-equipped for the contest, get in each other's way, don't cooperate or pass the ball, and generally, lose the game - neither a beautiful nor successful spectacle.

Leading digital cities say: Unacceptable! They want to win. They want to make the best of digital opportunity for their city and their citizens. And so they prepare digital guidelines, policies and standards to recruit, instruct, coordinate and empower their squad. The subject and extent of guidance material will depend on city's digital objectives and maturity, but might include standards relating to digital privacy and security, customer service and experience, digital inclusion, technological expectations (such as integration, accessibility, extensibility etc.), experimentation, data, and collaboration.

A few examples to illustrate. First to New York City and their Guidelines for the Internet of Things¹⁴, which “provide a framework to help government and our partners responsibly deploy connected devices and IoT technologies in a *coordinated and consistent manner*” (my italics). These Guidelines were prepared with four primary goals, as presented in the box below.



¹⁴ (City of New York, 2016)

i.

Provide a common framework to help government agencies develop and expand policies and procedures related to IoT.

ii.

Maximize transparency and openness regarding the design, installation and operation of IoT systems and how public privacy and safety will be protected.

iii.

Provide clarity on the minimum requirements and expectations for installing and operating IoT systems using public space or assets.

iv.

Advance the public dialogue about how government, the private sector and academic partners can maximize the public benefit derived from IoT solutions.

And the guidelines themselves cover five fundamental elements of IoT (as presented below), and include thirty-eight standards (which are so useful, I have included in full at Appendix 1).

i.

Privacy + Transparency. When we use new technologies on city streets and in public spaces, we are committed to being open and transparent about the “who, what, where, when, and why” for any data or information being collected and used.

ii.

Data Management. Data is the core of any IoT system. We will ensure that IoT and real-time data is captured, stored, verified, and made accessible in ways that maximize public benefit.

iii.

Infrastructure. To capitalize on the value and benefits derived from public assets, we will deploy, use, maintain and dispose of IoT devices, networks and infrastructure in an efficient, responsible, and secure manner.

iv.

Security Keeping New Yorkers safe is our top priority. To do so, we are designing and operating IoT systems to protect the public, ensure the integrity of services, and maximize resilience.

v.

Operations + Sustainability. We are committed to streamlining operational processes and ensuring financial, operational, and environmental sustainability to ensure that our city keeps running better and faster.

These are very powerful guidelines, synthesised from world best practice, co-designed with a wide array of city stakeholders, neither too prescriptive nor nebulous, but providing a sound framework that supports consistency, quality and autonomy. And so compelling have these Guidelines been they are now the centrepiece of a new partnership of twenty-one U.S. cities who have “committed to a common set of guiding principles that emphasise privacy, security, sustainability, resilience, equity and efficiency in their use of IoT technologies”. Further, in recognition of the dynamic nature of the digital world, the IoT Guidelines are to be a “living document and exist in perpetual ‘beta’...”, continually reviewed and updated based on feedback and monitoring to ensure ongoing relevance and utility.¹⁵

And now another example from San Jose and their *Framework for Establishing Demonstration Projects*.¹⁶ The Framework aims to capitalise on local ingenuity and creative

¹⁵ (City of New York, 2016)

¹⁶ (City of San Jose, 2008)

talent to drive innovation, community awareness, product commercialisation and, ultimately, city improvement. And it does so by providing clarity about the opportunities and expectations of partnerships for testing, demonstrating and evaluating new technology on the streets, and within the city of San Jose. For digital entrepreneurs and the community, the Framework acts as an attractive force, promoting the possibilities and benefits of living trials of new technology in San Jose. And for City Officials, the Framework provides the standards, assessment processes, governance, and implementation guidelines for demonstration partnerships, to both empower their engagement with such innovative possibility, and also ensure a consistent, coordinated approach.

Without such a framework, the risk profile for the city and their partners is much higher, there is

increased potential for overlap and incoherence in demonstration projects, and there is more likelihood of procedural inequity and rent-seeking. Rather, in San Jose, their Framework has been an active touchstone of city innovation, promoting possibilities, catalysing and guiding demonstration partnerships (from sustainability to transport to urban renewal to streetlights), and providing certainty and authority, those two hallmarks of sound project conception and management.



ENACTING DIGITAL DEMOCRACY

The digital city is not about technology. It is about better services, better experiences, better living. It is about people. Both citizens and visitors. And for a city with digital aspirations, it must know its people first, then its services, and then, and only then, the requisite digital technology. As Anttiroiko et al observe, to achieve smart outcomes, technology must be embedded in social.¹⁷ Not the other way around! People should not be made to fit with technology, but technology made to fit with people. People first, then services, then technology. And leading digital cities understand and embrace this philosophy.¹⁸ Let us examine how.

El Ciudadano es el eje principal en torno al cual se construyen las Smart Cities.
(The Citizen is the central axis around which smart cities are built)

(Municipality of Lima, 2016)

And so we shall start with knowing our people. Here is the very essence of democracy, and

It behoves the modern city to engage with democratic digital disruption, positively and proactively, harnessing digital capability to better know and serve the people.

for the purpose of this Report, digital democracy. Digital capability is changing democracy, public governance and administration. Changing it already, while portending still greater changes.

The ability to provide real time feedback, to engage with greater convenience, to increase public information and transparency, to coordinate group action more readily – these are powerful digital forces moulding and shaping democratic

processes and institutions, sometimes gently, sometimes with great violence. And it behoves the modern digital city to engage with this change, positively and proactively, harnessing digital capability to better know and serve the people. How of course, in terms of specific

¹⁷ (Anttiroiko, Valkama, & Bailey, 2014)

¹⁸ The concept of people first seems simple and obvious, but it is not a given. (Hollands, 2015) has criticised manifestations of the digital/smart city paradigm where “citizens are often cast as barriers to the corporate race towards the smart city and that they need to be educated by city leaders as to the benefits IT can bring.” He also argues that “smartness can also become a self-imposed label, a marketing device for city branding and an excuse for the domination of corporate entrepreneurialism models.”

actions, depends - as I will keep affirming - on the fabric of each city. The point is that cities must face up to these forces, and the best digital cities will do so with planned and committed method.

Such a city is Seoul, which presents a first-class case study of digital democracy, of a city knowing its citizens, where a host of digital city policies, systems, and applications work to encourage and facilitate citizen engagement, participation and creativity. Three examples will illustrate.



- First, the Oasis of 10 Million Imaginations website, a ‘citizen proposal system’ for residents to make city policy/program suggestions and ideas, vote on suggestions/ideas, and leave comments. Ideas that receive more than 10 votes are formally reviewed by the government, and the best ideas are implemented!! This platform has been very successful with more than 70,000 members, an average of 21,000 ideas per annum, and 565 ideas adopted to date (0.36% adoption rate).
- Second, the mVoting platform (smart-phone app and website) allowing rapid polling of citizen opinion through votes on policy and municipal matters. Polls can be targeted by various demographic factors including age, gender, GPS location, employment characteristics, and address, and citizens can set preferences for areas of voting interest. mVoting has been used for hundreds of polls with direct influence on city policy, has reduced the community and public costs of engagement, and enshrined Seoul’s philosophy of participatory democracy and the citizen as administration owner.
- Third, Eung-dap-so, the Civil Compliant/Proposal Integrated Service (CCPIS), available on website or smart phone app, which supports real-time complaints registration, response tracking, and response satisfaction rating. This digital service has improved citizen convenience and their satisfaction with the complaints process, as well as reducing average complaints processing time by 0.7 days (3.8 days down to 3.1 days) due to digital business integration.¹⁹

¹⁹ (Seoul Metropolitan Government , 2014)

By these digital tools, among others, Seoul aims to empower their citizens by active engagement and participation in the design, administration and governance of their city. And thus to know their citizens, to know what services they value, and to best govern on their behalf. The other side of this equation is for citizens to know their government, to inform their engagement, and to ensure public transparency and accountability. Here too is digital awakening great possibility, and here too must digital cities focus thoughtful attention. Indeed, most cities have an ‘open government’ program to open up the black box of government, aiming to give citizens and their democratic institutions greater visibility and more information about the processes, decisions and operations of city government. The signs of progress are manifest: open data websites are now ubiquitous, as are freedom of information provisions. And these are important steps forward. But the practical impact has perhaps not met expectations, often due to deficiencies in the relevance, timeliness, convenience, quality, and depth of openness.

Leading digital cities will move beyond the welcome statements of open government, and the tick box of releasing more data. They will engage with citizens (even using their digital participation platforms!) to understand what information is valued, and how this information should be accessible. They will invite dialogue about the trade-offs between

Leading digital cities will work with their citizens to make open government, and open data a meaningful reform, not just a tagline with a flurry of new data sets online

information quantity and information quality, and seek to weigh the benefits of greater openness against the public financial cost. And they will modernise governance, institutions and process to embed openness, rather than endure costly retrofits. That is to say, leading digital cities will work with their citizens to make open government, and open data a meaningful reform, not just a tagline with a flurry of new data sets online.

Beyond the principle of leveraging digital technology, so that citizens and city governments are engaged and communicating, there are the practical benefits of translating this engagement into tangible change and improvements for the city and its people. For our digital cities, this outcome rests on two resolutions. First, that the city and its services are planned, designed and delivered with people at the centre. We refer of course to the ethos of citizen-centric or user-friendly cities. Clichés, no doubt, but with deep truth, for too often cities and services are the result of historical, regulatory, administrative, technological,

accidental and fashionable forces, quite removed from citizen expectations and experience. Second, that people are part of the service design process. And here we refer to co-design. Again, a seemingly trite concept, but a most valuable exercise, and still (unfortunately) honoured more in the breach.

