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# DIGITAL MASTER PLANNING:

## *An Emerging Strategic Practice in Global Cities*

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### ABSTRACT

The 21st century is being shaped by two global trends: the near-total urbanization of the world's population, and the seamless integration of digital information technology throughout the built and manufactured environment. In this third phase of the diffusion of computing, following the mainframe (one computer, many users), and the personal computer (one computer, one user), the dominant model is ubiquitous computing, "in which individuals are surrounded by many networked, spontaneously yet tightly cooperating computers" (Wieser, 1991; Muhlhauser & Gurevych, 2008).

A diverse array of interests are deploying these technologies at an accelerating pace, and a handful of global cities find themselves at the forefront of the convergence of urbanization and computational ubiquity. This working paper investigates a key strategy these cities have developed through the creation of what we call "digital master plans". These plans are attempts to mobilize local stakeholders around visions, goals, and road maps to adapt to these external technological and economic pressures, within local social, economic and political constraints.

We surveyed plans from eight cities - New York, Chicago, London, Barcelona, Singapore, Hong Kong, Dublin, and San Francisco, identifying the scope of content addressed in the plans, the process used to develop the plans, and the overall approach to implementation chosen. We find that while there is little convergence of methodology, the plans share a common set of goals: the amplification of existing investments in infrastructure, government services, and economic development through sustained, incremental innovation in digital technology. We identify four strategic approaches for action for cities considering digital master planning: facilitative, learning, systems and interventionist.

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## **1. CITY GOVERNMENT IN THE DIGITAL ERA**

In the last 12-24 months, no fewer than eight leading world cities have published for the first time or significantly updated major policy documents that describe a comprehensive vision and set of initiatives for deploying digital technologies at the municipal level, and encouraging local information technology-based economic development. While these plans represent a newfound and overdue assumption of leadership in local government over the vision and implementation of ‘smart city’ approaches, they cover a wide-ranging and inconsistent set of issues. Unlike land use plans or transportation plans, which more or less address the same topics in San Francisco as they do in Singapore, there is no consensus yet about what digital master plans should cover, the process by which they should be developed, their legal authority, or how they should be implemented. They carry many different monikers, from Chicago's *Technology Plan* to New York City's *Digital Road Map*, for instance.

The emergence of digital master planning is happening at a crucial moment, as numerous technology products and services – such as Uber and AirBnB – have triggered heated regulatory battles at the municipal level. Some cities have resisted these firms (such as New York City) while others have embraced them (such as Portland, Oregon). But these plans provide a vehicle for developing and implementing frameworks for enabling technological innovation, while protecting vital public interests.

As cities grapple with the transition to a digital economy, expand e-government services and cope with the explosion of internet-connected devices, there is an urgent need to document and understand the state of municipal digital master planning and distill a set of questions for further research. There is also the need to distill the common, successful elements and processes that subsequent planning efforts can re-purpose.

Here we overview recent trends that have set the stage for digital master planning - the rise of e-government, the spread of broadband infrastructure, and the growing recognition of urban planning’s neglect of telecommunications infrastructure.

## ***Information Technology and Urban Citizens***

Digital technologies are playing an important role in significant changes in the way that government institutions conduct their business and connect with their citizens. And expanded use of information technology (IT) in city government has been a key enabler of new processes of governance such as “new public management”, “the minimal state”, “corporate governance”, “good governance” and “self-organising networks” (Rhodes 1996, 653)

Citizen participation in decision-making has the potential to change as governments take advantage of digital technologies and applications to facilitate communication with constituents and to provide online services. During the early part of the 2000s, the potential for new relationships between government and citizen-consumers were being identified, notably through new opportunities for interaction. One early report on electronic government and its opportunities for the United States talks both from the perspective of business models and public administration (McClure 2000, 3–4):

... electronic government refers to government’s use of technology, particularly web-based Internet applications, to enhance the access to and delivery of government information and service to citizens, business partners, employees, other agencies, and government entities. It has the potential to help build better relationships between government and the public by making interaction with citizens smoother, easier, and more efficient. Indeed, government agencies report using electronic commerce to improve core business operations and deliver information and services faster, cheaper, and to wider groups of customers.

Expectations in local government have increased as policy makers have anticipated that technologies such as the world wide web, geographic information systems, CCTV, sensors, or smart cards, not only will improve efficiency and effectiveness of services, but also will transform customer services (OECD 2005).

However, governments often struggle with service design (Gerber 2001; Parker and Heapy 2006) for offline and online services. Early “e-government” initiatives were described by auditors as chaotic and unmanageable (Layne and Lee 2001). There have been complaints of the lack of a theory from academia (Gronlund 2005) and of the lack new

business models for local e-government initiatives beyond improvement of information provision of customer data and service performance (Janssen, Kuk, and Wagenaar 2008).

There is also tension in government over whether to use technological innovations to increase the speed and number of transactions with citizens or to deepen intensive social services (Greenfield 2013; Townsend 2014). Similarly, there is a tension between efforts that focus on front-end or back-end information systems, which have different objectives and characteristics. The front-end responds to customer needs and provides services, where the back-end processes the data from the citizen-consumer and the government to provide information to the front-end. (Allwinkle and Cruickshank 2011).

The longer-term digital transformation of city governments has followed a predictable path from rudimentary cataloging of information to transacting to create customer value (Layne and Lee 2001). But the progression from simple content provision to enhanced interaction is very resource intensive, required changes in organizational practices, value chain activities, and strategic partnerships (West 2004). It also requires greater commitment to co-production in public sector service design with end users (Parker and Heapy 2006). This transition is made even more difficult in cities if the development of information architecture precedes innovation in new delivery and business models (Kuk and Janssen 2011) and in cases where the route to a “smart city” is led by entrepreneurs and amateurs outside of government (Allwinkle and Cruickshank 2011).