Leading digital cities take these resolutions very seriously. They have robust service planning frameworks founded on the principle of user-friendly and citizen-centric services. They build capacity (in people, systems and structure) to support high-quality, people-focused service planning and design. They investigate a range of options for delivering better outcomes and services, from digital to traditional to market to hybrid, and guard against pre-conceived technological or regulatory solutions. And they have well-articulated, well-enacted co-design protocols to ensure that people are part of the service design process.

Copenhagen provides a good example of citizen-centred service design. They have established a Smart Citizens Board for citizens who wish to co-develop and test intelligent urban initiatives and digital technologies. Citizens are able to sign-up online, and can: participate in city workshops to identify city challenges and possible solutions; test innovative ideas; evaluate new apps and services; and share information about smart city projects.²⁰

The advantages of such active city-citizen collaboration and co-design are manifold. Let me present three to illustrate.

- First, (and most obvious, yet often overlooked) the advantage of access to direct and independent user feedback on proposed services – assuredly a critical procedure if our settled aim is to deliver a user-friendly city. If a service is to work for citizens, it makes perfect sense for citizens to help design and test said service, to hone in on the key requirements, and iron out the kinks. And we should also note that while ‘user-testing’ by city government officials is most necessary (for sound project management etc), it is not sufficient to meet this criteria, as city officials, though still citizens, are generally not disinterested, representative testers.
- Second, access to the creativity of citizens - certainly not the exclusive realm of city governments and their officials - and through this creativity, the ability to develop

²⁰ Survey response from Copenhagen.

enhanced and broader option sets. Unlike city officials, who may already have identified a default solution, citizens will tend to bring a more open view to a particular city problem, as well as their own expertise and experience, both of which will unlock new possibilities. This point is affirmed by Anttiroiko et al who state that “city governments have to move away from a top-down approach to service delivery and ‘lead from behind’ the bottom-up development of a smart ecosystem...”.²¹

- Third, the investment in civic capital, trust and cooperation which offer a host of spill-over benefits to both future co-design processes and, more generally, the social fabric of the city.

Overall, this ethos of citizen collaborative design is neatly summarised and avowed by Anttiroiko et al:

“Services need to be redesigned and reconfigured to give citizens greater accountability and power over the running of services. This can be called a ‘proactive form of engagement’. Communities become partners with the local state rather than simply passive recipients of services, building social capital and creating sustainable and resilient local communities.”²²

But isn’t all this proactive engagement time consuming and expensive? Doesn’t it slow down service delivery? Fair questions, and indeed it might. However, one might also ask the question: are we prepared to accept the hazards of design flaws exposed only after implementation, of citizen dissatisfaction, of costly retro-design and fixes, and of negative public perceptions about digital innovation and services? For these risks, annoyances and costs are exactly what citizen co-design is intended to protect against. And, such risks should not be underestimated. For the consequences of one digital service mishap can be grave:

What we are therefore proposing is a re-weighting and re-profiling of the service cycle – towards proactive planning and collaboration, and away from reactive trouble-shooting and damage control.

²¹ (Anttiroiko, Valkama, & Bailey, 2014) p331.

²² (Anttiroiko, Valkama, & Bailey, 2014) p328.

undermining the particular project thereafter, precipitating lower public trust in digital more generally, and increasing city government risk aversion. Terrible outcomes, one and all, for the digital city agenda! And precisely why the upfront investment in better design and engagement is advocated: to return future dividends in reduced cost, reduced risk and improved citizen outcomes. What we are therefore proposing is a re-weighting and re-profiling of the service cycle, giving greater attention and resourcing to earlier project stages - the value-adding stages of proactive planning, collaboration and innovation - and consequently substituting away from (unwanted) later stages of trouble-shooting, re-working and damage control, which are reactive and wasteful.

A quick word here about the mode of engagement. For our leading digital cities, the mode of engagement should be active. Reaching out to people when and where and how they want to engage and communicate. Not simply putting a service design discussion paper on a website, and holding a community forum! This is old school passive - an engagement mode that tends to narrow the field to highly motivated interest groups or accidentals, effectively distorting the feedback and inadvertently deactivating many people. As cities aim for smarter services, so too must they aim and rehearse through citizen engagement. And be active! Active by using push-based engagement apps, such as in Seoul, which target engagement in real time, by demographic and geo-location. Active by finding the points where people are motivated to engage – when they are at an event, or experiencing a service, or walking by a proposed new development (mobile phone in hand all the time) – not by imagining people will log onto the engagement website later, for a leisurely public feedback session. Active by harvesting all the existing feedback on social media channels. And active by rewarding people for their engagement, and providing timely updates on process and outcomes, to build trust and authenticity.

For our leading digital cities, the mode of engagement should be active. Reaching out to people when and where and how they want to engage and communicate.

The target of engagement is also important. A sound service planning process should identify all relevant stakeholders. And engagement should be targeted accordingly. Leading digital cities will not hope that an engagement website is sufficient to find the right stakeholders. Nor will they allow engagement to be focused on and controlled by concentrated beneficiaries or opponents (e.g. rent-seekers, such as a vendor selling new

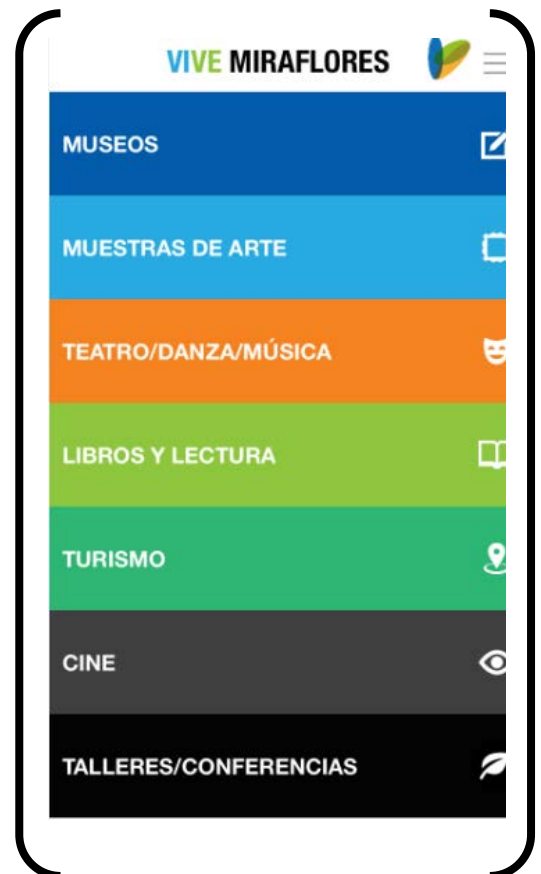
‘must-have’ digital products, or an industry incumbent who stands to lose market power). Nor will they be satisfied without giving voice to the oft-silent majority, the many citizens whose individual impacts might be small, but collectively is immense. Nor will they be content for key stakeholders to be spoken for exclusively by well-organised advocacy groups.²³ Nor will they permit particular demographics to dominate citizen engagement. Rather, leading digital cities will actively target and balance their engagement, working with the concentrated interests and the diffuse, with the supporters the opponents and the indifferent, with all relevant demographics, and with direct voices and indirect advocates. And all this because a people-centred city is the ultimate object, and people must then be part of the process, and not just anyone (by happenstance or being waylaid), but the right people by deliberate and active engagement.²⁴

It is needful now to briefly examine what we mean by ‘people’. Certainly, and principally, we mean citizens, those who live in the city, and them in whatever capacity they interact with their city – as a resident, as a student, as a worker, as a business owner. We should also include people (both individual and corporate) who do not live in the city per se, but who have interest in the city’s constitution and operation, from commercial, financial and institutional, to the cultural, political and social. Note that by saying people, we are not ruling out or dismissing critical city elements, like the environment, animals and heritage, but rather acknowledging that these fundamental aspects cannot be engaged directly (by dialogue), but must be spoken for by people as agents and advocates. Finally, by people we also refer to city visitors, being both those who visit the city in person, or virtually via the internet or conference call for example. And these people should be granted careful consideration. First because the city will (by definition) be more foreign to them, and well-designed (‘visitor-centric’) services are vital in opening up, demystifying and show-casing the city for the visitor. Second, because visitors are international conduits of the city’s reputation, stories, experience and possibility, and a conduit (if positively charged) that returns to the city more visitors, ideas, innovation, creativity and investment – all resources most valuable in building a leading digital city.

²³ (Anttiroiko, Valkama, & Bailey, 2014) highlight the need to allow “residents to directly and more accurately represent themselves rather than depending on the abilities of their representatives to aggregate and articulate their interests.”

²⁴ Nor should cities assume that digital tools and civic engagement are a panacea for inclusive engagement. As Dr Rebecca Rumbul has shown, while civic technology is widely used, there are clear demographic divisions in access and use of such technology, which vary by city and country. (Rumbul, 2015)

Lima, Peru affords a salutary example of this consideration for city visitors. In the district of Miraflores, the city provides free wifi (invaluable for most visitors!), and linked to the wifi is a city activation app, *Vive Miraflores*. The app curates the district for the visitor, presenting nearby and top events and attractions, including museums, art exhibitions, theatre, dance, music, lectures, conferences and cinema. Real time, convenient, geo-located information and guidance is the utility of the app (on your own mobile phone, enabled by the wifi), and digital revelation and enlivenment of the city - whose fullness of life and possibility is oft hidden to the visitor - the wonderful result. To be sure, the *Vive Miraflores* app could be further improved, by availability in languages other than Spanish, the ability to input a



visitor profile to personalise the city curation, feedback functionality, and expanding scope to dining and transport. But the current app is still excellent, sets a strong foundation, and signals clear intent to be a leading digital city, where the visitor is welcomed, hosted and embraced by the city, both in person and by digital engagement.