### ***Wiring Cities for Growth***

Cities have always lived and died by their communications linkages, which were intimately tied into trade and migration routes. The ascendance of telecommunications (*tele*, Latin root for ‘far’) and the globalization of trade has only made these connections more important. Such was evident at the advent of the industrial revolution, when Henry Estabrook, the Republican orator (and attorney for Western Union) bombastically declared in a speech honoring Charles Minot, who pioneered the use of the telegraph in railroad operations in 1851, “The railroad and the telegraph are the Siamese twins of Commerce, born at the same period of time, developed side by side, united by necessity.” (Estabrook 1913) By 1910, historian Herbert Casson could declare matter-of-factly what was clear to all about yet another technology. “No invention has been more

timely than the telephone,” he wrote. “It arrived at the exact period when it was needed for the organization of great cities and the unification of nations.” (Casson 1910)

Economic development continues to play a major role in motivating local governments to address the development of telecommunications infrastructure, and the business environment for firms that capitalize on advances in information processing and media. Since the 1960s, in the United States, ‘wired city’ initiatives have sought to employ new technologies such as cable television and fiber optics to create platforms for economic growth. Many global cities facilitated the development of satellite uplink stations during the 1980s to serve multinationals in the financial and broadcast media industries, through various mechanisms such as land grants, tax incentives and special financing.

More recently, however, the emphasis in has shifted from hardware to human resources, and direct job creation, as the growth cycle of technology firms has shortened dramatically. What’s more, the industries thriving on these new infrastructures have expanded while employment in traditional information and transactional activities has declined in many global cities. For instance, in New York City alone, during the volatile restructuring after the 2007-2008 financial crisis (2007-2012), the “information technology” sector grew by 28.7 percent, even as the banking, legal and publishing sectors all shrank. (Center for an Urban Future 2012)

The landscape for technology-enabled economic development policy and planning continues to shift. Researchers are starting to frame the advantages of developing high-tech clusters as not just economic but broader social and cultural development. (Leydesdorff and Deakin 2011; Kuk and Janssen 2011). And the emphasis on where to intervene has also shifted from national to local. In the 1980s, governments worldwide were promoting technology clusters as drivers of national economic development (Castells and Hall 1994; Porter 1998). In London, for instance, there has been fierce debate over whether the central government’s eagerness to channel additional investment into the East London tech cluster circa 2013-2014 disrupted its organic growth in an unfavorable way.

## ***The Birth of Digital Master Planning***

Despite its crucial role in the contemporary urbanization process, urban planners have not traditionally taken a major role in planning telecommunications systems, allowing the process of provision to be left to private industry (Byrum 2012). Surprisingly, the contemporary smart cities movement did little to improve this historical oversight. (Goodspeed 2014) presents a comprehensive review of recent scholarship of the contemporary smart cities movement - its focus has been on service innovation, infrastructure management, and to a lesser extent economic development. Comprehensive planning has not been a part of the smart cities agenda so far.

In the last several years, however, for a handful of elite global cities that has swiftly changed. City governments have stepped into the vacuum created by the urban planning profession and smart cities advocates. 'Digital master planning' is emerging as a distinct practice focusing on IT in government and technology-based economic development. It is an evolution building on e-government initiatives in the 1990s and 2000s.

Every revolution starts somewhere, and more often than we realize, more than one place simultaneously (especially in ICTs - think telegraphs, telephones, television, computers, packet-switching, etc. all of which were more or less invented in parallel in the United States and the United Kingdom). Most of the digital master plans were influenced by the first two documents that were written in 2011 in New York – the *Roadmap* - and in Barcelona – the *Smart City Strategy*. Both cities promoted their plans heavily to other cities in the USA (in the case of New York) and internationally (in the case of Barcelona through numerous international meetings such as the Mobile World Congress). We outline below the difference in the approaches of these two documents – New York as 'cheerleading' citizens and the private sector and Barcelona as 'transformational' and much more interventionist in its approach. Subsequent plans show the influence of these pioneering plans, with most of the plans taking on more of a coordination approach similar to New York but with future aspirations of urban transformation that are more in line with Barcelona.

## **2. WHAT THE PLANS SAY**

As public documents, the obvious starting point for analysis is to understand what the plans actually say about their authors' vision for the

role of digital technology in the future of the city. This section explains what digital master plans were selected, why they were included, and how we analyzed the plans. It describes and compares the scope and nature of initiatives proposed across the plans, including primary and secondary common elements as well as unique content within each document.

### ***Selection Criteria***

The primary consideration for plan selection was, quite simply, the plan's very existence. While, as noted above, local governments have devoted a significant amount of attention in recent decades to digital technology issues, only recently have a handful of cities produced comprehensive public strategies addressing more than one or two narrow areas of governance. The growing number of these documents is what prompted this study. Given this, however, it is noteworthy that all of the plans included - which represent most of the city digital master plans we have identified in the last 18 months - were produced by cities generally considered by scholars as first-tier, or "alpha" global cities. (see for instance, GaWC, 2012)

The plans were also selected on the basis that they covered a major city or city-region, that either implementation of digital technologies and/or ICT-based economic development was a focus of the plan, and that the stated objective of the plan was a major impact on the planning of the city. Finally, all of the plans were published within the last 24 months at the time of writing (the oldest document considered was Dublin's plan, published in October 2012).

The full list of plans include:

Adjuntament de Barcelona. (2012). "Barcelona Smart City: The vision, focus and projects of the City of Barcelona in the context of Smart Cities". Barcelona.

Committee on Information Technology. (2015). *Information & Communication Technology Plan: Fiscal Years 2016-2020*. City and County of San Francisco.

Department of Commerce and Economic Development. (2008). *Digital 21 Strategy*. Hong Kong Special Administrative Region.

Digital Dublin Leadership Forum. (2013). *A Digital Masterplan for Dublin*. Dublin City.

Infocomm Media Masterplan Steering Committee. (2014). *Infocomm and Media In 2025: Consultation Document*. Singapore.

Mayor's Office of Media and Entertainment and NYC Digital. *Road Map for the Digital City* (2011); *New York City's Digital Roadmap: Progress and Innovation* (2012); *New York City's Digital Leadership: 2013 Roadmap* (2013). New York City.

Office of the Mayor. (2013). *The City of Chicago Technology Plan*. City of Chicago.

Smart London Board. (2013). *Smart London Plan*. City of London.

To supplement information from the published plans we interviewed officials responsible for developing these plans in most of the cities surveyed. The interviews were conducted by Stephen Lorimer (London, Barcelona, and San Francisco) and Anthony Townsend (New York, Chicago) using a semi-structured interview guide. A written response was submitted to the interview questionnaire by officials in Hong Kong. The interview addressed three aspects of the plan reflected in this working paper: the content, the planning process used to create the plan, and the approach to implementation. The interview asked the participants to describe the content of the plan, the inception and writing process of the plan, and the implementation of the plan.

### ***Primary Themes***

The plans varied significantly in their focus and breadth. The plans in Chicago and San Francisco were the only ones that had an initiative in every category. San Francisco had by far the highest number of initiatives - 153 in total with Dublin's 45 as the next highest number. The New York plan had the highest number of initiatives associated with both citizen and business engagement. Dublin had the most amount of focus on promoting ICT-based economic development. The San Francisco and Singapore plans both had at least half of their initiatives on IT infrastructure. The Hong Kong plan was the most focused on government IT infrastructure. The London plan had the most focus on e-government of all the plans. The Barcelona plan had focused the most on urban infrastructure with more than half of their initiatives in that area. The differences between the cities were more pronounced than were expected. These differences were driven by local issues and structures, but there were similarities across cities that are tied to how they see themselves as global, connected cities.



However, eight primary themes emerged clearly from the plans. These themes describe distinct applications of digital technologies by local government in service delivery and economic development. These themes include, for example, expanding access to IT infrastructure – internet access for businesses, homes, and public spaces, along with improved skills and urban infrastructure. Others focused on the promotion, incubation and nurturing of technology-based innovation and economic development is another theme. Other initiatives were more internally-focused on innovation in delivery of public services and openness in government operations. Many initiatives may touch on multiple themes, but each initiative was assigned to the most relevant category.

*Primary themes* covered include:

- E-government
- Promote IT industry
- Citizen engagement
- Open data
- IT Infrastructure
- Internet access
- IT skills
- Urban infrastructure

### ***Secondary Themes***

There were other, emerging secondary themes that cut across many of the primary themes in order to more fully describe the uniqueness of each plan. Several secondary themes reoccurred in multiple plans, including:

- Academic-city links
- Emergency services
- Sensor networks
- Government portals
- Evaluating success
- Civic hacking
- Exporting solutions
- Cloud computing platforms
- Tourist economy
- Energy efficiency

- Energy generation
- Transportation access

For example, the New York plan included initiatives in academic and city collaborations, technology awards, and encouraging use of a city-specific internet domain. Dublin’s plan focused on internet access through fibre and making the city a “Digital Safe” City.” Chicago’s plan included the confluence of citizen engagement and urban infrastructure into a Digital Public Way. London’s plan promotes a common data platform across the European Union and Queen Elizabeth Olympic Park as testbed for new infrastructure. San Francisco had detailed initiatives to improve city database systems including those involved with their emergency services, while Hong Kong’s had specific initiatives that gave small and medium enterprises a more equal opportunity to procure from government with cloud services. Singapore promoted infrastructure through smart health, urban logistics, the IT industry through improve intellectual property licensing, and citizen engagement by focussing on the elderly. Barcelona’s efforts in urban infrastructure included initiatives in energy efficiency of buildings, parking, urban agriculture irrigation, and noise monitoring and abatement.

The decision to classify these initiatives as secondary themes stems largely from the observation that they appear most subject to short-term political and economic cycles, and their ultimate likelihood of progression is less certain than those within the primary themes which are expected to remain consistent for the foreseeable future.

*Table 1. Digital Master Plan Proposed Initiatives By City, (Frequency)*

	<b>NYC</b>	<b>Dub.</b>	<b>Chi.</b>	<b>Lon.</b>	<b>S.F.</b>	<b>H.K.</b>	<b>Sing.</b>	<b>Barc</b>
Internet access	4	0	3	0	4	0	0	0
IT skills	7	6	6	2	9	3	2	0
Open data	6	4	3	4	8	1	0	2
Citizen engagement	7	2	1	4	15	1	1	1
E-government	3	9	4	11	13	4	0	3
IT infrastructure	1	7	1	1	89	4	5	5
IT industry promotion	2	16	8	7	5	0	0	0
Urban infrastructure	0	1	2	0	10	0	2	15

*Table 2. Digital Master Plan Proposed Initiatives By City, (Percentage Distribution)*

	<b>NYC</b>	<b>Dub.</b>	<b>Chi.</b>	<b>Lon.</b>	<b>S.F.</b>	<b>H.K.</b>	<b>Sing.</b>	<b>Barc</b>
Internet access	13%	0%	11%	0%	3%	0%	0%	0%
IT skills	23%	13%	21%	7%	6%	23%	20%	0%
Open data	20%	9%	11%	14%	5%	8%	0%	8%
Citizen engagement	23%	4%	4%	14%	10%	8%	10%	4%
E-government	10%	20%	14%	38%	8%	31%	0%	12%
IT infrastructure	3%	16%	4%	3%	58%	31%	50%	19%
IT industry promotion	7%	36%	29%	24%	3%	0%	0%	0%
Urban infrastructure	0%	2%	7%	0%	7%	0%	20%	58%

## ***The Plans in Detail***

The following section describes the content of each of the plans together with the views of government officials charged with their creation. As a mnemonic, for each plan, we propose a shorthand moniker to broadly characterize its overall strategic approach, tone and aims.

### *The Engagement Plan*

New York City's three "digital roadmap" plans (2011, 2012, 2013) are notable for focusing on engaging both citizens and businesses in its limited program. Examples of this were the promotion of social media for communication with citizens and promotion of the city's technology sector through education and skills. The roadmap is organized around five overall areas of access, open government, engagement, industry, and education. There were written with "strategic goals that will guide our development and implementation of open government in New York City". The roadmaps were written to be relevant within the timescale of the mayor's term of office, and the portion of the plan simply documenting what had already been done rose from a third of the 2011 edition to all of the 2013 edition as the 2013 mayoral election approached. This resulted in a heavy focus on quantifying progress on implementation in the plan. This focus on showing progress is in keeping with the emphasis on engagement and communication in New York's plan.

### *The Bread and Butter Plan*

Chicago's 2013 *Technology Plan* is notable for its actionable, clear strategy and initiatives. There was a succinct vision of the city as a place where technology "fuels opportunity, inclusion, engagement and innovation". There is a table that summarizes the city's technology strengths along with the opportunities for future actions and public benefits. The plan organized its 28 initiatives around five overall strategies: next-generation infrastructure; every community a smart community; efficient, effective and open government; civic innovation; and technology sector growth. It made itself relevant to urban planning through the "Digital Public Way" initiative of connected transit, sidewalks and street fixtures. This is typical of the type of value-driven initiatives in Chicago's plan.