Cities could do well to heed Lima's example, in both output and purpose. And more broadly, to give thought to such digital city activation for citizens, who after all, are but a special type of visitor, none of whom know the full vibration and pulse of activity and life within their city. Leveraging digital engagement to extend the city's possibilities for our citizens, and to unlock the

citizen's potential within and on behalf of their city! Now here is aspiration worthy of leading digital cities.

But lo, all this enthusiasm for digital engagement and digital democracy, have we not forsaken our premise of putting people first, and moulding digital for people, not people for digital? What if people are unable to engage digitally, either by lack of access or capability? And what if they simply don't like digital? Excellent questions, so let us address them in turn. First, the premise of putting people first remains solid, as we have indicated that all services (including and especially digital engagement!) should be co-designed with citizens. Convenience, timeliness, ubiquity, reliability, interactivity, and effectiveness, are common citizen preferences and likely objects of a co-design process, all of which lends support for a digital solution, but it need not be so if citizen co-design determines a better solution. Or a mix of solutions, for no-where have we ruled out complementary use of traditional engagement methods, such as written submissions or town hall events, if indeed this is the revealed preference of people.

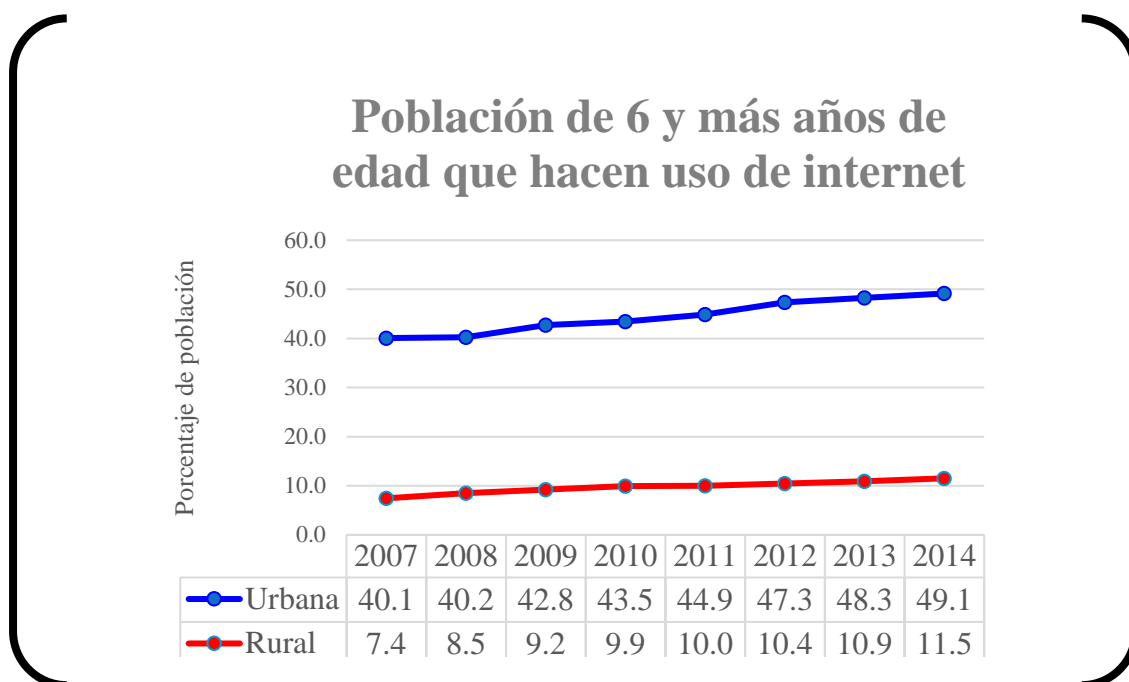
Second, the question of digital exclusion, I maintain, is best answered by action to address the exclusion, rather than throwing the baby out with the bathwater, and dismissing digital engagement and services. Leading digital cities will investigate the extent and the impact of digital exclusion amongst their citizens,²⁵ and take direct action accordingly.

- San Jose has a digital inclusion strategy which includes initiatives to provide access to high speed broadband in low income communities, increase digital devices for low-income students, build digital skills in civic libraries, and create pathways into high-tech jobs in Silicon Valley.²⁶

²⁵ (Bunyun & Collins, 2013) for example note that “those who are more likely to be digitally excluded have the attributes that are often associated with other forms of social exclusion. Digital exclusion is a modern element that can compound disadvantage.”

²⁶ (City of San Jose, 2016)

- Similarly in Lima, where digital exclusion is a very real policy challenge (less than 50% of households in the Lima Metropolitan area have internet connection- see figure below)²⁷, the government has focused on fibre-optic expansion, wifi availability, and the simple innovation of providing movable digital labs in shipping containers to build digital skills at schools.²⁸



- For New York inclusion is central to their digital strategy, *Building a smart and equitable city*. “As the world becomes more digital and technology-dependent, the opportunity gap between technology haves and have-nots carries increased urgency. Narrowing this digital divide and ensuring all New Yorkers can participate fully is central to the City’s strategy for technology and innovation”.²⁹
- In Hong Kong, there has been a range of digital inclusion programs, including digital outreach for the elderly, sponsorship schemes to develop digital inclusion mobile applications, and the Internet Learning Support Program.³⁰

²⁷ (Municipality of Lima, 2016)

²⁸ Interview with Lima.

²⁹ (City of New York, 2016)

³⁰ (The Government of Hong Kong SAR, 2015)

- San Francisco’s Digital Inclusion Strategy includes programs such as free and affordable wireless across the city, computer ownership, enhanced digital literacy, and multi-language content.³¹

To restate our second answer, the signs and challenges of digital exclusion should excite direct digital inclusion actions, not digital detraction or discontinuance. And the very same principle applies to the unintended negative aspects of digital technology such as digital addiction, digital bullying, and security and privacy breaches. Targeted remedial policy and action is the answer, not broad, severe measures to attack the bad of digital in ways that also undermine the great good of digital.

Third, for those who simply don’t like digital, while this opinion might pertain to individuals or certain demographics, by and large digital literacy, digital acceptance, and indeed digital preference is the overwhelming trend in cities across the world. The people are speaking, and

Targeted remedial policy and action is the answer to digital exclusion, not broad, severe measures to attack the bad of digital in ways that also undermine the great good of digital.

beyond digital exclusion as a driver of digital discontent (which is likely the underlying issue and thus to be addressed directly as per above), then there is no clear rationale for city governments to swim against this vast cultural and technological tide at the behest of the minority. That some people did not like (and still do not like) cars, or electricity, or pasteurised milk, or daylight savings is certain, but that did not stop the inevitable progress and extension of these convenient, beneficent innovations. And nor should personal taste or caprice by the few prevent

the application of digital in our cities, when it has proven so efficient, productive and positive for the many. Again, and to be clear, I am not precluding traditional engagement and service channels, which may in fact be most appropriate, but rather counselling against digital innovation being held hostage to history and minority predilection (often dressed up as digital discrimination – again refer to answer two). Yet some might ask, what is the harm in multiple service channels, using digital, paper, telephone, face-to face, or combination thereof? And indeed, as stated earlier, this might be appropriate in many instances, or temporarily during transition periods, but where digital has proven itself safe, effective,

³¹ (City of San Francisco, 2007)

popular, reliable, and accessible (i.e. the superior to other channels), then it should be adopted exclusively. For the harm in multiple service channels, when they simply duplicate functionality, is the unnecessary additional cost to the city, and ultimately this means less or lower quality services, or higher taxes – a not particularly people-centric consequence.

But before we move on, we must admit that dissatisfaction with digital is often the fault of bad digital experiences and services. And here the onus is squarely on city governments to design (with citizens) and deliver high quality digital services which embody the ‘user-friendly’ experience. Again, this accords with our principle of people first, as poor digital services should never be inflicted on citizens, not should citizens endure them. To summarise, though legitimate objections to digital democracy might be raised, leading digital cities will address such concerns by citizen engagement, co-design, committing to better digital services, and digital inclusion initiatives, not by ignoring, devaluing or deferring the digital revolution.

First people, then services, then technology.

And now, let us return again to our digital democracy standard, propounded at the very start of this section. The City of San Francisco describes it thus:

“Our vision is less about the technology (which we care about very deeply), and more about people, community and culture change. Technology enables. But it is our belief that values shape technology – not the other way around.”³²

Or, as plainly stated in this report: first people, then services, then technology. And so we have through this section addressed the first two criteria. As a leading digital city (applying digital philosophy and digital technology) we are actively engaged with people, and they are engaged with us in turn, and our service requirements are thus well understood through this relationship. Now we arrive at the third criterion, digital delivery, and the need to understand the technological options, digital possibilities, vendors and the market, procurement, contracts, partnerships, incentives and business models. All most important, to translate digital democracy into tangible change, reform and improvement for the city. For what profits all the citizen engagement and digital democracy if positive and direct change is not the result? It is simply inauthentic, ineffective, ergo unprofitable and discreditable. Better

³² (San Francisco Municipal Transportation Agency, 2016)

services that are modern, citizen-centred, efficient and outcome-focused must be the result, and must be in reality and perception. And this result depends on digital delivery, which we will explore in the following section.

OPTIMISING DIGITAL CITY ACTION

PRIORITISATION AND SEQUENCING

A digital city plan gives direction, digital governance gives the power, and digital frameworks and guidelines gives the standards and rules. Solid digital city foundations! But more is yet required.

The actions!! What digital projects and initiatives should a city give favour too? And in what order?

Too often these questions are answered by opportunism, serendipity, convenience, and the best or latest digital sales person. And indeed, there is something to be said for the ad hoc opportunistic approach to picking low hanging fruit, and riding the latest tech wave. Because this drives change, builds digital momentum, uncovers opportunity, and learns lessons. However, the more mature cities, who strive to optimise digital activity and investment, will take a more sophisticated approach.

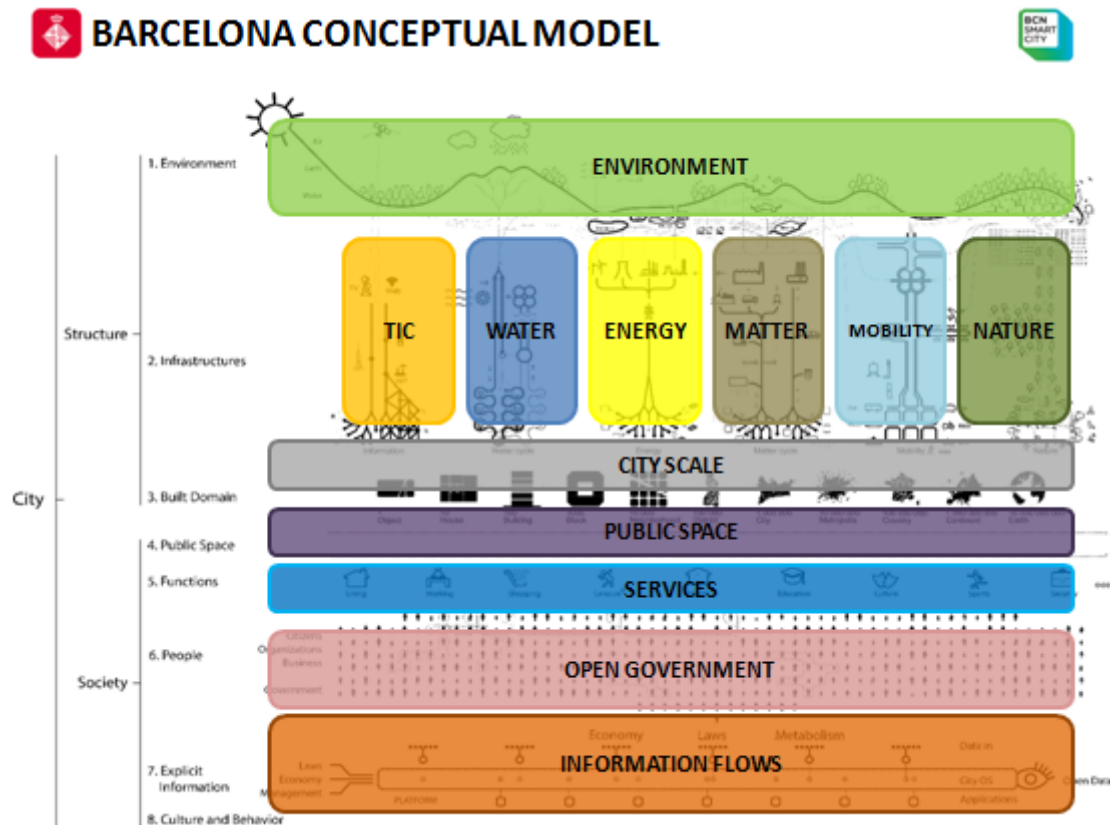
The question of ‘what digital projects?’ should be answered not by opportunism, serendipity, or fashion, but by careful assessment and prioritisation.

As noted in my introduction, this Report will not (and is premised on the fact that it cannot) present a city template for digital objectives, or a text-book priority list of digital initiatives and sequencing. And I reiterate that this is neither feasible nor desirable, even when cities might have broadly similar digital aspirations, due to vast differences in the regulatory cultural, financial, political, demographic, and historical landscapes of cities. Rather, what we can explore and suggest, with sound application for all cities, notwithstanding their dissimilarities, is a robust process for identifying, comparing, and prioritising digital city actions.

Let us start with the process of identifying possible initiatives. And all the while, remember our assumption that we now have a digital city plan, governance and supporting frameworks that provide the lens and focus to guide this identification.

First, we should disassemble our digital city into its key elements, to keep the task ordered and comprehensible. How this is done is discretionary. One could break the digital city down by the objectives in the digital city plan. Or perhaps a more technical classification by digital services, systems, capability, and infrastructure. Perhaps from the perspective of the

data which underpins smart city functionality as proposed by (Wenge, Zhang, Dave, Chao, & Hao, 2014). Or by digital relationships, as in Seoul, who have classified digital projects as G2C (government to citizen), G2B (government to business), and G2G (government to government).³³ An example of digital city architecture is provided by Barcelona in the diagram below.³⁴



Second, once we have our digital city architecture, we must then assess each of the elements, and the interconnections. Again, our method of assessment is flexible. Suppose we are working with digital architecture as per the example diagram, then we might assess these elements based on a simple strength weakness opportunity and threat (SWOT) analysis. And if we wish to be more sophisticated, we could add quantitative measures and risk analysis to provide an objective view. In either case, we now have a basis to make informed decisions about areas of risk, priority, and opportunity.

³³ (Seoul Metropolitan Government , 2014)

³⁴

Third, once we have our digital city assessment, we can start to develop project options, or more specifically, possible solutions to identified weaknesses and problems, and actions to retain strengths and realise opportunities. The risk of developing options before such assessment is the

Exclusive top-down digital city planning and prioritisation is an anachronism that modern digital cities can ill afford.

propensity to copy from other cities and posit tech solutions and products without defined problems and objects – that is to say, option development in a vacuum is untargeted and inevitably imitative. But no, that is not our fate! For we have the assessment, and can target our projects and solutions to subjects of highest value. In terms of process, I should go no further before highlighting the need to have strong stakeholder engagement throughout, both within and external to government. It almost goes without saying, but I say it anyway, as the benefits of early buy-in, diversity and expertise in perspective, and relationship investment, are too significant to neglect. And we shall say more in coming pages about the value, indeed the necessity, of engaging outside of government to broaden and sharpen the option set. Exclusive top-down digital city planning and prioritisation is an anachronism that modern digital cities can ill afford.

And now, finally we have our digital project options, directed by our digital plan and aspirations, framed by our digital architecture, targeted by systematic assessment, and distilled by collaboration and engagement.

So, onward to the tricky but critical business of comparing and prioritising our digital city project options. At this point, the project options should be properly scoped, including scale, cost, revenues, and timing. And the business cases should start to confirm individual project value and integrity, and allow basic project comparisons. If the business case is strong, it will also include a financial and cost benefit analysis, including Return on Investment (ROI) and Cost-Benefit Ratios (CBR). And it is these figures, whereby possible digital projects are made comparable, which leading digital cities use to prioritise their effort and investment. Clearly, *ceteris paribus*, a digital project with a ROI of 210% and CBR of 3.5 should be preferred to a project with ROI of 35% and CBR of 0.7. Thus, supported by rigorous process and assessment, can city decision makers choose optimal digital pathways – priorities and sequencing that maximise economic and financial benefits for their cities - rather than be subject to the winds of mimicry, fad, and sales pitches.

The mechanics and the strengths of financial assessments and cost benefit analysis (CBA) are well known, and need not be rehearsed here. More relevant to this Report are limitations of the cost-benefit methodology, and alternative assessment approaches, which are worth exploring further. The weaknesses of CBA are widely acknowledged, and include the cost and complexity of the method, reliance on data (which is often not available), sensitivity to assumptions and inter-temporal discount rates, inability to measure intangibles (like aesthetics, culture, and beliefs) and its blunt approach to equity dimensions.³⁵ For these reasons, it might not be practical for a city to prepare a full CBA, especially when aiming to compare a wide range and number of digital project options, nor might the single CBA output deal adequately with important city considerations relating to equity, culture, and beauty, nor might it support a participatory process or effective communication of decision rationality.

To address these limitations, many cities use Multi-criteria Analysis (MCA) to assess their digital project options. MCA is commonly used when there are multiple goals to be balanced (rather than simply maximising economic value, and imagining the potential value being redistributed so no-one loses), and multiple stakeholders with different objects. As the name suggests, MCA rests on the identification of a specific number of objectives, with corresponding indicators and attributes, measured, sometimes in monetary values, but more often by scoring, weighing and ranking a number of qualitative impacts and criteria. MCA is also characterised by inclusion of stakeholders in the assessment process, to ensure weighting of all perspectives, and buy-in to the final decision and guaranteeing implementation phases.³⁶ As noted in subsequent sections of this Report, collaborative partnerships are a critical part of digital city value creation, which adds heft to applying the MCA methodology.

³⁵ (Beria, Maltese, & Mariotti, 2012)

³⁶ (Beria, Maltese, & Mariotti, 2012)

Barcelona City presents an excellent case study in the use of MCA. In fact Barcelona City has developed its own MCA in collaboration with Smart Engineering at the Universitat Politècnica de Catalunya. The Prioritisation Index for Heterogeneous Urban Investments (PIHUI) identifies economic, social and environmental requirements with corresponding criteria and indicators which are all weighted. All alternative projects are then assessed against the criteria and assigned scores, which (by mathematical function) determine a project index and ranking. The wonderful innovation of this particular MCA method is the ability to assess heterogeneous projects, unlike other methods that allow only homogenous project assessment, say a range of proposed projects relating to a particular public transport objective. This facility is especially valuable for digital city projects, which may relate to various objects (from transport to planning to waste to business development), and various agents (from digital systems to services to partnerships to policies). The PIHUI has proven most valuable in Barcelona, allowing smart city decisions to be made according to clear, consistent and transparent criteria, encouraging inclusive project assessment, and being easily adapted as the decision

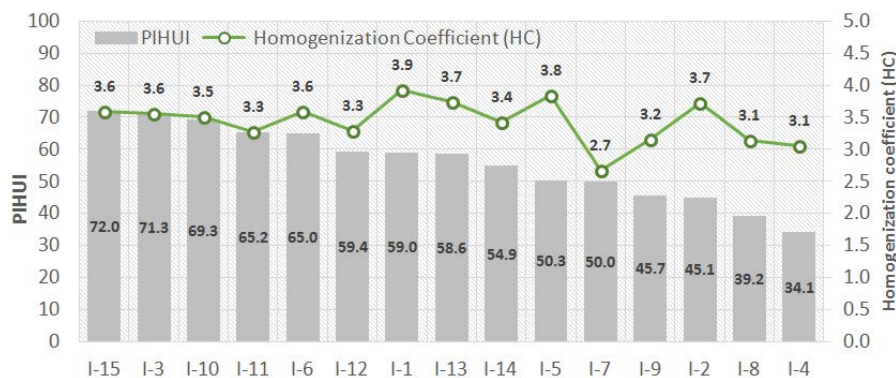


Figure 2- Prioritization ranking of the 15 heterogeneous public investment projects.

makers' criteria changes. Moreover, academic testing has demonstrated the robustness of this MCA approach, showing that the PIHUI supports accurate, consistent and repeatable evaluation.³⁷

³⁷ (Álvarez, 2016)

Here now we have two methods (CBA and MCA) to compare and prioritise digital city projects. And there are others. Which method is to be preferred depends on circumstance – the critical matter is for cities to adopt some formal digital assessment method, to secure systematic, transparent, superior decision making. Moreover, it should not be imagined that these methods are mutually exclusive. CBA and MCA can be, and often are, used as complements (through their rankings may not be consistent), and can also be integrated, such that the CBA becomes one of the criteria in a larger MCA.