### *The Galvanizing Plan*

The 2013 *Smart London Plan* plan is notable for branding London as “Smart” and putting forth a modestly ambitious framework within a limited regional government dependent on future collaborative initiatives with national and local governments. The plan brings together London’s successes in IT infrastructure and the digital economy. For each of seven strategies, 3-5 action steps and 2-3 case studies of ongoing projects were presented: (1) Londoners at the core, (2) with open access to data, (3) leveraging London’s research, technology & creative talent, (4) brought together through networks, (5) to enable London to adapt and grow, (6) and City Hall to better serve Londoners’ needs, (7) offering a ‘smarter’ London experience for all. Like New York’s plan, London’s plan was designed to be delivered within the current term of the mayor - yet with its delivery just a year ahead of the mayoral election that seemed unlikely. Likewise, the plan focuses on quantifying progress on efforts already underway with less of a focus on new initiatives and their benefits.

### *The Bureaucrat's Plan*

The San Francisco Information and Communication Technology (ICT) Plan (2015 draft for 2015-2020, 2013 adopted for 2014-2018) is the most administratively-focused plan, largely confining its scope to direct city investment in technology for public sector use. It organizes the largest number of initiatives (153) around three strategic goals to (1) support, maintain, and secure critical infrastructure (2) increase efficiency and effectiveness, and (3) improve access and transparency. It has a very practical vision to “deploy and support technology that improves City services.” The focus on security and disaster preparedness is unique along with the continuity built into the plan whose city’s administrative code requires a biennial update. It is also unique in that it has a budget lines and specific program descriptions with funding targets to implement every initiative outlined in the plan.

### *The Transformational Plan*

Barcelona has arguably cemented its position as the leader of the international smart city movement over in recent years. Unlike other plans, the *Barcelona Smart City Strategy* was started in 2011 but is continually revised package of projects that encompasses big urban infrastructure such as lighting, transportation, energy and water. All of the other plans avoid expensive urban infrastructure sectors in favor of less expensive moves around open data and e-government. Barcelona’s strategy consists of 24

projects across 11 areas in the three main categories of structure (7), information (13) and society (2) with two cross-cutting initiatives on international positioning and cooperation. The vision for Barcelona is, according to project manager Julia Lopez-Ventura, to be “hyper-connected to the world, but also so it can let its citizens live in their neighborhoods if they wish.” Examples of the initiatives include developing citywide fiber network, a data warehouse, and a “City OS” simulation model with a series of providers that are shown as delivery partners. With its unique focus on urban infrastructure, international sharing and collaboration, the Barcelona plan broadcasts out its self-belief that it is a leader in the smart cities movement.

#### *The Economic Development Plan*

As Hong Kong’s status as a self-governing region, the Digital 21 Strategy plan approaches focuses on promoting the IT sector as both part of its overall economic and social development plan, and as a strategy for government innovation. The plan organized 13 initiatives around four strategic goals of (1) building platforms for residents and businesses, (2) research and development and open data, (3) expanding IT firms into mainland China and abroad, and (4) integrate public services by developing e-government services. Hong Kong’s plan supported four specific technologies: cloud computing, big data analytics, the Internet of Things, and wireless and multi-platform communications. Its initiatives include individual user identities, internet access, programming in schools, including the elderly, cloud services for SMEs, and platform-agnostic provision of e-government services.

#### *The Citizen’s Plan*

The *Dublin Digital Masterplan* was unique because it saw government’s use of technology to empower citizens. The initiatives were organized around seven major actions including fiber to every home, building a digital accelerator district, a sister cities virtual network, and digitizing all government services. Flexibility was central to the plan “to allow us to change direction, constantly rethinking our journey towards the ultimate Digital City.” The *Masterplan* included a self-assessment tool called the Digital Maturity Scorecard.

Dublin used this to assess its progress in six areas: (1) City governance, (2) social, economic and environmental impact, (3) ubiquitous city networks, (4) leveraging urban data, (5) fostering digital services capability, and (6)

digital access and skills proficiency. At the time of the masterplan, Dublin scored a 2 out of 5. The *Digital Masterplan* inspired our generic term for these technology plans.

#### *The Partnership Plan*

The *Singapore Infocomm Media Masterplan* had many of Hong Kong's characteristics of promoting economic and social development through the IT sector, and to emphasize this the writing of the document was led by a 14-member committee drawn from the private sector. The plan had 10 main initiatives that were organized around five strategies to (1) establish agile and trusted ICT infrastructure, (2) build the sector, (3) support human capital, (4) enabling business and the public, and (5) build an R&D ecosystem. There were three overarching visions in the plan, to be a smart nation, promote innovative talent and enterprises and support better living. All of these were designed to promote the social and economic performance of the city-state in partnership with the companies that were tasked with driving that change.

### **3. HOW THE PLANS WERE MADE**

This section describes the processes by which digital master planning processes were initiated and conducted in several of the cities discussed earlier. Our analysis of the content of digital master plans was aided by the fact that, by its nature, this material was part of the public record. However, the process by which these plans were developed was typically not subject to much public scrutiny.

The plan development process was the focal point of our interviews with officials in five of the eight cities whose plans we discussed earlier (an additional city provided responses in writing). These discussions gave us deeper insight into the project initiation, stakeholder engagement, research, and plan authoring, review, ratification and dissemination processes we conducted a series of interviews with officials responsible for these activities in selected cities.

*Road Map for the Digital City: Achieving New York City's Digital Future* (Spring 2011)

*New York City's Digital Road Map: Progress & Innovation* (August 2012)

*New York City's Digital Leadership: 2013 Roadmap* (November 2013)

New York's plan, while one of the first of this wave, was produced through a rather different process than the rest. First it was led by the city's Chief Digital Officer (CDO) Rachel Haot, who plays a role not present in any of the other cities. The CDO has unique responsibilities for promoting social media and the tech-based economy, but the position lacks authority to implement major programs. On taking office in January 2011, in part to define the position's leadership role, Haot took advantage of a mayoral mandate to produce a 90-day report, essentially an audit, to develop a more substantial agenda. The goal was less to craft a long-term vision than to chart a product "road map" similar to those that were common in the digital media startup world where she had come from. The report was completed and released to the public four months later.