No matter our preferred method, once we have the assessment of our entire option set and rankings, the question then becomes: how many projects should be prioritised for implementation? This depends, for the most part, on three constraints: the quality of the projects; the city hurdle rate; and available funding. The first constraint relates to whether the project options meet basic viability tests, as embedded in the assessment methodology. For example, does the present value of benefits exceed the present value of costs under CBA, or

So we have our digital city priority projects, hewn from the fertile branches of smart city possibility, by deliberate planning, engagement, and assessment.

does the project meet fundamental regulatory criteria under a MCA. In essence, are the possible projects any good!! Hopefully we have a fair selection of digital projects that pass this first test. The second constraint relates to the appropriate level of return (over and above $NPV > 0$, and MCA ticks) which a city deems appropriate, when it must deal with funding scarcity and a range of competing city

investment priorities beyond digital. So, for example, while we might have 10 digital projects with a positive NPV (with discount rate of 10%), once we apply the city hurdle rate (say 15% in this instance), we might only have 6 projects left. And finally, the last constraint which might bind our project prioritisation is the designated level of funding available. Following our example above, if the 6 remaining projects require \$3 million in funding, but we only have \$2 million, then we must further prioritise our projects so not to break our budget constraint.

So we have our digital city priority projects, hewn from the fertile branches of smart city possibility, by deliberate planning, engagement, and assessment. What now is to be said for sequencing? What is the best order of investment and delivery? A simple matter indeed, when our digital projects are *independent*: that is to say, when each project stands alone, having no impact upon the other digital projects, and not being impacted itself. In such

conditions, the optimal sequence is to invest in the highest ranked project (as per the chosen assessment method) first, then continue down the rankings, 2nd, then 3rd, then 4th and so on, and deliver all such projects above the designated hurdle rate and within our budget constraints. Easy! And so it will be for many prioritisation processes. Alas, the world is not always so simple, especially the digital city world, whose very essence is interconnection and integration, where networks, systems, infrastructure and services can have multiple interdependencies. So might a city network project rise higher in the optimal investment sequence, if a number of other digital city projects are dependent on such a network. And a new data management system might similarly be prioritised earlier if it bestows positive benefits on proposed sensor based data collection projects. We can easily comprehend how important these interdependencies are in determining the optimal sequence of digital projects. And we can also imagine the great layers of complexity that have now been added to the assessment process.

How then are cities to formally account for this additional complexity? Let me suggest two possible solutions. First, to *satisfice* in the face of complexity, and to investigate and identify the interdependencies as part of the CBA or MCA assessment, and make assumptions about sensible sequencing (and possibly project integrations) which are based on experience and logic. These assumptions then form a set of sequencing constraints, whereby the ranking under the CBA or MCA can be reordered to give the satisfied investment pathway. A simple solution, and often very effective, but subject to the weakness of untested assumptions and heuristics. The second solution is to be even more *sophisticated* in the face of complexity, applying more advanced mathematical techniques to the CBA and MCA, which can test a great number of posited interdependencies and pathway permutations. Such portfolio and pathway optimisation techniques are being more commonly applied to city infrastructure systems with interdependencies, and will determine the optimal investment pathway. Naturally, the second option will demand greater expertise, time and cost, and this must be weighed up against the expected marginal improvement in sequence optimisation. Again, the critical matter for cities is to engage with these interdependencies, which can have significant impacts on sequencing, to apply *a* method, no matter how basic, to account for this complexity, and to continue building the sophistication of their assessment method over time.

NEW BUSINESS MODELS

The digital city demands innovation, not only in technology, services and citizen engagement, but in business models, funding, and partnerships. The day of smart city projects 100% funded and directed by government is waning. As San Jose City Council says, ‘their smart city potential comes not from public funding, which is limited, but from being part of the world’s most innovative community ..’.

San Jose is walking the talk.

And San Jose is walking the talk. In a flagship example, the City Council is partnering with Philips Corporation to install 50 SmartPoles which have an LED light-head and contain microcell equipment.³⁸ For every SmartPole installed, Philips is upgrading 15 streetlights in



the surrounding neighbourhood to modern LED streetlights. And the financial cost to the City Council of upgrading 800 streetlights to energy saving, cost saving modern technology? Zero! No cost to the City Council and their citizens! Philips Corporation is upgrading the streetlights for free as they are able to sell the micro cell capacity on the Smartpoles to mobile carriers, who are always looking for new capacity as mobile data demand continues to soar. And so lighting amenity is increased, public assets are upgraded, energy efficiency is improved, commercial opportunity is enabled, mobile connectivity and its economic benefit is expanded, and the City Budget is protected. New value, created, captured and shared by leveraging a new business model and partnership.

³⁸ (City of San Jose, 2015)

These levers are also operating in New York where their LinkNYC initiative is blazing new digital city trails. LinkNYC is a communications network that will replace over 7,500 pay phones across the five boroughs with new structures called Links. Each Link will provide superfast, free public Wi-Fi, phone calls, device charging and a tablet for Internet browsing, access to city services, maps and directions. LinkNYC is delivered under a Franchise Agreement with the New York City Department of Information Technology and Telecommunications by CityBridge, a consortium of leading experts in technology, advertising, connectivity and user experience. And as in San Jose, LinkNYC will come at no cost to taxpayers, as the project generates its own revenue through advertising, sponsorships and partnerships. In fact, LinkNYC is expected to generate more than half of a billion dollars in revenue for the City of New York, under the 50/50 revenue-sharing arrangements.³⁹

LinkNYC initiative is blazing new digital city trails.



As with individual business models, so too is innovation being applied to entire digital markets. A prime example is the establishment of the City Data Exchange (CDE) in Copenhagen, launched in May 2016. The CDE is essentially an online stock exchange for data, where public and private data can be bought and sold. Hitachi, who won the tender by the City of Copenhagen, worked with the City as well as companies, universities, not-for-profits and other cities to develop the CDE. The Exchange brings together data from a range

³⁹ (LinkNYC, 2016)

of sources and organisations (not just government), where some data is free, and some is monetised.⁴⁰

This initiative addresses three systematic weaknesses with the global push for better access and use of data, widely activated under the banners of ‘big data’ and ‘open data’.

- First, the fragmentation of data sources across organisations, the invisibility of many of these sources, and, accordingly, the high cost of searching for data.
- Second, the low incentive to both collect and then to release data due to the inherent cost.
- Third, the lack of clear signals about what data is in demand, and how it is valued.

CDE in Copenhagen: an online stock exchange for data, where public and private data can be bought and sold.

All these weaknesses and frictions are classic symptoms of market failure, where lack of information, coordination, signals, and incentives lead to sub-optimal supply and consumption of data, and thus, in a world of complexity needing untangling through evidence-based policy and analysis, to sub-optimal city and citizen outcomes. A market, such as CDE,

properly designed and operated, is the predictable and positive resolution of these data problems.

Understandably, proponents of ‘open data’ (or more specifically, ‘freely available public data’) may have reservations about such integrated data markets, particularly any charge for government data sets - rightly considered a community asset - and the attendant diminution of transparency and public value. However, the current counterfactual, whereby government data sets (despite open government requirements) are (in general) not being released to the high standards of timeliness, quality, breadth and depth envisioned by the community and open government aspirations. The discipline and openness of a market mechanism can address these present ‘open data’ limitations, through incentives to improve data quality, undertake (previously) marginal data collection and release, increase data frequency, find economies of scale, reduce data costs, and expand data offerings. Of course, there are many data sets, because of the significant community interest and positive public externalities, which should always be freely and regularly available. Open government provisions should

⁴⁰ (City Data Exchange, 2016)

be carefully designed to identify and balance these interests, giving clear direction about how to classify public data and ensure appropriate public availability. More sophisticated open government policies, which recognise and leverage both market and non-market mechanisms to maximise data availability and release, should be preferred to blanket open data provisions which may have perverse impacts on both data quality and quantity.

City governments are also applying new models to encourage and reward citizen engagement and affirm positive behaviours. In Seoul, for instance, citizen participation on the Oasis of 10 Million Imagination platform is rewarded through a Mileage Membership System where points are accumulated for registering, making suggestions or leaving comments. Mileage points can then be exchanged on the Seoul City website for gift certificates or T-Money (used on the public transport system). The object is for citizens to remain engaged and continue participating, and the agent of influence is simple, cheap and effective. While such reward systems have a long history and wide usage in commercial spheres, they have been adopted slowly and cautiously by governments, for many reasons, including natural conservatism, a desire to differentiate public goods, and equity concerns. City governments should revisit these hesitations, and identify opportunities (within proper guidelines) to apply rewards, gamification, and behavioural economic principles that support their digital city programs.

PARTNERSHIPS

Partnership is the new black in government. Especially in the digital city which is built on networks, co-design, innovation and connecting things, ideas, data, and people. Truly no man, no woman, no organisation, no thing is an island, entire of itself, in the digital city. And we have noted already many examples of successful partnerships in this report: civic partnerships in Seoul, data partnerships in Copenhagen, and municipal/telecommunication partnerships in San Jose.

*Partnership is the new black,
especially in the digital city.*

Leading digital cities understand and embrace these connections. They are receptive to the opportunities of course, but also systematic and deliberate in both planning for, and entering into partnerships. So in San Jose, for example, one of their smart city values is to “effectively partner with the private sector, universities, foundations and other organizations to accelerate impact”.

And to make this a reality San Jose has committed to making it easier to partner with the City, by:

- creating an Office of Strategic Partnerships in the Mayor's Office to provide a single point-of-contact for philanthropic and private sector organizations, to improve their ability to secure external expertise and resources to drive results; and
- streamlining procurement processes to more easily work with the city on initiatives.⁴¹

Such commitment recognises that, notwithstanding possible benefits, all relationships have a cost - in time, friction, opportunity and effort - and these costs often preclude or cruel partnerships. For cities seeking positive partnerships, they should first identify and smooth the systematic and procedural points of friction and cost. As San Jose says, it should be easy to partner with the City. No need to gift-wrap the partnership in red tape!

Partnerships should also be resilient, and maintain mutual interest and mutual benefit in achieving the desired outcome. The operative words here are 'mutual benefit' and 'outcome'. Regarding mutuality, partnerships which become one-sided, by change of circumstance or poor design, are not sustainable. The partner whose benefit has been compromised has little incentive to invest in and continue the joint initiative. Creating and sharing value is the ongoing imperative. Regarding outcomes, this is the very purpose of action and partnership, not the partnership itself (even if it does provide a good media release), nor indeed the outputs it produces. What we want is impact!

Increased digital literacy in disadvantaged youths is the object, not an online education app which no-one uses. Improved innovation commercialisation is our aim, not establishing an 'innovation forum' which is a fun weekly social gathering. We don't want partners washing their hands when a product is delivered (be it an app, or an innovation forum, or whatever), with no incentive to translate it into positive community impacts. Rather, we should aspire to partnerships where all parties are committed to an outcome, and all share benefit in achieving the outcome.

Make doing business easy: no need to gift-wrap the partnership in red tape!

⁴¹ (City of San Jose, 2016)

Copenhagen's collaboration with Hitachi provides a good example of such a partnership. The partnership was formed on a vision of increasing the availability and the use of public and private data. And while this involves delivering a product, the city data exchange in this case, the partnership does not end there. Rather, both the city and Hitachi remain committed to the outcome, and have the interests and incentives embedded in their partnership to deliver more useful data (the outcome!), not just an online data market (the output).⁴²

Having examined methods of attaining and sustaining positive partnerships, let us now briefly discuss key digital city partners:

- First and foremost (and credo of this Report) are our **citizens**, and the partnerships to prioritise, co-design, test and improve city services. We have explored this most fundamental partnership in the digital democracy section of this report, and need say nothing more here.
- **Private vendors** who (for the most part) deliver our digital solutions (infrastructure, networks, sensors, systems, services etc) on behalf of the city. And these, naturally, are critical partners for their technological and delivery capability which turns digital objectives into reality. Now I have made reference in this Report already to the risk of city governments wandering into sub-optimal partnerships with vendors, and buying products that they did not actually need, or did not work the way they hoped. To be clear, this is a warning to city governments not to be under-prepared buyers, rather than a criticism of (or aspersion towards) the vendors as digital city advocates and sellers. Moreover, beyond being providers of valuable digital products and solutions, private vendors often play a crucial role in raising awareness of digital possibility within city government and the community, catalysing change and action, uncovering red tape, questioning unfounded risk profiles, and building new business models to create and share value. That is to say, private vendors may act as a disruptive digital force, and the city must proactively engage with such disruption, to ride the wave when it offers a good break, and to close the beach when people will get hurt.

⁴² Interviews with Copenhagen.

- **Innovators** (local and beyond) are also effective agents of change and disruption – energy most necessary for evolution and improvement. The city innovation ecosystem should be nourished and encouraged to partner with the city to solve urban and community challenges. This is discussed further in the next section.
- **Other cities** – while each city is unique, a host of digital skills, experiences, solutions and lessons are transferable between cities, at least in part. Inter-city digital partnerships are a very useful means of leveraging effort and accelerating results. (Indeed this is the very premise of this Report!)
- **Academics and researchers** offer expertise in scientific, mathematical, computer, engineering, economic, and social theory, analysis and evaluation that far outstrips that of city government. Partnerships that apply this capability to analyse complex city problems and design highly technical, innovative solutions will be particularly valuable.

We have already noted a range of such partnerships through this Report, from partnerships with citizens in Seoul, to corporate partnerships in San Jose, and a multi-lateral city partnership in New York. To reinforce the point, a few more examples:

- San Jose is partnering with Intel to implement an IoT Smart City Demonstration Platform, which leverages a network of air quality, sound and microclimate sensors to further the City's Green Vision initiative.⁴³
- Stockholm is applying the 'triple helix' model (public, private, academic), partnering with five large corporations (ABB, Ericsson, Scania, Skanska and Vattenfall) as well as the KTH Royal Institute of Technology to develop, pilot and evaluate innovative initiatives to address city challenges.⁴⁴

⁴³ (Smart America, 2014)

⁴⁴ Survey response from Stockholm.

- San Francisco is partnering with City Innovate, a not-for-profit organisation that brings together the private, public and academic sectors to collaborate and co-create solutions to urban problems.⁴⁵
- The City of Raleigh in North Carolina partners with the North Carolina State University on a range of smart city enterprises such as project-oriented work that is student/classroom based, and collaboration on grant applications.⁴⁶
- New York is a member of Civic Hall, a multi-lateral partnership hub, community center for the world's civic innovators, and space where social entrepreneurs, change-makers, government employees, hackers, academics, journalists, and artists can share knowledge, build tools, and solve problems together.⁴⁷

DIGITAL INNOVATION

Digital city is almost synonymous with innovation. Both involve change, redesign, new ideas, doing things differently, and connecting things in fresh ways. So to be a digital city is to embrace innovation, and to be innovative embraces digital.

This symbiosis is well understood by leading digital cities. And their efforts to encourage, promote and support innovation are a pillar of digital strategies world over.

Before noting these innovation efforts, we must consider - as we did previously with partnerships - the structural and systematic barriers to innovation in the digital city. Leaving an exhaustive study of this worthy topic to more dedicated research reports, I present two of the most relevant for digital innovation. First, the regulatory, technical, bureaucratic and procedural constraints – or, in other words, red tape, archaic regulation, unwieldy administration, and the historical accretion or irregularity of government processes. Undesirable at the best of times, but particularly toxic for digital innovation which tends to be at the edge of technological and social change, and

City governments should proactively identify regulatory and administrative barriers, and reform and modernise to assist (rather than impede) innovation.

⁴⁵ (City Innovate Foundation , 2016)

⁴⁶ Survey response from Raleigh.

⁴⁷ (Civic Hall, 2016)

therefore the furthest ahead of laws, regulation, standards, and bureaucracy. By way of example, a general theme of my digital city interviews was the great difficulty in progressing digital innovation relating to light-poles (be it for wi-fi, smart nodes, or smart street lighting) because the relevant laws, regulations, relationships and protocols simply do not anticipate or encompass such innovation. And let me say, that having encountered this nexus of modern innovation and historical utility regulation, great persistence and ingenuity has been applied around the world to overcome these challenges. The preferred approach is for city governments to proactively identify such regulatory and administrative barriers, and reform and modernise to assist innovation, rather than impede. Cities with digital aspiration should include such a program of regulatory and process reform in their digital plans and governance.

The second barrier is the risk tolerance of city governments, which, generally speaking, is relatively low. That is to say, when dealing with public monies, there is traditionally high accountability, high scrutiny, and high sensitivity to ‘failure’, all of which inclines to low change, low risk initiatives and expenditure. But this is the antithesis of innovation! And it is a constraint which leading digital cities recognise and are grappling with. In San Jose, for instance, one of their smart city values is to “embrace calculated risks, pilot new initiatives and iterate to learn from failure before scaling”. And this is a fair summary of how many digital cities are addressing this challenge of low public risk tolerance. Start small, experiment and trial solutions, evaluate and learn from mistakes, and then, if the solution works, scale up. This is a tried and tested approach, which lowers the innovation risk profile, through imputed insurance premiums of time and money invested up-front. However, this routine raises questions about whether the cost of insurance is good-value, what is the appropriate level of risk for city governments (beyond the risk sensitivity of negative newspaper headlines, and supposed/imagined community outrage), and the possibility of more sophisticated approaches to risk management (such as whole of council digital innovation insurance). This entire subject is again deserving of more complete research and investigation. But in short, cities must be more sophisticated in how they engage with and manage risk.