Unlike other plans, which as we will see, went to considerable length to engage large networks of stakeholders and leverage external resources, Haot's team relied upon its own staff and a fairly closely-held circle of outside advisors for ideas. While businesspeople, policymakers and issue advocates were consulted during the plan development process, there is little evidence of outreach beyond the "tech community" or of any formal process for identifying gaps in stakeholder engagement.

New York was an early leader in committing to an ongoing planning process from the beginning. The release of the first road map in 2011 came with a commitment to a subsequent one-year update. While much of the second and third road maps were merely progress reports on the 31 initiatives contained in the initial road map, the sustained commitment sent a powerful signal to stakeholders. According to Haot, the amount of time spent on the plan was small in her overall scope of responsibilities - perhaps an average of five percent of her entire term, concentrated in a flurry of activity several times each year. Following the development of the first road map, in subsequent years stakeholder engagement processes were less formalized. Because projects were underway, updates were constantly being fed into Haot's office, and updates to the plan could be made on a rolling basis.

*Chicago Technology Plan* (June 2013)



Chicago's plan was catalyzed by Haot's work in New York. "Rachel released the [2011] New York plan on Mayor Emanuel's inauguration day," says John Tolva - the city's Chief Technology Officer who conceived and delivered the plan. "[It] sat on my desk for twenty months. I read it and then just left it there. It was the only thing that stayed on my desk, because I knew we aspired to that, but I didn't have my arms around enough to put something like that together."

By 2013, Tolva had secured the mayor's support and the resources of the Civic Consulting Alliance, a non-profit organization that provided pro bono advisors on leave from industry to local government. Drawing heavily on a 2007 plan developed by the Chicago Local Initiatives Support Corporation (LISC) and the MacArthur Foundation, The City That NetWorks, Tolva's team undertook a series of several hundred community stakeholder interviews feeding into a four-month-long plan drafting process. Governance was provided by a steering committee consisting of leaders from the MacArthur Foundation, the Chicago Community Trust, and the city. Soon after the report's publication, Tolva left government to return to the private sector. In 2014, responsibility for plan implementation was handed to the city's new Chief Information Officer Brenna Berman.

### *Smart London Plan* (December 2013)

As direct competitors in the global economy, London and New York track each other's urban policy and planning innovations closely. It's no surprise then that, like Chicago, London's own digital master planning efforts followed in the wake of New York's 2011-2012 reports. However, according to Catherine Glossop, a policy officer at the Greater London Authority (GLA) who led this work, London's efforts were strongly influenced by Chicago's plan, particularly its focus on open data and its approach to leveraging the resources of local universities.

But the planning process used in London was markedly different in two ways. First, the stakeholder interview research conducted by the team was largely internally focused versus the external focus of Chicago's research - meetings were held to solicit input with every department in the GLA. Second, Smart London was governed by a large and diverse advisory board which was reconstituted several times as the project's aims changed. What was inherited from a previous effort under the deputy mayor of

business and enterprise as the Digital Advisory Board (which created the first open data store for London), was reconstituted as the Smart London Board to develop the vision and plan, chaired by a handful of academics. Then refreshed the board for delivery phase, with an emphasis on bringing in members who would commit resources to implement the plan - not in terms of money but a broad range of commitments to deliver.

Smart London's timing brought a sense of urgency to the effort. Unlike most of the other plans, which came either early or mid-cycle, Smart London came relatively late in the election cycle, just a year before the mayoral election. Glossop sees it as an advantage, "I think the fact that it was, that it had such a short term focus was actually helpful in a way, because that helped to focus the departments' attention and funding on actually delivering and sharing something...".

#### *Barcelona Smart City Vision, Focus and Projects* (October 2012)

Since its dramatic transformation surrounding the 1988 Summer Olympic Games, Barcelona has devoted substantial effort to maintaining its position as a leader in urban planning, policy and design.

Barcelona's smart city efforts date to the mid-2000s. International attention has increasingly focused on Barcelona's smart city efforts in recent years with the launch of the industry's largest trade show, the Smart City Expo, held since 2011. This campaign coincided with the election of Mayor Xavier Trias, a pediatrician who has pursued a bold campaign of sustainability and innovation for Barcelona. The overall vision, with a target for 2050 rest on three pillars: self-sufficient, productive neighborhoods, within a hyper-connected metropolis.

Much like in Chicago, the city's team was supplemented by pro bono consultants from outside government, in this case three persons from local consultancy Doxa in addition to five government staffers on the team.

#### *San Francisco ICT Plan* (2013, March 2015 Draft)

Unique among the plans considered here, San Francisco's is the only plan that is the product of a legally-mandated budgeting and planning process. It is developed by the Committee on Information Technology (COIT) a

planning and governance body charged with creating a five-year ICT plan on a biannual basis for the city. COIT has five permanent members - the Mayor, the President of the Board of Supervisors, the Controller, the City Administrator, and the Chief Information Officer, and eight department heads from the City's major service areas. The Committee also includes two members of the public with expertise in technology and public policy.

Chief Information Officer Miguel Gamiño took office in July 2013 just after the adoption of the city's second five-year IT plan in April 2013. He has focused on the development of the most recent five-year strategy, a proposed draft of which was released in March 2015. While COIT staff are the plan's lead authors, Gamiño pushed for a more strategic view: "We did list some specific projects, but I wanted to try to avoid getting caught into being overly prescriptive. If it's going to be strategic, it should list objectives, not necessarily very specific methods."

San Francisco is perhaps the furthest along in learning how the digital master planning process repeats itself, evolves and learns as the plan must be updated every two years. While much of the process has been sustained, according to Gamiño he has worked with COIT staff to avoid a rote repetition of previous plan process. "We didn't want to get to where we were just updating a plan", he says "We really wanted a fresh look at things. The process was structured. We specifically gathered certain people and we specifically solicited certain feedback and we had very specific facilitated discussions. It was very methodical and structured, but we didn't just follow the method of last time."