Beyond addressing these systematic inhibitors to innovation, leading digital cities are busy creating a city-wide eco-system to promote and catalyse innovation. In particular cities are establishing urban innovation labs. Urban lab what now? Put simply, experimentation (ergo lab) on the street (ergo urban). And this innovation facility is enabled and permitted by the

city (under an agreed framework, guidelines, and incentives) to trial, test, and evaluate innovative technology and digital solutions on the city street, in real life, in real time, live - hence the alternative title, 'living lab'. A few examples from our digital city subjects:

- Barcelona has a beautifully expressed innovation goal of “creating a dialogue and experimentation agora” where anyone can progress smart city innovation and research.⁴⁸ This goal is epitomised by the Barcelona Urban Lab which facilitates use of public space to trial innovative products and technology to support commercialisation and improve municipal services for the community. Pilot projects to date have included traffic lights adapted for the blind, remote utility meter readings, and smart street lights fitted with presence, vibration, temperature, humidity, sound and pollution sensors, GSM aerials, Wifi Mesh access point and webcam for video surveillance functions.⁴⁹
- The Copenhagen Street Lab was established to test digital solutions to urban challenges in a real life setting. Citizens, companies and researchers are invited to submit smart city solutions. If the proposal meets certain criteria, the city works with the innovation partner to refine the solution, install technology, iterate the test, and evaluate the results.⁵⁰
- The Municipality of Copenhagen is also a founding partner of the Danish Outdoor Light Lab (DOLL). Using their three labs – living, virtual and quality – DOLL works with municipalities, innovators and private companies to develop and test smart lighting and smart city technology.⁵¹
- In Seoul, the Bukchon Hanon village, a popular tourist district, has been designated as a Living Lab where private companies are able to trial IoT technologies. To date, free public wi-fi has been provided to the entire district, CCTV cameras have been installed for safety and monitoring of foot traffic, a multi-language tourist map with

⁴⁸ (City of Barcelona, 2014)

⁴⁹ (22@Barcelona, 2016)

⁵⁰ (City of Copenhagen, 2016)

⁵¹ (Danish Outdoor Lighting Lab, 2016)

open Application Programming Interface (API) has been developed, and an open public IoT platform is being created.⁵²

- The City of Stockholm is an active partner in the Urban ICT Arena, an open co-creation arena in Kista, where digital technology is developed, tested and showcased in an urban environment.⁵³
- San Francisco identifies its city as an urban laboratory and aims to engage the community to crowd source the best locations for testing.⁵⁴
- San Jose has established an innovation zone and is encouraging start-ups and innovators to test and trail new technology in their city. They are facilitating such innovation by hosting ‘demo days’ to showcase innovative companies in Silicon Valley, as well as sponsoring public competitions to crowd source solutions to civic challenges.⁵⁵

⁵² (Seoul Metropolitan Government, 2015)

⁵³ (Urban ICT Arena, 2016)

⁵⁴ (San Francisco Municipal Transportation Agency, 2016)

⁵⁵ (City of San Jose, 2016)

CONCLUSION

Dear reader, we have arrived at the final section! So many words have brought us here. Many examples of digital city excellence. Many observations, thoughts and ideas, from the mundane and obvious, to the incredible and opinionated, and all in between. Let me distill them all into a few key conclusions. Let's aim for ten. It's a very good number. Memorable.

i.

Be a digital democracy. Easy. Just be one, right. Ahhh, this is an ocean as wide as it is deep! A voyage for many Churchill Fellowship reports. But for now, a brief cruise. Put people at the centre of the digital city. Commit to a city that is citizen-centric and user-friendly. Actively engage and empower citizens and visitors, using modern real-time digital mechanisms (and other modes as citizens choose). Co-design with citizens – have them apply their creativity and criticality to proposed city services. Be a real open government, where digital helps makes government transparent and accessible, where open data is quality and timely. And remember, above all: people first, then services, then technology.

ii.

Get a digital city plan. Align it with the city strategic plan. City government to lead and coordinate. Engage all stakeholders in the planning process. And keep the plan fresh. Don't get lost in the big digital world, and don't let 'opportunity' find you. Set your own path. Raise a banner that all your digital people believe in. And create the city you want.

iii.

Establish digital city governance. Get clear leadership and central coordinating authority, and include all players. There are too many players, too much complexity, and too much project interdependence to discount governance or to designate as peripheral. Governance! It's boring, and difficult, I know, but if you want a digital city, it's really important. Say it with me now, governance!

iv.

Develop and advertise digital city guidelines and standards. No-one wants sub-standard or misguided digital! Digital city policies and standards ensure consistency, keep citizens first, reduce risk, protect security and privacy, allow integration, account for openness, and promote scalability. They empower our digital city players, giving them guidance and certainty, while preserving our desired standards of performance.

v.

Prioritise digital projects. So many digital initiatives, not enough time and money! You've got to pick the best ones, for your city, and imitation or subjective judgment is not the best way. Rather, apply a transparent, objective method, and refine and improve the method over time. Get your stakeholders involved. Prepare a business case. Be daring and try to integrate CBA and MCA analysis. Remember that digital projects are often interdependent, so give thought to sequencing.

vi.

Leverage new business models. And leverage old (existing) city assets. Digital city projects, often leaning on existing physical city infrastructure, create new value from data, communication capacity, efficiency, advertising, and new services. The right business model can maximise, unlock and share this value. Projects that deliver new services for the city, and money to the city budget are possible. Don't go thinking that more public spending is the only way to create a digital city. Because, it ain't so.

vii.

Partner for the win in the digital city! Connecting ideas, technology, expertise, things and people is the essence of digital transformation. Partnership is a given. Identify and reduce systematic partnership friction and barriers – make it easy to partner. Get digital partnerships to stick, by keeping focus and incentives on the shared outcome - move beyond the memoranda of understanding (MOU), the media release and the product.

viii.

Support digital city action with complementary regulatory modernisation. Old laws, old processes, old administration are a great barrier to new ideas, new culture, new innovation and new technology. Regulation needs to keep up with societal change, not dissuade and distort positive evolution.

ix.

Gear your city for digital innovation. Innovation in cities will happen. It is inexorable. But we can hinder or accelerate. We can be indifferent to the innovation ecosystem. Or we can permit, encourage and showcase innovation. A simple method is to recognise and promote the city itself as a great big living laboratory for digital experimentation and trial. Good for business commercialisation, good for innovation culture and community engagement, good for municipal service improvement. At the same time, it's worth reviewing the city's risk management assumptions and practices – there may be better ways to manage and insure the risk of digital innovation.

x.

Set digital city performance targets and evaluate. Did you notice? This conclusion is not even discussed or foreshadowed in this Report! Not necessarily because leading digital cities lack, but because it's often not readily apparent. But this in itself is informative. So let's back ourselves. Be clear about our digital city objectives, set some targets, put them online and in the digital city plan, get baselines and data, be accountable, and evaluate projects and share findings, so we can all do better.

How might this Report and its conclusions be applied in Australia? Or more generally, how can a review of international digital cities, their experiences, achievements and lessons, help accelerate the creation, connection and application of digital technology in Australian cities and towns? Indeed this is a topical question, and the subject of national dialogue in light of the Australian Government's current smart city policy agenda and smart cities and suburbs program. And there is certainly much to be gained for Australia in modeling international

digital city best practice and anticipating the manifold hurdles of digital city planning and delivery. Accordingly, key points of application for Australia will include:

- in establishing or resetting their digital/smart city agenda, cities and towns could do worse than review their plans and progress against the ten conclusions of this Report, as listed above;
- as our international counterparts have done well for many years, Australian cities and towns (individually and collectively) need to better narrate and promote their digital city achievements. Australia has excellent smart city stories to tell, but international recognition is low, and this moderates the attraction of digital investment, innovation and capability;
- rather than jump to funding exciting digital initiatives and solutions, we might apply the maxim of ‘people first, then services, then technology’, and better assimilate active citizen engagement and co-design into the development and prioritisation of our digital projects;
- where citizen and city needs are aligned, cities should look at opportunities to co-develop and co-fund digital solutions, and thereby leverage expertise, capital and procurement process;
- while such inter-city partnerships will be formed for proposals to the Australian Government as part of the smart cities and suburbs program (being a program requirement), councils should also give thought to forming multi-lateral partnerships combining innovators, private companies and academics, supporting projects with innovative funding and business models;
- we have noted the interdependence of digital city innovation and city regulation. Cities and relevant governments should consider the synergies of coordinating their smart city and regulatory reform (red tape reduction) agendas;
- so too has good governance been stressed as critical for digital city success. Cities should review their governance, giving especial consideration to appropriate levels of

across-city authority and coordinating power, and to incorporation of all stakeholders in the governing framework;

- arguably a single set of digital city standards and guidelines could be adapted by most Australian cities and towns. Instead of duplicating work across Australia, there may be benefit in collaborative development and sharing of such standards. The 21 city partnership in the United States, which coalesced around New York's IoT Guidelines (presented at Appendix 1), demonstrates this possibility;
- more broadly, digital city information and knowledge sharing between Australian cities should be encouraged. As a specific example, technical expertise relating to digital project assessment and prioritization would be a valuable shared resource; and
- where cities and towns are trialing and testing innovative digital solutions, they should consider sharing findings with other cities.

To support application of this Report and better digital city outcomes in Australia, I am in the fortunate position of being an insider, working for the Australian Capital Territory (ACT) Government, as Director of Smart City and Regulatory Reform. (Please note again my introductory caveat that this Report is not endorsed by ACT Government nor is it a statement or reflection of Government policy). So I will remain at the front line of digital city action, working with colleagues locally, nationally and internationally, to deliver better smart city outcomes for Australian cities and towns. In particular I will:

- continue to work on behalf of the ACT Government and the Canberra community, as they direct, to help build a smart city with smart regulation;
- engage with the Australian Government as they shape and deliver their smart city agenda;
- collaborate with counterparts in other States and Territories, cities and towns, to create new digital partnership and shared value; and

- work with other digital city agents to catalyse innovation, develop new business models, build digital city culture and awareness, and wave the banner of ‘people first, then services, then technology’.

This Report and its conclusions will be widely disseminated across Australia and beyond, including by:

- a series of public speaking events;
- direct discussion with digital city colleagues, policy makers, innovators and implementers in Federal, State, Territory, City and Regional governments and councils;
- workshops with digital city stakeholders, companies, advocates, and innovators (i.e. those outside of government)
- participation and interaction at Digital City and Smart City conferences;
- sharing on social media; and,
- media engagement, both interview and written articles.

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APPENDIX 1 NEW YORK IoT GUIDELINES

PRIVACY + TRANSPARENCY

City IoT deployments must protect and respect the privacy of residents and visitors. The City is committed to being open and transparent about the “who, what, where, when, why and how” of data collection, transmission, processing and use.

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1.1: The City should make processes and policies related to IoT and IoT-related data publicly available in an up-to-date, clear and comprehensive manner. IoT principles, guidelines, operational policies and responsibilities should be transparent and made public via a City government website.

1.2: IoT data should only be collected, transmitted, processed and used for specified, explicit and legitimate purposes. The purpose of data collection (e.g., a use case such as monitoring air quality), what data is collected (e.g., particulates in the air) and how data is being collected (e.g., pollution sensor on a light pole) should be transparent and made public via a City government website or other public notice.

1.3: Data and information collected by IoT devices should be classified and treated accordingly, per the City of New York's Data Classification Policy, as Public, Sensitive, Private or Confidential. All personally identifiable information (PII) should be classified at a minimum as private. All data that is classified as being confidential, or personally identifiable, should be protected from unauthorized use and disclosure.

1.4: PII should by default be anonymized before being shared in any way that could make the information publicly searchable or discoverable. Any copies and reproductions must have the same or higher level of classification as the original. Any combinations of data should be reclassified according to the City's Data Classification Policy.

1.5: PII data types should have a clearly associated retention policy and disposal procedure. Sensitive, private or confidential data should be kept for no longer than is operationally necessary or required for the specified, explicit and legitimate purposes.

1.6: Before any sensitive, private, or confidential data is shared outside the originating City agency, the agency should ensure that the need cannot be met by using anonymized or aggregated data and that the appropriate protections are in place to preserve the confidentiality of the data.

1.7: All public data sets are subject to the NYC Open Data Law and as such should be freely accessible via the City's Open Data portal.

DATA MANAGEMENT

City IoT deployments must protect and respect the privacy of residents and visitors. The City is committed to being open and transparent about the “who, what, where, when, why and how” of data collection, transmission, processing and use.

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2.1: IoT systems (e.g. how data is collected, analyzed and used) should be designed with the use case in mind (e.g. predicting demand for trash pick-up based on data on trash volume, weather and events) to maximize the benefits that can be derived data collection (e.g. routing garbage trucks more efficiently). Where useful, relevant business and historical data from the City or its partners should be made available and utilized by applications.

2.2: The desired measurement from any IoT system (e.g. pedestrian counts) should be collected and categorized as efficiently as possible, using as few steps and/or manipulations as necessary.

2.3: IoT data should be collected and stored according to open standards, contain relevant contextual metadata, be exposed through open, standards-based application program interfaces (APIs), and be provided with software development kits (SDKs) where applicable so it can be easily shared or combined with other data sets.

2.4: IoT data should be archived in a federated way and made accessible throughout the City through a central portal (e.g. the City's open data portal) or a catalogue of documented open APIs unless restricted by existing laws or regulations and/or doing so would compromise privacy or public safety. Data from other systems not operated by the City, such as from a private sector partner or from crowdsourcing, that could provide public benefit can also be provided in this form with the source documented accordingly.

2.5: The City recognizes the use of distinct and sometimes conflicting non-proprietary international, national, or industry standards for data and technology interfaces. In cases where standards conflict, the one that most closely aligns to the use case will be selected.

2.6: Each IoT device data set (e.g. temperature) should be validated and verified (e.g. through redundancy in data collection and/or historical data) and the resulting master copy clearly labeled before it is used, aggregated and/or released. Data should be versioned so that any updated data can be distinguished from the original and/or master copy. The retention and disposal policies for the master copy should be explicitly defined.

2.7: IoT data should be both audited and continuously monitored for accuracy and validity. This process should be automated where possible.

2.8: All data sets (e.g. 311 service requests) should be checked for geographic, social or system-driven bias (e.g. geographic differences in civic engagement) and other quality problems. Any biasing factors should be recorded and provided with the data set and corrected where possible.

INFRASTRUCTURE

IoT devices, networks and infrastructure shall be deployed, used, maintained and disposed of in an efficient, responsible and secure manner to maximize public benefit.

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3.1: To support citywide coordination of IoT deployments, City agencies should maintain an inventory of IoT devices that they deploy using a standardized format. City agencies should also maintain an inventory of the public or private assets on which devices are installed and the networks used by these IoT devices including details on the network type (e.g. LTE), security protocol (e.g. WPA), location, service level agreements, and contact information for the network and system operator.

3.2: The City should accumulate and publish, via a City government website, public information on IoT systems including but not limited to examples of deployed IoT devices (e.g. air quality sensors) and the different types of public assets (e.g. light poles) on which they are deployed.

3.3: The City should make public, via a City government website, a standardized protocol, including points of contact, for requesting access to, and approving use of, City assets for IoT deployments. Where appropriate, the City will detail restrictions on particular types of public assets and/or siting restrictions (e.g. rules for landmark or historic districts).

3.4: IoT deployments shall, where possible, leverage or repurpose existing conduit and public assets, maximize energy efficiency, and adhere to sustainable device disposal procedures.

3.5: The City should leverage existing wireless and fixed networks where possible and appropriate. Networks for IoT deployments should be selected to best support the specific use case. This should include but is not limited to ensuring appropriate security protocols, bandwidth, pricing models, and service level agreements (SLAs).

3.6: All IoT devices and network equipment installed by the City, on the City's behalf, or on City property should have clear site license agreements and established terms of service governing who is responsible for ongoing operations, maintenance, and the secure disposal of equipment. IoT devices and network equipment should be labeled clearly with the name and contact information for the responsible party.

3.7: Public assets should be instrumented in an orderly manner that minimizes clutter and allows for ease of access for replacement, repair and addition of new equipment or devices. If new conduit is being installed using public assets (e.g. to access rooftop of public buildings) or using public right-of-way (e.g. in City streets), location details must be filed with the responsible agency and use of the conduit should not be restricted to one party.

3.8: IoT systems should be designed to maximize resiliency in the event of a natural disaster (e.g. severe flooding) or other emergencies (e.g. electrical outages). Critical systems should have established emergency response plans to ensure the appropriate continuity of service.

SECURITY

IoT systems should be designed and operated with security in mind to protect of the public, ensure the integrity of services, and be resilient to attacks.

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4.1: IoT systems should be designed with an explicit focus on minimizing security risks (e.g. unauthorized operation or hacking, system faults, tampering, and environmental risks), limiting the potential impact from a security breach (e.g. the release of personally identifiable information), and ensuring that any compromises can be quickly detected and managed.

4.2: IoT systems should utilize established security frameworks, where possible, and ensure communication between components is tightly constrained.

4.3: Identity and access management controls should be in place to ensure that the right people have access to systems, networks, and data at the right time. Users with access to IoT systems should be identified and authenticated. Identification should be to the individual and not to the role.

4.4: All data should be protected in transit and at rest, and systems should be secured against unauthorized access or operation. Data storage mechanisms must not be easily removed from devices and systems must not have vulnerable external interfaces (e.g. unsecured USB ports).

4.5: All partners utilizing public assets and/or networks for IoT deployments should adhere to the principles and guidelines set by the City. The City has the right to restrict or revoke access to assets, devices, and public networks to protect the public interest and public safety.

4.6: The City and its partners should engage in both audit-based and continuous monitoring to ensure that systems are working and that devices have not been compromised.

4.7: Responsibilities related to security monitoring and the protection of IoT systems should be clearly defined. In the event of a breach, public and private sector entities will be required to comply with the City's breach disclosure and notification requirements.

OPERATIONS + SUSTAINABILITY

All IoT deployments should be structured to maximize public benefit and ensure financial, operational, and environmental sustainability.

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5.1: Demonstrated need, business case, and public benefit (e.g. economic, social, and environmental outcomes) should be required prior to deployment of any new IoT devices or solutions. In addition, proof of concept should be required prior to citywide deployments.

5.2: Prior to deployment, the City and its partners shall identify all stakeholder and user groups (e.g. community residents and city employees) that will be impacted by the IoT solution and establish feedback mechanisms and methods of engagement for these groups. Before and during deployment, the City and its partners should also check for and address biases in the IoT solution (e.g. information asymmetries) that may result in unintended consequences (e.g. inequitable service delivery).

5.3: The City shall prioritize access to its assets and public networks for IoT device deployments that are distributed in an equitable manner and have the greatest public benefit. Public-private partnerships and business models that offset costs or generate revenue in ways aligned with greatest public benefit are encouraged but must be closely evaluated for risk.

5.4: All projects and associated contracts or agreements should outline the “who, what, where, when, why and how” of the implementation, operations, risk management, knowledge transfer, and maintenance of IoT systems. This should include clear definitions related to system and data ownership and responsibilities.

5.5: Solutions shall be designed to be flexible and responsive to evolving needs. Agreements should enable the addition of new functions and update of components over the life of the agreement at a fair and transparent cost.

5.6: Performance metrics should be maintained for solutions. Agreements should specify intended outcomes of a solution and levels of service and provide for penalties, modifications, or terminations of the agreement in the event that the solution does not perform.

5.7: The City and its partners should reuse infrastructures and components where possible, leverage citywide contracts or agreements, and develop solutions collaboratively among agencies to avoid duplicating existing solutions or functions and extract the greatest value from investments.

5.8: All components of a solution should be implemented in a modular manner, prioritizing open standards where possible, to ensure interoperability and prevent dependency on a single vendor.