*Hong Kong Digital 21 Strategy* (1998, 2001, 2004, 2008, 2014\*)

Hong Kong is an outlier to this study for several reasons - historically, despite functioning as a de facto municipal government due to its unique political status it has performed many functions of a national government in economic, industrial and fiscal policy. As a result, it began digital master planning far earlier than the other cities in this survey (1998) and the scope of its activities span a much broader range of policy domains. In the other cities we look at, these issues of research policy, scientific and technological competitiveness, education and telecommunications would be worked out at a national level and serve as assumptions and constraints for local plans.

Here we focus on the process to develop the most recent iteration of the plan, the 2014 update to the *Digital 21 Strategy*. Unlike other plans, which were developed in environments of extreme resource scarcity, the Hong Kong government budgeted substantial funds to commission a consultant to “review Hong Kong’s achievements under the Digital 21 Strategy and make recommendations on a new blueprint to steer our ICT development in the next few years. Around 20 engagement sessions with ICT industry bodies, academia and ICT professionals, major users and Government departments were held to gauge their views and insights on the way forward. We also conducted a three month public consultation in late 2013 to gather views from the industry, academic and the public.”

### **Consistencies and Discontinuities**

Our analysis of the processes used in these six cities to develop the digital master plans discussed earlier reveals several common threads and fault lines.

First, **the plans have strong authorship**. That is to say, these are for the most part political documents produced to advance a particular policy agenda advanced by a newly elected official. While they draw on outside resources during development, they typically have a single author in a mayor’s office with strong oversight. Even when larger steering committees are engaged, these are generally not consensus documents in the sense of more traditional kinds of urban plans. Also unlike traditional plans, they lack substantial quantitative bases of evidence upon which to base their proposals.

Second, as much as they come from the top-down, **digital master plans are often second-half policy plays** after new mayors have tackled the bread and butter issues and are ready to score points on the innovation mandate. Technology concerns clearly takes a back seat to issues such as schools, housing, transportation, public safety and jobs. For instance: the *Chicago Technology Play* was a second-half play during Mayor Rahm Emanuel’s first term in office; the *Smart London Plan* was released only a year before Boris Johnson’s re-election; Michael Bloomberg didn’t launch the *Digital Road Map* efforts until after winning his third term, which by law would be his last.

Third, while every plan devoted much of its energy to developing and articulating a vision, a surprisingly large amount of effort across the cities went into merely **documenting what was already going on**. In Chicago, for instance, we estimate that as many as half of the proposed initiatives were already underway. In New York, the three annual plans were substantially devoted to documenting past accomplishments (approximately  $\frac{1}{3}$  in 2011,  $\frac{2}{3}$  in 2012, and the entire 2013 document). Much the same was true in London, and likely elsewhere.

Just as important as the commonalities were the big differences among cities' planning processes.

The most obvious difference was the **variety of time horizons** cities chose. In established areas of city planning, like transportation and land use, planning timetables are fairly well established. But digital master plans range from those intended to be fully implemented in a single mayoral term (New York City) to those spanning a half-century or more (Barcelona's 2050 timeline), from vague middle-of-the-road timeframes like London's to legally precise and binding ones like San Francisco's (5 years).

The other big area of discontinuity was the **widely varying role of external stakeholders in governance** of the planning process. While all cities consulted a variety of internal government stakeholders, there was little similarity in the extent and transparency of their consultation with those outside government. These range from Smart London, which assembled a large, fairly representative and publicly named board to New York, which mostly consulted with a fairly exclusive network of technology industry insiders and activists. Consultants often came and went on different projects with little or no visibility.

## **What Works**

While it is premature to call them best practices, we did identify a number of successful common approaches to developing digital master plans.

First, ***digital master plans are most successful when they aspire to be visionary***, but successful visioning usually requires avoiding too much prescribing of specific implementation details. For instance, we

found that many of the plan authors were very reluctant to even identify particular regulatory changes that might need to be pursued to achieve their vision. The visions and plans were seen as documents intended to spur change, if not to actually directly bring it about. Fittingly, many of the plans were developed by one person, only to have a different person take over with a different skill set to actually implement and deliver on the plan's commitments.

The second, and somewhat surprising, lesson was the widespread acknowledgement that ***local governments lack the internal staff resources to conduct digital master planning exercises without substantial external assistance***. As Chicago's John Tolva reported, that city's plan would never have been possible without the pro bono assistance of the Civic Consulting Alliance. Barcelona, London, and Hong Kong all also reported relying on external consultants - both paid and pro bono - to various degrees. Cities undertaking plans should be prepared to assess requirements and marshal the necessary external resources, and address potential conflicts of interest.

Finally, ***digital master planning processes need to specify the process for updating and revisions*** to the plan. We've seen variations on this idea, with varying degrees of success. In New York, a mayoral mandate ensured annual updates, but when political power shifted there was no statutory requirement to keep the process moving forward and planning lapsed. In San Francisco and Hong Kong, statutory requirements have kept plan updates coming at regular intervals, but at the sacrifice of originality and ambition in their tone, scope and goals. They satisfy legal requirements, but they rarely inspire or mobilize.

#### **4. HOW THE PLANS ARE IMPLEMENTED**

Given the very recent nature of these plans, and their very different timetables and levels of specificity, they have been implemented to broadly varying degrees. Some cities have specific target dates and initiatives to be undertaken, other cities are less precise about where they are headed and how they get there. What we can say something about is the overall approach to implementation, and the strategies for implementation we find at work in these plans and the organizations and stakeholder networks that produced and ratified them.

### *New York*

As New York City's digital road maps were largely a synthesis of existing strategic plans within agencies, implementation was largely the result of carrying out those proposed agendas. A notable aspect of the road maps, and unique among the plans in this survey, is that the scope of initiatives was deliberately limited to what could be completed by the end of Mayor Bloomberg's third and final term in office. This was discovered in an interview in response to our questions about the plan's legacy for the incoming mayor, to which the plan's author, the city's Chief Digital Officer responded, that "the roadmap was achieved" - i.g. there was nothing to carry forward.

Beyond agency-specific implementations, the Chief Digital Officer launched a number of targeted projects aimed at increasing and consolidating the city's social media presence, promoting the city's rapidly growing technology sector, and providing information about access to broadband services.

### *Chicago*

According to officials, as many as half of the initiatives proposed in Chicago's 2013 plan were already underway in some form when the plan was released. Still, the ambitious scope of the project demanded substantial attention to the issues of implementation. Unique among the cities we looked at, Chicago subsequently entered into a formal agreement with a non-profit organization, the Smart Chicago Collaborative, which was funded by the Chicago Community Trust and the MacArthur Foundation, and had grown out of an earlier effort to leverage technology for community development. Under contract to the city, Smart Chicago has embarked on a number of initiatives including the development of neighborhood-level technology assessments that customize the plan to local community needs. The plan's implementation is now being spearheaded by the city's Chief Information Officer, rather than the Chief Technology Officer. At the time of writing, an update was reported to be in development, but the process and release timetable were not public.

### *London*

Implementation of the *Smart London Plan* was always going to be a challenge because of the limited power of the Greater London Authority, which one official described as "largely a strategic organization." As a

result, a heavy emphasis was placed on mobilizing commitments from advisory board members to deliver pieces of the agenda. Following the publication of the plan in late 2013, the board was re-shuffled for a second time, with many of the academic partners supplanted by corporate members with substantial resources and relationships to bring to implementation efforts.

### *Barcelona*

In contrast to the other plans which are mostly fairly short- to medium-range, Barcelona's efforts are ongoing and lay out a vision that may not be fully implemented for decades to come. They are also quite explicitly focused on a rigorous and ongoing evaluation. "We made an exercise and evaluated some indicators for the smart city. It's a 30-slide PowerPoint," says the city's Julia Lopez Ventura. Finally, the city has invested substantial funds in establishing a new institution, the Barcelona Institute of Technology (BIT, which sounds like, but is not a university), to manage key parts of implementation. BIT is intended to serve as a combination technology transfer accelerator, business incubator and demonstrator.

### *San Francisco*

San Francisco's implementation follows a constantly revised five-year target. Not only was San Francisco one of the few plans whose development was required by law, it was the only truly municipal government (as noted Hong Kong and Singapore both are special cases) in our survey where the plan was developed and implemented by the same department. Furthermore, as the head of the city's technology department, the plan's implementers have considerably influence over decisions about technology selection, acquisition, deployment timetable, etc. at both a tactical level which can be exercised through decision-making, recommendations, and advisory capacities. Presumably, in extreme cases, officials can also propose and advocate for local legislation to advance their objectives against objections within other branches of government, though we don't have any evidence of this.

## **5. WICKED PROBLEMS IN SMART CITIES**

As an emerging urban planning practice in a select handful of global cities, digital master plans are a promising frontier of strategic intervention with



as yet unclear large-scale impact and uncertain long-term future. But the market and governance forces that they are grappling with - the diffusion of ubiquitous computing and the upheaval of urbanization are great enough that governance activities designed to shape their intersection should draw our interest.

### ***Grappling With Intractability***

But this survey provokes more questions than it answers. Why are global cities choosing this moment to engage in long-range, comprehensive digital master planning? And why so many different approaches and such differences in scope and style?

It's easier to speculate about an answer to the first question. Clearly, these cities are playing off each other. Singapore and Hong Kong's plans have tracked each other for over ten years. Chicago reacted to New York's Plan, and London responded to the momentum that both plans generated. New technologies have also reached critical tipping points both among broad citizen constituent groups (mobile phones) but also within the business and issue advocate communities (think health and education where data privacy is becoming a key concern). The increasing awareness that technology is not something limited to a handful of locations, but ever-present in the city is a crucial catalyst for comprehensive planning.

The second question, however, is a lot harder to answer. Especially when we consider that both the subject matter of these plans, and the plan authors themselves are globally inter-connected — many of the plan authors know each other professionally and have consulted each other's activities and publications online — we would expect more convergence in content, process and implementation than our findings suggest. Might the variability be an indication of localization, come about as an institutional response (deliberate, or not) to the complexity of planning problems in smart cities?

As described by Rittel and Webber (1973), planning problems are “wicked”, and inherently different from the kinds of problems that scientists and engineers deal with. They can not be definitively described, it is never possible to know if they are fully solved, solutions cannot be tested prior to application, each is unique, and so on. Given that digital master plans deal with complex technologies layered over time on top of already complex physical infrastructures, with weak institutional and

regulatory authority to tie them together, and new, invisible, and oftentimes menacing flows of data accompanying them — wickedness seems guaranteed to be built in to these endeavors, even before humans get involved. Computers are so bound up in the notion of wicked problems in fact — that while wicked planning problems have always been around —as Goodspeed (2014) highlights, Rittel and Webber’s critique was actually developed *in direct response* to the overly confident and ultimately unsuccessful application of computer-based simulation to urban policy analysis in the 1960s.

In conclusion, we highlight a few of the more salient wicked problems that emerge in our analysis of these plans, their development, and implementation — and our thoughts on where government should focus its efforts in contemporary digital master planning.

#### *Moving from Visioning, to Planning, to Regulatory Reform*

There is a reluctance of many digital master plan and planners to directly engage with difficult questions about implementation of their future visions, goals and road maps. Often these challenges involved tackling complicated regulatory and institutional reforms. When the writers of the plans sit down to write a digital master plan, they are inspired by a future world where ways of doing and interacting are transformed by technology. Open data is already opening up markets to new players -- in the transportation sector, social media companies are pioneering new business models and products built on open data.

Some of the areas around digital planning that have confronted them include:

- Procurement, for example government digital marketplaces
- Tax Reform
- Shared Economy in both goods and services from AirBnB and Uber to local sharing (e.g. the Toronto Tool Library) although evidence is growing that users see them as digital agencies

Few of the plans do a good job of explaining what big new platforms (e.g. LinkNYC) are going to do to enable innovation. Platforms are not just around the physical objects that make up infrastructure, goods, and services in a city. Platforms for innovation also can be created around open data around law and regulation and associated data stores.

### *Getting Past the Rhetoric of Technology*

Leaders of smart city or future city groups in the public sector are backing away from a tech-driven vision of the future city. Cities are starting to shy away from making bold statements about the “smartness” of a city and we predict that the language is moving towards a more technology-neutral language of “future” cities. This does not mean that cities are taking a luddite view of the world. Instead, this language enables cities to say no to less useful technologies and concentrate their efforts on more useful ones. However, technology companies accuse city governments of stifling innovation through policies of “picking winners.” Future cities sections need to show that they can perform better.

### *Inclusion and Engagement*

Most of the plans pay lip service to inclusion, but really lack compelling details about who is left behind currently and how they’ll be brought into the fold, or empowered to choose their own path. Too often, city government do not see their role as enablers of the market and decline to use their regulatory levers. Instead, digital technologies are poorly understood as something to get out of the way of instead of direct to enable the best value for the city.

### *Public-Private Partnerships / Mobilizing Effective Implementation*

Most plans don’t do a very good job of explaining the value streams created by the various initiatives. Questions include who they come from, who is at risk, and who benefits. Value is also generated in the short and long term. Governments give open data away so that private enterprise can create value from it, but governments do not state in what ways it will receive value in return. Enabling private sector data through funding internet access also creates value. For example, publicly-funded residential access enables smart thermostats in those homes, but the benefits of that data are not shared with the public funder.

### *Assessment*

Self-assessment tools and quantitative measures of success are critical to establishing a plan’s credibility and accountability. Dublin’s Digital Maturity Scorecard was created because the plan was designed as a long-term document to stand without revision. In contrast, the frequent revision of New York and San Francisco’s plans means that their self-assessment

has been tweaked in each revision to reflect short-term accomplishments and avoid highlighting lack of progress in other areas.

***Digital Master Planning: Paths for Action***

The continued effort devoted to digital master plan development and implementation in the cities we surveyed suggests that these initiatives have led to worthwhile outcomes. Given the limited record to evaluate track records, and the paucity of formal evaluation tools, its still too early to judge these claims decisively. But we do believe that there is a clear case that many of the activities and approaches found in these examples are worth adapting in other contexts.

We conclude by briefly summarizing four distinct paths for action among cities undertaking the initial development of digital master plans. We generalize these paths as: facilitative, learning, systems and interventionist. The purpose of outlining these paths is that no single way of digital master planning is generalizable across all cities. But rather local governments can consider the time frame for planning and implementation, the available resources, and potential sources of leadership — and then lean towards one approach or another. It’s also important to understand that these paths represent anchor points in a spectrum of approaches. In actual practice, any given city is likely to blend elements of multiple approaches. These paths for actions are summarized in Table 1.

*Table 3. Paths for Action*

<b>Path</b>	<b>Time</b>	<b>Resources</b>	<b>Leadership</b>
Facilitative	Next election	Minimal	Economic development
Learning	Next election	Substantial	Procurement
Systems	Next election	Moderate	ICT
Interventionist	Long-term	Substantial	Project management

### *Path 1 — Facilitative*

The facilitative approach to digital master planning, which is well-suited for resource-scarce situations with short-term demands for results, focuses on scoping initiatives that can build off activities already present in the public and private sector. Typically, the best lead for planning under this approach is in the area of economic development, as the facilitative approach is well-suited to promoting skill development in private-sector technology firms. These firms can sell products that can benefit the functioning of the city and provide additional income and jobs should the product become refined enough so that it can be exported to other cities. The facilitative approach is good for showing short-term progress (e.g. current election cycle) because the scoping process uncovers many technologies that are either available or already being implemented by the city without any central coordination. This means that minimal resources are needed in money and staff because the facilitative approach effectively coordinates and reports previous commitments in technology without requiring new long-term commitments.

### *Path 2 — Learning*

The learning approach to digital master planning emphasizes pilot projects as a tool for building support for ongoing efforts. In this approach, the best lead for the plan is in the area of procurement, as the learning approach is best for leveraging knowledge in both the public and private sector to test new models of public sector implementation. The delivery of these projects is dependent on enough resources to manage public-private partnerships and leveraging public assets to allow private investment in technologies to improve city life. It is a useful approach to show progress in the short-term because the scoping process for pilot projects will uncover technologies that are either available or already being implemented by the city without any central coordination. With substantial resources, these technologies and projects in progress can be leveraged into procuring more substantial pilot projects to robustly test out the goals of the digital master plan. This means that there are few long-term commitments that are needed, but the digital master plan is used to amplify and coordinate earlier public sector initiatives and private sector talent by procuring projects from which the city learns a great deal about what technologies work where. If there are substantial resources available and the city needs demonstrable results in the short-term, handing the lead to procurement and implementing the learning approach is the best path to the digital master planning of the city.

### *Path 3 — Systems*

The systems approach to digital master planning makes cities learn the potential benefits of technologies for their city by focusing on the ICT systems that are owned and operated by the city and other public agencies. Generally, this requires a higher level of resources than other short-term payoff paths. In this approach, the best lead for the plan is in the area of information and communication technology departments, as the systems approach is best for focusing on internal public sector issues that need to get resolved before procuring new technologies. The delivery of these projects is dependent on a medium level of resources to allow for managing the investment of new IT and sensor systems by the public sector. It is a useful approach to show progress in the short-term because the public sector can focus on what improvements it can make and deliver. In time, these technologies and projects in the public sector can be leveraged into more private sector and public-private partnerships in future revisions of the digital master plan. This means that there long-term commitments are envisioned but there are clear steps that need to be done internally as a first step in the implementation of the digital master plan as opposed to previous results where implementation is more in the hands of the private sector.

### *Path 4 - Interventionist*

The interventionist approach to digital master planning undertakes the creation of a long-term, living strategy for the city and initiates public-sector-led projects to implement it. In this approach, the best lead for the plan is in the area of project management, as consistent and substantial investment over time is required. The delivery of these projects is dependent on the resources to start projects at all scales. It is a useful approach for long-term digital master planning because investment commitments are over a timespan for the payback from investing in new technologies may often take longer than an election cycle. With substantial resources, these technologies and projects in progress can be leveraged into procuring more substantial projects to robustly test out the goals of the digital master plan. By testing these goals, projects can be dropped and added, making the master plan a 'living' document. If there are substantial resources available and the city commits to demonstrable results in the long-term, handing the lead to project management and implementing the interventionist approach is the best path to the digital master planning of the city.

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In closing, its important to note that these plans have grown out of a unique set of global cities. With most of the world's urban population growth forecast to occur in a broader swath of small- and medium-sized cities, we believe there is a special challenge in thinking about how to scale down the kinds of efforts we've observed here for places that will lack much of the technology industry know-how in the local stakeholder community, and less access to other external resources for implementation. Unless these obstacles can be overcome, digital master planning might appear then to be a fad limited to just a handful of trend-setters, soon swept aside in a few years to make way for the next great governance innovation.

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